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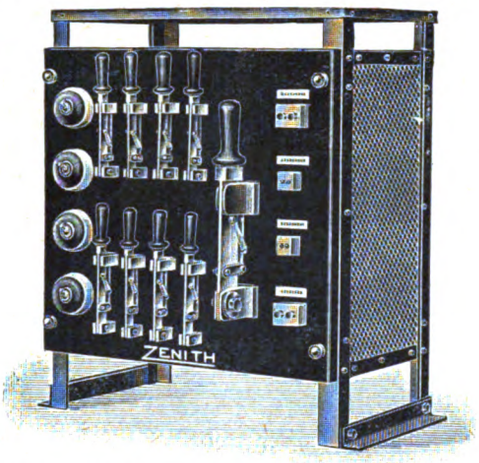

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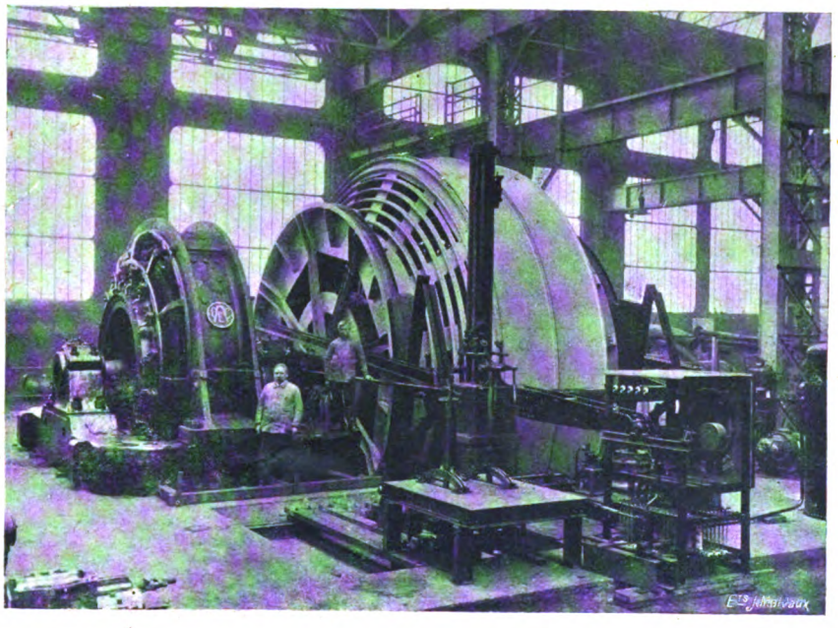

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Notes of the Week.

Variations on an Old Theme.

If we were musical critics we should say that the proceedings at the recent annual meeting of the Tramways and Light Railways Association were variations on an old theme. But that is perhaps hardly fair. For Mr. W. E. Ireland's Paper did at least show a realisation of the truth that if British tramways are to do better in the future than they have done within the last year or two more attention must be paid to car and track design as well as to such burning questions as fares and legislative difficulties. It is pleasant to see from the discussion that this realisation is not confined to Mr. England. One way in which some advance can be made is the weight per seat. A single-deck coupled car in which this figure is 244 lb. compared with 393 to 567 lb. for British cars, and 531 to 676 lb. for American cars was described, and it was suggested that two of these cars coupled together would help to solve some of the difficulties of loading and unloading, energy consumption and axle loads. The effect on traffic congestion was, perhaps wisely, not mentioned. In the second Paper read Mr. Chivers dealt with the traffic problem, and though calling attention to many things which have often been dealt with before made the important point that much reform might well come from within. Like Mr. Ireland, he stressed the need for attention to improved methods of design and construction, including in these more comfort for the passengers. Though therefore little fresh was said, the proceedings were a useful *résumé* of the present position of this form of transport.

Tramway Finance.

An examination of the annual reports for 1922–23 of the various municipal tramway undertakings in the country shows that the industry has weathered the worst of the storm. At Bradford a "profit" of £104 600 was obtained against £56 000 in the previous year in spite of—or perhaps because of—a reduction in fares, though lower traffic and other expenses also had a beneficial effect on the results. The capital account has been written down by a contribution of £47 000 from revenue and £20 000 was transferred to the renewals fund, on which item it is expected £40 000 will be spent during the coming year. At Sheffield, though the income decreased by £49 543, the expenditure decreased by £55 473, with the result that the net "profit" was £11 934 more than last year. Over £13 000 was assigned to rate relief, a policy with which we are in absolute disagreement, though it is only fair to add that £67 487 was contributed to renewals. An interesting point about the year's finance is the success obtained with widely different policies with regard to fares. Brighton gets on well with twopenny fares as the "backbone," Aberdeen with penny fares (has the climate anything to do with it?), and the same contradictory experiences could be duplicated in many places. We gather that in the long run it is a question of management assisted in many cases by a more or less sound policy in the early stages of the undertaking's history.

Steels for Modern Trackwork.

Much has been written on steel rails—for instance, at the International Railway Congress at Rome in 1922, and doubtless more information will be forthcoming at the next congress of this body, which will be held in London in 1925. In the meantime Sir Robert Hadfield has contributed a useful survey of the subject in his recent paper before the Institute of Transport. Rails in general fail either because of fracture or owing to excessive wear. On railways, at least, the first-named cause of failure is most dangerous. It may be due to unsound or segregated steel, wrong structure arising from faulty manipulation, or progressive development of surface cracks. The first

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defect is undoubtedly the most important statistically; in fact it has been indicated as the cause of quite half the troubles that arise. Meantime conditions of service are becoming increasingly severe, especially on electrically operated railways, with their almost continuous service, and the demand for a high-grade steel is evident. Most of Sir ROBERT'S paper was devoted to a discussion of manganese steel which, although more expensive, is claimed fully to justify itself by greater wearing power. Some tests have shown that this material has five to six times the resistive power of ordinary steel. Other alloy steels such as those containing silicon, nickel or chromium, have possibilities, but none has achieved the extensive use that manganese steel has done. The production of sound steel is a problem that has hitherto been tackled in a somewhat rough and ready manner, based on liberal discards of dubious material. Sir ROBERT states that he has devised a process which should reduce the discard to not more than about 12 per cent. The process consists in ensuring freedom from dissolved gases and then providing suitable means of feeding the fluid steel as it is solidifying, and so preventing the formation of a pipe cavity. In the final section of his paper Sir ROBERT pleaded for a somewhat less conservative attitude on the part of railway authorities. Certainly a railway company must exercise discretion in wholesale adoptions of new material; but it is probable that in the past progress has sometimes been held up by an excess of caution.

Motor Standardisation.

THE Electric Power Club (the B.E.A.M.A. of the United States) has just come to an important decision on the question of the rating of industrial motors and generators by rescinding their existing standards of a 50 deg. rise without overload guarantee, and a 40 deg. rise with a 25 per cent. overload guarantee for two hours, and by recommending the adoption of a 40 deg. rise for all open-type "general purpose" machines carrying the full rated load continuously. Such motors are also to be capable of carrying sustained overloads not exceeding 5 per cent. with a 90 deg. rise. This decision ends a controversy which has lasted seven years, and, though not bringing British and American designs into coincidence, is at least a compromise by settling the 40–50 difficulty on a 50–50 basis. It will be noticed that in the American specification there is a limit which is not found in British practice. The 40 deg. rise only applies to "general purpose motors"—i.e. motors sold for any application the buyer chooses. Motors designed for any particular application can be used up to any temperature for which they are designed. The British rules are more general.

History of the Controversy.

As some assistance towards obtaining the views of British engineers on the American decision it may be useful to recall the history of the controversy. At the meeting of the International Electro-technical Commission in Berlin in 1913 a 50 deg. rise for Grade A machines was specified, no overload conditions being laid down. This standard was accepted by the B.E.S.A., but not by the B.E.A.M.A., and at the 1920 meeting the British representatives demanded an overload clause. In the United States the larger manufacturers developed a 50 deg. motor without overload guarantee, while smaller makers adhered to the 40 deg. rise plus 20 per cent. overload for two hours, with a maximum of 55 deg. This led to the production of two different lines of apparatus. At the Geneva meeting last year the American delegates could not agree among themselves, while the British delegates proposed a 40 deg. rise plus 25 per cent. overload for two hours without any overload temperature guarantee. A 40 deg. rise plus 25 per cent. overload for two hours with a temperature restriction of 90 deg. was finally accepted. The decision which we have just recorded brings all American manufacturers into line, and is thus, we hope, an important step towards international standardisation.

A Solution of the Atmospherics Problem.

IN another column of this issue we give an account of an interesting equipment which has been devised to eliminate "atmospherics" and other parasitic currents from wireless messages. The device, which is due to Mr. YVES MARREC, a French engineer, consists in the production of local low-frequency oscillations at the receiving station, the actual frequency being determined by a suitable choice of the characteristics of one or more aperiodic circuits. These aperiodic circuits are tuned to the frequency of the local oscillations, the latter being superimposed on the received oscillations so as to produce two sets of oscillations of a different character. These oscillations are then passed through tuned low-frequency circuits the saturation of the valves in which is controlled to reduce the heating of the filaments. In this way a filtering action is secured which not only eliminates the atmospherics, but also cuts out signals from stations which may be transmitting on a wavelength similar to that of the signals which it is desired to receive. A demonstration of the apparatus shows that the results leave nothing to be desired. A solution of a difficult problem therefore seems to have been secured, greater speed in transmission should be possible and, it is claimed that the costs of messages will be reduced by two-thirds. We understand that commercial use of the invention is already being made in France, and we shall await further results with interest.

Chester and Consulting Work.

THE question whether chief engineers of municipal electricity supply undertakings should be allowed to do outside consulting work has often been discussed in the columns of THE ELECTRICIAN and elsewhere. It has been argued that as these officials are paid more or less adequate salaries to perform certain duties their work and their remuneration should be confined to those duties. It has also been argued that it is an advantage for a particular electricity supply undertaking that a chief engineer should take outside consulting work. By so doing he gains experience which may be useful in carrying out his main duties. Both these points of view are logical enough, but the attitude taken up by the Chester Corporation with regard to its chief electrical engineer is neither logical nor fair to Mr. BRITTON. It appears that in December 1922, on the recommendation of the Finance Committee, the Corporation resolved that any additional salaries or fees received by certain officials shall be paid to the Council. In May Mr. BRITTON was asked to advise the Prestatyn Urban District Council on an electricity supply scheme, and received the permission of his committee to do so. This resolution was objected to by the Finance Committee, and the Electricity Committee then recommended that Mr. BRITTON be allowed to do outside work which did not interfere with his duties and to retain the balance of any fees received after any expense incurred by the Corporation had been refunded. This recommendation was defeated at the last council meeting, so that as the matter now stands there appears to be no objection to Mr. BRITTON doing consulting work so long as the Corporation take the fees. This can be for the good of neither party, and the corporation had better adopt one or other of the logical attitudes we have outlined above without delay. As Sir JOHN FROST rightly said in the course of the discussion, to do anything else would be retrograde.

Pull and Sag on Transmission Lines.

A DEVICE of some interest to mains engineers who have charge of overhead lines is described by Mr. A. VAUPEL, in a recent issue of the "Elektrotechnische Zeitschrift." It consists of a collapsible stick of insulating material with a

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scale painted on it. This is employed for measuring the height of the line above the ground at a number of equidistant points and so obtaining figures of the pull and the sag. In practice one man carries the pole and a second man sights through a telescope from a selected point on a tower near the ground to a point on the same height above ground on the next tower. The elevation of this second line above ground is read on the calibrated stick. Such measurements, made at a few points between two towers, may be drawn to scale on a cross-section sheet and will give the exact sag of the wire. An earthing wire is attached to the stick, to safeguard the man holding it in direct contact with the live transmission wire. From the sag, the known weight of the wire per unit length, the distance between the towers and the temperature during measurement the author gives a formula for calculating the pull on the wire.

Tidal Power.

The sight of power running to waste is not one that can be viewed with equanimity by any one with engineering instincts. It is not, therefore, surprising that the problem of the utilisation of the tides for the generation of electricity has long been a favourite subject by speculative engineers, and that in spite of the egregious Severn barrage scheme and the criticism to which it was rightly subjected, the idea is still receiving consideration not only in this country but all over the world. It may be admitted, in fact, that even allowing for the high capital costs and the difficulties inseparable from operating a hydro-electric station where the flow is in two directions, there are places where the tides can be successfully used. The idea must not, therefore, be lightly dismissed as chimerical, but must be considered from first principles, taking all factors into consideration in the same way as any other engineering problem. The utilisation of water power *per se* is also a matter which must not be neglected.

We are therefore glad to see that among the subjects for discussion at the London meeting of the Permanent International Association of Navigation Congresses, which is being held this week at the Institution of Civil Engineers, are "The Utilisation of Waterways for the Production of Power" and "The Utilisation of Tides for the Production of Power for the Working and Lighting of Ports and for Maritime Works." A number of reports on these two matters were presented by engineers from all over the world, and a large amount of useful information has thus been collected.

General Position of Water Power Understood.

The first of these subjects, important as it is, need only be briefly dealt with here, principally because the water-power resources of the world (as that term is generally understood) have recently received thorough investigation, both in this country and elsewhere, and the general position is well understood. In summing up the various reports presented to the Congress for consideration, Sir JOHN PURSER GRIFFITH remarks that it is important, in view of the shortage of fuel and its increasing cost, to develop water power wherever available and to combine navigable waterways with water-power installations. With these conclusions there will be general agreement, as well as with others to the effect that cheap power means cheap industries, that the position of existing right must be considered, and that some State control of water power is necessary. Such a policy has been advocated again and again, by us among others. But the real difficulties will arise when details come to be discussed.

No Tidal Installation in Successful Operation.

The position is different when we come to consider the question of tide utilisation. We are not aware, though it has often been suggested, that this utilisation has ever been achieved, and the voluminous reports presented to this Congress mentions no installation that is in successful operation. It will be noted that the subject of discussion is limited in scope. It does not, like the Severn barrage scheme, suggest the transmission of power for general use, but only its employment on the spot. This is wise. The load factor in docks is not high, and it might be that as the load itself depends to some extent on the tides, economic operation might be obtained in this limited way. On the other hand, the capital costs would necessarily be high, with the result that it would probably be cheaper to use steam plant, or, better still, to take a supply from the public mains.

Some Limitations of Tide Utilisation.

In his general report on this subject Mr. C. S. MEIK points out that as the tide is to be utilised for power for working the port, the head depends on the rise of tide at that port, and no latitude is therefore allowable for the selection of a site favourable for generation. The lock water may or may not be used for generating power, but in either case storage of water at high level will be necessary. An important omission in all the reports is reference to cost and the value of the information given is in most cases rather diminished by failure to give figures as to head flow and other factors.

Effect on Navigation.

The most interesting report on this subject is from the pen of Mr. ERNEST LATHAM, who, after referring to several schemes that have been suggested in this country, points out that to provide any large amount of power large areas of tidal water must be impounded. He emphasises the importance of this by giving examples showing how rivers like the Thames and the Severn would be affected by such a change. The same arguments would, we imagine, also apply to the harbours at Yarmouth and Lowestoft, the water in which, it is suggested, might be used for power generation. To expect that the latter place would ever be developed for this purpose is to show considerable optimism. The harbour is artificial, and the fall of a spring tide is only slightly over 6 ft., so that the average head of working a turbine would be very small.

Mr. LATHAM being the one reporter who descends to anything in the way of detail, attention may be drawn to some figures that he gives. With a tidal range of 20 ft. he estimates that the supply reservoir with a variation in level of 5 ft. would have to be about 4 square miles in order to develop 20 000 H.P. Since at the present time we have no use for generating stations of the rabbit hutch variety these figures provide their own argument. A fall of 5 ft. is very low, and the equipment would therefore be costly. As Mr. Latham rightly remarks, so much power would hardly be required by working a port. But the matter is too important to be considered solely from so limited an aspect.

No Enthusiasm.

The other reports may be dismissed very briefly. They either describe apparatus which might be used in connection with the tides, such as the "Ondo pump" and the hydropulsor, or deal with the construction of ports with a view to the utilisation of tides. They carry us little further. The general impression that is, in fact, gained from the perusal of these documents is that the utilisation of tides is still the prerogative of theorists. But even they have not produced a general scheme the details of which could be modified to suit particular cases. Harbour, dock and electrical engineers show no great enthusiasm about the project, and we suspect that the true reason for this lack lies in the balance sheet. The one exception to this rule is that afforded by Mr. W. J. HARMSEN, who gives particulars and plans of an installation which is in course of construction at Hauscourt on the Mid-Beveland Canal in Holland. He admits that the cost will be high, but we think that the results should do much to assist progress in this direction. Until then we can best recommend an attitude of caution towards both the theory and the practice.

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Autosynchronous Motors.

By PROF. A. LINDSTROM.

Since the early eighties, when alternating current was first used for the transmission and distribution of electric energy for lighting purposes, the inductive influence of the transmission lines—which produces phase displacement between voltage and current in the lines and the machines connected in circuit—has been known. The disadvantages of such phase displacement were, however, not fully realised until the three-phase system, with induction motors, was introduced in the early nineties. Every attention has since been paid to the design, construction and proportioning of induction motors to minimise this phase displacement, but in spite of all efforts the fact remains that most electrical power installations suffer from a large phase displacement which has necessitated special precautions being taken to reduce this by increasing the power factor of the installation. One way to obtain an improvement in this respect—and the practice is rapidly increasing—is to employ synchronous motors wherever possible for converting electrical into mechanical energy, or to use synchronous machines as condensers or phase advancers without utilising the same for mechanical conversion.

Before studying closely the possibilities of utilising synchronous motors, or more particularly the autosynchronous motor (the subject of this article) for power factor correction, it should first be explained in some detail the meaning and importance of cos φ.

The Importance of Cos φ.

The angle φ is the phase angle referred to above between the voltage and current in an alternating current system as shown in a vector diagram, and the cosine of this angle is the figure (never greater than 1) which indicates to what degree the electromagnetic energy in the lines, machines and transformers is effectively utilised; that is the reason why

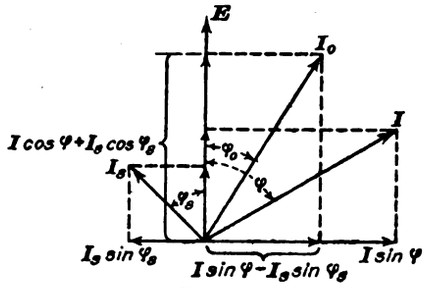

FIG. 1.

this is now generally termed "power factor." It must not be assumed that the portion of the energy which is not effectively utilised is actually lost, but this portion certainly circulates throughout the system, passing the point or points where the energy is consumed and returning to the power source through the corresponding conductors, apparatus, etc.

At first glance it might appear as if no harm was done when this particular form of energy is circulated in the system and returned to the source. Here, however, lies the great disadvantage of a low power factor, as the whole installation including generators, transformers, transmission lines and apparatus must have a larger current carrying capacity and be sufficiently dimensioned for both the effective energy consumed and the non-effective energy returned. In addition to this the losses in the various parts of the complete installation are dependent on their resistances and the squares of the current; these are real losses, corresponding to the total energy transmitted, whether consumed or circulated.

Power Factor and First Cost.

In this way a low power factor will unnecessarily increase the first cost of an electric installation, and, in addition, increase its running cost. Such energy which—on account of cos φ being less than 1—is thus returned to or reacts on the power source, is often called "reactive energy" in contradistinction to the consumed power termed "active energy." If, for example, the power factor of an electric installation is 0·75, this really means that 75 per cent. of the generated and transmitted power is utilised and consequently active, whereas 25 per cent. is sent back, and is consequently reactive. It necessarily follows that if the power factor could be increased from 0·75 to 1, an additional 33 per cent. of useful energy could be obtained from this plant without in any way increasing its electrical proportions; and in certain respects these could even be reduced. As a power factor as low as 0·75 is quite usual in practice the above example clearly emphasises the necessity of taking effective steps to increase the power factor of such electric installations, which matter has during recent years been most seriously considered in its various aspects by central station engineers. A simple solution of the problem will have far reaching effects, and whilst already of importance to all distributors and users of electric energy it will be more so in the future.

An important fact in this connection is that the supply companies and authorities now fully realise the great drawback of a low power factor on their supply networks, and are already introducing more stringent regulations with the object of making their charges on a different basis by penalising consumers with low power factors in such a way that, in addition to the usual kilowatt hour meter measuring the effective energy, a similar meter is installed measuring the reactive energy. When this latter exceeds a certain predetermined value—depending on the size and nature of the consumer's installation—a charge is also made for additional units of reactive energy in accordance with special schedules prepared by the supply company. No doubt changes will very soon be made in most supply companies' charges on somewhat similar lines to those indicated above with the same object in view.

An effective means of increasing the power factor is by utilising a machine or device which can neutralise to a large extent the reactive effect in such a way that it need not be produced in the power house or transmitted from there to the place of consumption; in other words, if the machine or device is on the consumer's premises it can be made to produce a

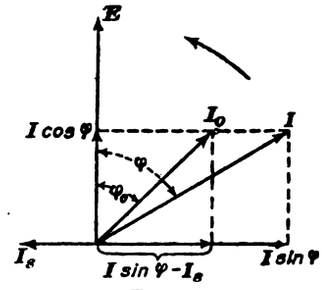

FIG. 2.

contra reactive effect of corresponding magnitude. Such an arrangement is found in the over-excited or over-magnetised synchronous motor.

Synchronous Motor.

A vector diagram best demonstrates the property which this motor possesses of increasing the power factor of a certain energy demand. As an example, if at the place of installation where the energy is consumed by asynchronous or induction motors the voltage is E, the required current I and the phase displacement on account of the characteristics and load on these motors is φ, the active effect or energy component will be (see Fig. 1)

$$P_a = E \times I \cos \varphi \text{ watt}$$

and the reactive effect or wattless component

$$P_{re} = E \times I \sin \varphi \text{ rewatt.}$$

In this article the reactive energy is called "rewatt" so as to indicate its reactive nature, consequently reactive units or kilowatt hours are styled kilo rewatt hours.

If now at this point a synchronous motor running at no load be put in circuit in parallel with the other motors, and this motor is over-excited, its current I_s will be vectorially in an opposite direction to $I \sin \varphi$; in other words, it is anti-reactive (or negatively reactive). This current will reduce the value of $I \sin \varphi$ in such a way that the balance of the reactive current is $I \sin \varphi$ minus I_s. In this way the total current I_0 is obtained, which is less than the original I, and the new phase angle φ_0 is also less than the original φ, as a result of which cos φ has been increased a corresponding amount. The wattless component or reactive effect has been reduced by an amount equal to that given by the synchronous motor

$$E \times I_s \text{ rewatt.}$$

The synchronous motor need not, however, run without load

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to obtain this advantage, but can at the same time be used to do actual work.

Fig. 2 shows a vector diagram under the latter conditions.

The active effect or energy component of the synchronous motor is now

$$E \times I_s \cos \varphi_s,$$

and its reactive effect or wattless component

$$E \times I_s \sin \varphi_s$$

when φ_s is the leading phase angle. The resulting current is now I_0 with a phase displacement φ_0.

Influence of the Synchronous Motor.

In this way it is easy to ascertain the influence of the over-excited synchronous motor on the total power factor under different conditions. For instance, if the synchronous motor has a variable load ($E \times I_s \cos \varphi_s$) it is necessary to know how its reactive current $I_s \sin \varphi_s$ varies in order to determine its influence, or, in other words, how its reactive current (dependent upon the field current of the synchronous motor) ought to be raised to obtain the desired result in respect of cos φ, etc. Needless to say, when three-phase is in question it is essential to multiply by three or $\sqrt{3}$ if E is volts per phase or between

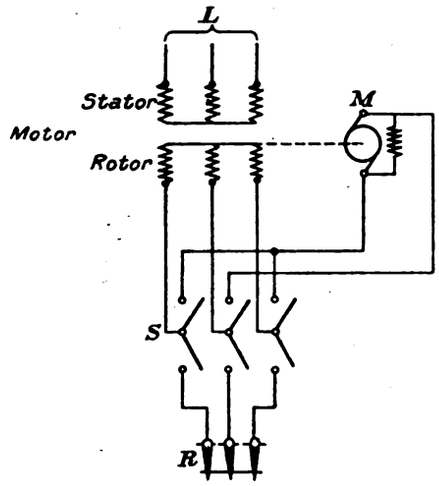

FIG. 3.

phases respectively, in order to obtain the correct result. The following question might here be asked: Is the advantage obtained by increasing the power factor more than the total extra cost (initial cost plus operating costs) of an over-excited synchronous motor in comparison with an ordinary induction motor? This question can, without hesitation, in practically every case be answered in the affirmative, and generally speaking it is found that the extra cost of the synchronous motor is more than balanced by the gain at the generator end, and that a real profit is secured in the reduction of losses in or initial cost of conductors or cables, transformers and apparatus, and, last but not least, in an improved voltage regulation on the whole system. This is, of course, on the assumption that the synchronous motor is connected at the place of power consumption and suitably designed for its work. It is well-known that the synchronous motor is unsuitable in cases where increased slip is required at heavier loads, for example, when working in conjunction with a flywheel. Neither is a synchronous motor suitable where repeated stopping and starting is required; but, on the other hand, the asynchronous motor under such conditions is an ideal machine.

It is obvious from what has been stated above that the ideal motor for power factor correction purposes, which at the same time performs useful work, would be a machine having the starting and running characteristics of an asynchronous motor and the phase compensating characteristics of a synchronous machine. These ideal characteristics are all combined in the subject of this article, viz.:—

The Autosynchronous Motor.

This motor was invented in 1900 by the well-known Swedish electrical engineer, Mr. Ernst Danielson, at that time chief Technical Engineer of Allmanna Svenska Elektriska Aktiebolaget, Vesteras, Sweden. The term "autosynchronous" really means a synchronous motor which "auto"-matically gets into synchronism. A short description of its design and characteristics will show in what respects its name applies.

From the diagram (Fig. 3) it will be seen that the motor is fundamentally an asynchronous or induction motor, as a rule a three-phase one. L is the supply net to which the motor is connected, S a three-pole throw-over switch which is closed downwards when starting the machine. The resistance R in the rotor circuit is connected in the usual way, and when gradually cut out the motor starts up as an ordinary induction motor and runs at a speed of a few per cent. below the synchronous one. The direct-coupled exciter M has now its normal voltage, and when in the following operation the throw-over switch is moved rapidly to the "up" position the rotor is magnetised by direct current from M, and its speed is then automatically accelerated up to synchronism. The voltage on the exciter M is then adjusted so as to over-magnetise the rotor in order that the machine should give the required reactive current, with the result stated above—i.e., increase of the power factor of the net.

Apart from certain inherent characteristics with regard to overload capacity, etc., the only difference between this motor and an ordinary induction motor is that the winding of one phase of the rotor has about double the copper section of the others, as the current in same is twice the magnitude of the current in either of the others. The rotor slots are also exactly dimensioned and arranged in a special manner. It is obvious that the exciter need not necessarily be direct-coupled to the motor, and also that direct current can be supplied from any other source so long as the correct voltage and current are obtained. As the voltage of the rotor winding during starting must be kept reasonably low the required direct current will also have a low tension with consequent high amperes. To overcome this drawback to some extent an arrangement is often used by which the three phases in

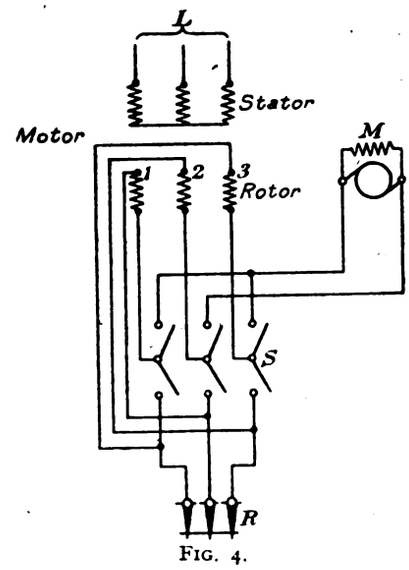

FIG. 4.

rotor are delta connected during starting and star connected when running (as shown in Fig. 4). In such a case it is necessary to furnish the rotor with six slip-rings, of which the three marked 1, 2 and 3 in Fig. 4 are provided with brush-lifting and short-circuiting arrangement.

Running Characteristics.

Regarding the running characteristics of the autosynchronous motor, it should be noted that if the machine is overloaded above its maximum rating as a synchronous motor, it falls out of step, and provided the overload is not too large, it continues to run as an asynchronous motor until the load is decreased to an amount just below that at which it fell out of step, when the motor again automatically synchronises itself. During this period the motor runs at a lower speed corresponding to the slip of the motor. Should the motor, on account of heavy load or large flywheel effect of the driven machines (especially if the motor is direct coupled to same) not be able to synchronise itself, a temporary increase of the excitation voltage will generally effect the desired result.

In order to appreciate fully how the autosynchronous motor operates it is important to know its inherent characteristics and, as same are best shown graphically, the second part of the article will explain briefly in a popular form the working diagrams of the autosynchronous motor and finish off with a short discussion on the points resulting therefrom.

(To be concluded).

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Tramways and Light Railways Association.

Interesting Matters Discussed at Swansea.

The twenty-sixth annual general meeting and the fifteenth annual congress of the TRAMWAYS and LIGHT RAILWAYS ASSOCIATION was held at Mumbles Pavilion, Swansea, on June 21st and 22nd. On the opening day the delegates were officially received by the Mayor of Swansea (Ald. O. J. DAVIES), who recalled the previous visit of the Association in 1912, and stated that Swansea, particularly Mumbles and adjoining bays, owed much to the popularity of the Mumbles Light Railway and the Swansea Improvements and Tramways Committee. He looked forward to the proposed electrification of the Mumbles Railway and its consequent development of the Gower Peninsula.

In reply, Mr. C. G. TEGETMEIER (chairman of the Council of the Association) said that it was important to recall that on this occasion they had present in Mr. E. Garcke the man who beyond others had been responsible in 1897 for the foundation of an Association which represented all the private owners of the country, with a capital of about 25 millions. In addition a number of municipal enterprises were included in the Association membership. At Swansea the tramways undertaking was a joint concern of the borough council and the private company, the corporation having invested considerable capital for which they got an assured interest return and a share of accruing profits.

Annual General Meeting.

The annual general meeting, which was presided over by Mr. Tegetmeier, was then held.

The statement of accounts, adopted by the meeting, showed revenue for 1922 to be £793; expenses, £836; adverse balance, £43; which, carried forward to balance sheet, reduced the surplus assets to £659, of which £500 was invested in War Loan.

The following six members of the Council retired by rotation: Messrs. C. G. Tegetmeier, A. W. A. Chivers, J. A. Forde, P. M. Rossdale, W. G. Vernon-Smith and J. C. Whiteley. The Council recommended election to Council of Messrs. L. E. Harvey, H. Holliday, E. R. Soames and W. S. Wreathall, and the recommendation was adopted. In addition Mr. H. L. White, Grimsby, was elected to a vacancy, leaving one which, it is understood, will be filled by Mr. W. G. Verdon-Smith (Bristol), who succeeds to the chairmanship vacated by Mr. C. G. Tegetmeier.

Conditions Better Than Last Year.

Moving the adoption of the annual report, the Chairman, Mr. TEGETMEIER, said it was satisfactory to note that labour and wage conditions were better than last year. The Council had accordingly been able to devote more time to technical and administrative questions. This had resulted in the establishment of a permanent Research Committee who, with experts, would investigate technical questions affecting the well-being of the industry. Foremost among these would be design and construction of tramway rolling stock, and they agreed with the Minister of Transport as regards draught preventers for top deck, but not single, cars. Tramway rights on matters of licensing of motor omnibuses to compete on routes would receive attention, and the Council committee had appealed to be heard by the Departmental Committee to be set up by the Minister of Transport on hackney carriage licensing. Touching the economics of the industry, the Chairman said it had been deemed inadvisable to set up a special unemployment insurance scheme for the industry. In the matter of wages and the proportion they represented of working costs charged against revenue, it would be impossible for many undertakings to revert, as required by the Act, in December, 1924, to the statutory maximum fares, and unless legislation was introduced to give relief it would have to be sought by private Bills. The wage agreement of April, 1922, still stood and had worked satisfactorily to an extent. The sliding scale had resulted in reduction by 15s. per week of the war wage increase of 40s. In the matter of wireless and wireless development, where aerials were put up subsequent to the tramways the onus of protection was on the tramways at present, but the Council sought to alter this.

A Paper on "Tramways and Some of To-day's Problems" was then read by Mr. A. W. A. Chivers. This is given in abstract in the next column.

Tramways and Some of To-day's Problems.

By A. W. A. CHIVERS.

Tramways play an important part in providing travelling facilities to-day. During 1921-22 over 4 000 million passengers were carried and the car miles exceeded 332 million. But, taken generally, tramways in this country have not proved remunerative, the net receipts for the period specified being only 6·6 per cent. of the capital expenditure. Yet 1921-22 was in many respects a record year. Since then expenses have decreased but receipts have diminished to a greater extent, owing to the general trade depression. Unfair omnibus competition has been another prejudicial factor, but the author is not adverse to omnibuses, which serve a useful purpose. But the small concerns that operate only at certain periods of the day and did not recognise the responsibilities incurred by reputable undertakings constituted unfair competition.

Tramways Cheapest for Dense Traffic.

Where density of traffic is high and calls for a fairly frequent service tramways can provide a cheaper and better service than any other form of road transport. But they are fettered by onerous statutory obligations. The maximum fares chargeable are limited, special services at cheap fares must be provided for workpeople, and the whole cost of construction and maintenance of the permanent way has to be borne, including paving between and for 18 in. on either side of the rails. It is therefore not surprising that tramways are not very remunerative. To illustrate this, the author calculates the effect of relief from these burdensome charges and shows that the percentage of receipts to capital expenditure would be increased from 6·6 to 10·5 per cent.

Some Problems for Solution.

Problems may be divided into those which the industry itself can solve and those which involve relief from unfair burdens and competition. To the first class belong problems leading to greater efficiency in operation. Improved methods of construction and maintenance of the permanent way, resulting in reduced costs, have been introduced. The B.E.S.A. specification provides for harder rails which are more immune from corrugations and developments in welding appliances and their use in reclaiming dished joints have reduced the costs of maintenance. The time is opportune for consideration of rolling stock and finality in this field of work has not yet been reached. The tendency is towards greater seating capacity. More up-to-date methods of collecting fares, and reducing the size of car so that a conductor can do his work efficiently, are also important. Ticket issuing and change-giving machines are now being considered but at present are not entirely satisfactory.

Some Changes in Design.

Apart from the use of top-deck covers the chief improvement in body design during recent years is the more general adoption of vestibule and semi-vestibule ends, giving more comfort to motormen and conductors. Little, however, has been done to provide more comfortable seats for passengers. The average speed of many tramcars is still miserably low—due probably in some cases to congestion caused by other traffic. In many cases the substitution of modern ventilated motors for those of the old type is justified by savings in maintenance. Thus Mr. Humphreys, of the Black Country Tramways, has found the average cost of maintenance per motor only £3·69 for the ventilated type, as compared with £38·9 for the old type. Some bogie trucks give excellent running, but some single truck cars leave much to be desired and the problem of getting sufficient resiliency and comfortable running is difficult. Mr. Pilcher, of Edinburgh is experimenting with a new form of rubber-packed wheel which seems promising. Experiments with sliding collecting shoes in place of trolley-wheels have in some cases given satisfactory results, but in other cases the results have been less successful. With the sliding shoe the more rapid wear of the trolley-wire is admitted; in some cases, especially on curves, it has been prohibitive. Generally speaking, the method must be regarded as being in the experimental stage.

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There are many important problems connected with the management of tramway undertakings, which vary greatly. In the second group of problems importance attaches to the question of tenure and the short recurring periods when local authorities may exercise options to purchase, which tend to deter the raising of money for improvements. This insecurity of tenure tends to stifle progress, and new legislation is needed to deal with the matter comprehensively. An extension of the period during which increased fare charging powers are authorised under the Tramways (Temporary Increase of Charges) Act 1920 is also becoming urgent. Renewed reference is also made by the author to the unfair burden involved in roadway maintenance, and the various Acts bearing on these problems are dealt with in a series of appendices to the original paper.

DISCUSSION.

Mr. A. G. VERDON SMITH said that as a matter of general policy there was never any such suggestion that tramways should be abandoned, and it had been introduced with the legal and technical turn of mind of the author. He was sorry that no indication of the legislation to which Mr. Chivers appeared to look for aid was given. Protection was badly needed by tramway interests against the opening of new routes by motor buses in streets already covered by the trams.

Mr. Garcke on Tramway Abandonment.

Mr. E. GARCKE stated that the abandonment of tramways spoken of by Mr. Chivers was only a question of the possible economic necessity of certain subsidiary routes of large enterprises and certain unremunerative "side-lines," run because they were imposed as a condition to the original undertakings, being turned over to other means of transport, They should be allowed to relieve themselves of unnecessary obligations to maintain unprofitable tracks in such cases.

Mr. WALTON thought that as the question of unfair omnibus competition was raised annually, it was time something was done. Better labour meant better results as far as track work was concerned. Modern methods of generation would help to reduce running expenses.

Light Small Cars the Solution.

Councillor C. J. MORRIS-MAUCOR (Edinburgh) said he believed in light small cars, though in Edinburgh they had single and double-decked cars. The weight on the road to carry 60 persons was less than 9 tons, and arrival at a suitable weight car was bound to benefit an undertaking. They had experimented with a rubber-packed wheel which had been used 16 hours a day for 6 weeks and had given every satisfaction, and would, they hoped, do much to absorb the shock by friction on wheel and rail.

Talk of Abandonment Useful.

Mr. C. J. SPENCER (London) thought talk about abandonment of tramways might be of benefit if only for the reason that when the millions who used trams heard of it they would not regard the possibility of losing trams without consulting their own convenience. The Government seemed to forget the importance of trams. For certain classes of work, whatever might be said for other transport, trams could not be replaced. It might be that speeding up of services would improve the position.

Bus Competition.

Mr. BECKETT (Municipal Tramways Association) dealing with position of local authorities in the matter of bus competition, said they were situated much as private companies or Watch Committees, the licensing authorities often did not even consult the Tramways Committees, and where a licence was refused appeal could always be made to the Minister of Transport, which resulted generally in a way being found to grant a permit for the buses. The wages charged against revenue were 100 to 120 per cent. above 1914 figures, and represented some 60 per cent. of the working costs. How, then, were reductions to be made? Cost of living had only decreased 14 points in 15 months, and the Chancellor had stated that he did not expect any price reductions for some time, and did not look forward to a return to pre-war costs. They had come to a stabilised figure now and could not return to pre-war charges.

At the conclusion of the meeting members attended a luncheon given by the Swansea Improvements and Tramways Co., Mr. C. G. Tegetmeier presiding.

In the evening the Mayor and Corporation of Swansea entertained the delegates to dinner at the Hotel Metropole, Swansea.

In reply to the toast of the Association, Mr. VERDON-SMITH said that more would have been done by the Association in tramway development but for hampering legislation imposed on tramways. In this country the tramways of to-day represented a capital expenditure of £86 000 000, there being about 250 undertakings and about 2 500 miles of rails. The proportion of municipal to private expenditure was about three to one, and the number of miles open about two to one. At the beginning of the Association in 1896, these figures were just about reversed. Private enterprise had done the pioneer work of exploring and proving the possibilities of tramways, and municipalities had exploited this. They did not complain, however, but were proud of the early work they had done.

The delegates reassembled on Friday morning at Mumbles Pier to consider a Paper by Mr. W. E. Ireland, entitled "Tramway Rolling Stock." This is given in abstract below.

Electric Tramway Rolling Stock.*

By W. E. IRELAND.

There has recently been a revival of the desire to produce rolling stock of lighter weight. It is convenient to consider double deck and single deck cars separately, as some of the material factors in design differ considerably in the two cases.

Taking the double deck car first a prime essential is to determine the top-deck load. Two factors have then to be considered, the stability of the car and its power to resist overturning by wind pressure or centrifugal force on curves, and the strength of pillars, rails, etc., to resist vertical load. The top-deck passenger load may reach 6 440 lb. or more, which, added to the weight of the roof cover, 3 700 lb. for a car 32 ft. 4 in. long, gives a total of 10 140 lb., to be carried at about 10 ft. above rail level.

Centrifugal Forces and Wind Pressure.

In the original paper the author presents a table showing centrifugal forces at speeds varying from 1 to 15 miles per hour on curves having radii from 45 to 100 ft. Data for wind pressure at an air velocity of 60 miles per hour are also given. The application of these forces is illustrated diagrammatically. To render the car stable with a heavy top-load, weight must be introduced into the lower parts. In the original paper the author explains the method of determining the centre of gravity. Next the vertical forces have to be considered and the author illustrates an approved form of substantial underframe. In order to bring the centre of gravity into a safe position a considerable amount of weight has to be added. As the weight of the motor and other parts of the electrical equipment is known the remainder must be in the trucks. In some cases the cross section of truck sides must accordingly be increased beyond that necessary for strength.

Single Deck Car Design.

Turning to single deck cars the author compares the weights of typical American cars with those customary in this country. Contrary to the views held by some, there appears to be ample room for reduction in the weight of American cars. The author describes a design for single deck coupled cars, in which weight can be reduced to a minimum. The weight of each car constructed to this design is 9 520 lb., i.e., 244 lb. per seat (which compares with 531 to 676 lb. per seat in American cars and 393 to 569 lb. per seat for British cars in the tabular data given previously). The cars, if used in pairs, would be electrically coupled but each would take power for its own motor from its own trolley. Small master controllers would be fixed on each car and provision would be made for automatic application of brake gear in the event of cars parting. In addition to the effect of magnetic brakes, two independent systems of mechanical braking are specified. Protection from buffing shocks, arising from the contact of one unit with the other, or in the case of collisions, especially on curved tracks, would be provided by a flexible buffer plate. The main advantages of the design are (*a*) greater loading and unloading capacity to serve rush traffic owing to number of entrances and exits provided, (*b*) reduction in energy consumption and maintenance costs, and (*c*) lower axle loads, tending to longer life of tracks, tyres, etc.

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Conclusion.

The author next turns to a question on which there has been much controversy, i.e., the wear of tyres. He describes in detail a series of tests which support the conclusion arrived at by others, namely, that brake-block action at any speed above, say, half-a-mile per hour has no appreciable wearing effect on the tyres. Comprehensive tests on other debatable points have also been made and the author's conclusions on this may be summarised as follows :—

(1) That the load per square inch on the area of contact presented by a tyre flange on the ramp in special track work is too great to permit of the flange carrying the tread clear of the railhead when traversing crossings, etc.

(2) That brake-block action in its effect on tyre wear is negligible.

(3) That the life of a tyre in terms of radial thickness is governed by (*a*) its width; (*b*) the load per sq. in. on the area of contact; (*c*) the elastic limit of the steel from which it is made, that is to say, a tyre whose tensile strength is 100 tons per sq. in., with an elastic limit of 50 tons, would give the same results as a tyre of 70 tons per sq. in. tensile strength, whose elastic limit is also 50 tons.

(4) That normalising, heat treating and tempering are essential to secure uniformity of structure in the steel.

(5) That to secure tyres on each axle of closely uniform hardness, they should be matched by their Brinell numbers; each tyre should be passed through a suitable hardness testing machine, and the hardness number stamped on the tyre.

(6) That the initial angle of inclination of the tread of a tyre should approximate as nearly as possible to its " typical shape."

DISCUSSION.

Mr. A. W. A. CHIVERS (London) said it was difficult to reconcile the necessity of increasing the weight of top-deck cars so much as would appear from Mr. Ireland's paper. The " S " type as now plying between Swansea and Oystermouth had seating accommodation for 54 people and had an unladen weight of 964 lb. or a weight per seat of 175 lb. An endeavour should be made to bring down the weight of top-deck trams to something approaching this. The type of bus mentioned, " S " type (A.E.C.), was not the lightest on the market, for there was one in London with a weight per seat of only 168 lb.

Weight Per Seat.

Mr. R. S. PILCHER (Edinburgh) stated that the weight of tramcars in this country averaged, 444 lb. per seat, but at Edinburgh recently they had one of only 354 lb. per seat. This was probably the lightest weighted car in Great Britain, and he thought there could be little doubt that cars in this country were too heavy.

The Car of the Future.

Mr. A. H. JACKSON (London) was of opinion that the ideal tramcar would prove to be a four-wheeler with a motor on all four wheels on double steel axles with double bearing boxes. Each wheel should have separate drive by a separate motor and so enable the body to be dropped between the wheels. He would like to see a multi-unit control and was in favour of making cars more comfortable by cushioning seats.

Mr. R. T. HOWLEY (London) also favoured lighter trams. The future of the tram lay in a sort of rural train, and he further believed we should then see the introduction of coupled cars with master controllers.

Speaking from the manufacturer's point of view, Mr. W. JOHNSTONE (Loughborough) thought that much for the future of tramcar design might be brought about by closer co-operation between tramway managers and manufacturers. At Cardiff there had been a problem of building a double-decked car to come within the limitations imposed by low-built bridges. The problem had been tackled and the result was that this tram had had an enormous success, its receipts per car mile being very striking.

The delegates were then entertained to lunch at the Hotel Metropole, Swansea, by the Swansea Harbour Trust.

In the afternoon, as on the previous day, buses were placed at the disposal of the delegates by the Swansea Transport Company for journeys to the Gower Peninsula or the National Oil Refineries at Skewen.

The proceedings concluded with a banquet on Friday evening at the Hotel Metropole given by the British Electrical Federation.

Mr. Garcke on Industrial Welfare.

Mr. EMILE GARCKE presided, and in proposing the toast of the Association dealt with the benefit to society of organisations whose objects were to define their relationships with other organisations and the community for joint welfare. The relationships between capital and labour at present were too unstable to last without considerable change, and the dependence of labour on capital should not be overlooked. The fitness of things in nature to their environment seemed to be beyond the emulation of mankind, but he believed the changing processes of social and industrial affairs and outlook portended to eventual better economic organisations and fitness to environments.

Reviews.

Testing of Transformers and A.C. Machines. By C. F. SMITH, D.Sc. (London: Sir Isaac Pitman & Sons.) Pp. x. + 91. 2s. 6d. net.

This is a companion volume to " Testing of Continuous-Current Machines," by the same author, and also one of the admirable series of technical monographs published by the firm of Sir Isaac Pitman and Sons. Dr. C. F. Smith for many years now has been the author of books on testing, which have been of great service to many engineers, so that we have every reason to expect what may be called the cream of the subject in a volume like the present. The first chapter is devoted to principles, and contains much useful information, but we do not like the expression given for the average temperature rise by resistance—viz., $\frac{r_2 - r_1}{r_1} \frac{100}{0{\cdot}428}$; because the temperature coefficient should not be taken to be constant. An accurate expression, using the constant, is :—final temperature $= \frac{r_2}{r_1}(234{\cdot}5 + t_1) - 234{\cdot}5$; so that we are thus left to choose between using $(r_2 - r_1)/r_1$ with a varying resistance coefficient, or r_2/r_1 with a constant coefficient. We prefer the latter form; and, after all, it is the final temperature that we really need in order to find the temperature rise. Then follows a chapter on transformer testing, which is on fairly normal lines. In the next chapter we find no indication of how to determine the efficiency of modern alternators on load. These large units, whether driven by steam or water turbine, have to be tested, whether without or with load; and considering their paramount importance nowadays, methods involving the measurement of losses by air-heating, etc., deserve consideration. Further, the oscillograph, though now an essential part of the testing equipment of large works, is also ignored. Induction motors are dealt with in the last chapter, the no-load and short-circuit methods receiving ample attention. Rotary converters are not dealt with.

Though the contents are good, we feel that important matters have been omitted; even in the limited space at the disposal of the author, we feel that some of the more laboratory type of information might well be replaced by the more practical tests met with under modern conditions.

S. PARKER SMITH.

Elements of Radio Telephony. By W. C. BALLARD, Jr. (London: McGraw-Hill Publishing Co.) Pp. x.+132. 7s. 6d. net.

Any new American technical book discloses developments of interest to those interested in the subject. The " Elements of Radio Telephony," by Ballard, is one of such.

The author's statement that the treatment is qualitative rather than quantitative is only too well confirmed in reading the book. It is possible without going into unnecessary details to give particulars of general dimensions which would be of great interest to all readers of such a subject, and one fears that this is but an excuse, unconscious, perhaps, for a very hurried treatment. No doubt the apparatus described is well known in America, but to the English reader much of it is new and a description in fair detail would have been interesting. As it stands the book merely provokes curiosity.

The most interesting section is the twelve pages on " Vacuum Tubes " or Valves. The action of the wireless valve is so often treated in a ponderous manner that Ballard's clear and simple treatment is a very welcome help to those wishing to obtain a general idea of what a valve is, how it is made, and how it works.

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Eliminating Atmospherics.

Interesting Invention by a French Engineer.

The elimination of atmospherics and other parasitic noises, in which term may be included signals from stations other than the one from which reception is desired, has long been a problem for those engaged in wireless work. The problem has been increased rather than decreased in difficulty by the use of the valve, for though by means of the latter apparatus signal strengths may be amplified, the same amplification is also applied to the "strays." Among the latest inventors to tackle this problem is M. Yves Marrec, whose equipment, which we inspected the other day, seems successfully to have solved the dual difficulty of eliminating parasitic noises and "filtering" the messages from two stations which may be transmitting at the same time on very similar wavelengths.

Success Under Difficulties.

The demonstration took place on the first floor of a six-storey building on Holborn Viaduct. A frame aerial is used for reception, and in spite of the fact that the trains of the Central London Railway are running not far beneath M. Marrec was able to isolate messages from Long Island, as well as from many nearer stations, and to print them on the tape of a not very modern type of Morse inker. We may add that the demonstration took place at 10 a.m. on a sunny day, a time and condition of atmosphere which is acknowledged not to be the most successful for wireless reception. This printing of messages in itself is a distinct step forward, as the interference of other transmitting stations and parasitic noises has hitherto only resulted in disjointed markings. It is claimed that the arrangement allows messages to be transmitted correctly four to six times as fast as has hitherto been possible, and that the necessity of closing down important long distance transmitting stations during the congested hours of the day is entirely eliminated.

Details of the Invention.

A diagram of the arrangement used is given herewith. It will be seen that it consists of a series of low frequency valves. After detection has taken place in the usual way the received current passes through one or more aperiodic amplifying circuits, in this case made up of three-electrode valves, which mutually react through transformers to produce first an amplification of the signal current and second local low frequency oscillations. The frequency of this latter set of oscillations is determined by a suitable choice of aperiodic circuits, so that when they are imposed on the combined transmitted and parasitic signals two waves of a different character are obtained. These oscillations are passed through a series of low frequency circuits, which are tuned to the note of the wave resulting from the superposition of the message current upon the local oscillation. The valves in these circuits are controlled by a rheostat which reduces the heating currents of the filaments and so regulates the amplification due to the resonance circuits. In this way a filtering effect is obtained which cuts out the parasites. The filtered wave can then be amplified and received in the ordinary way.

It should be pointed out that the resonance circuits have little amplifying effect and are specifically tuned to be "bad circuits" for all oscillations not of a particular frequency. On the other hand, the valves in these circuits do limit the amplitude of the received currents and produce sufficient amplification to allow of re-amplification later. In this way not only are parasites eliminated, but the signals from other stations are also cut out.

Overcoming Strong Parasites.

This method has in practice one defect when the signals are weak and the parasites powerful. This is owing to the fact that in order to generate sustained oscillations of a sufficient amplitude more than three stages of valves in the aperiodic circuits are necessary and the sustained oscillations themselves become troublesome. This is overcome by keeping the heating and high tension batteries in the "parasitic-eliminating circuits" separate from the batteries supplying the receiving apparatus proper, while sustained oscillations are generated and amplified by using more aperiodic circuits than are necessary for receiving. The heating rheostats of the aperiodic valves are adjusted to reduce the plate saturation current so that they work simultaneously as generators of sustained oscillations and amplifiers, and the heating rheostats of the resonance amplifiers are adjusted so that the plate saturation current is sufficiently reduced to limit amplification and at the same time to give the desired selection. The oscillations produced by the utilisation of a large number of aperiodic stages could also be generated by a low frequency heterodyne acting by induction upon the low frequency receiving circuits, if the currents are sufficiently amplified.

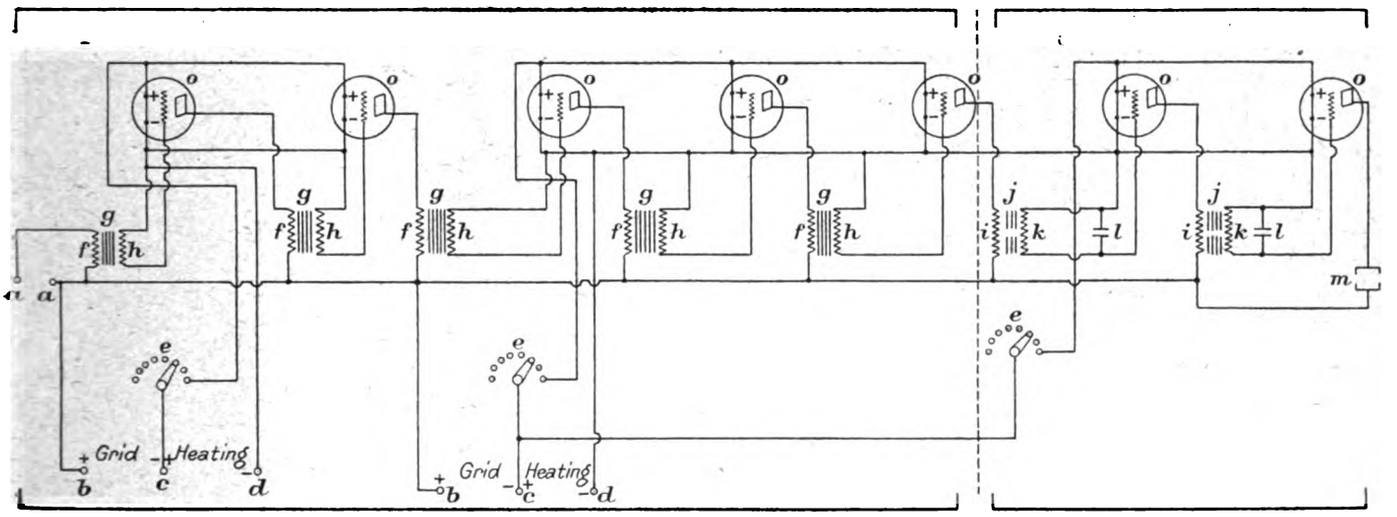

DIAGRAM OF CONNECTIONS USED IN THE MARREC SYSTEM.

A Memorial to Clerk Maxwell.

L.C.C. Fix Tablet on his Residence.

"Nature" states that a circular tablet of blue glazed ware bearing the inscription "James Clerk Maxwell (1831–1879), Physicist, lived here," has been affixed by the London County Council to 16, Palace Gardens Terrace, Kensington, where Clerk Maxwell resided for a time. Maxwell's occupation of the house probably dated from the latter part of 1860, immediately after his appointment to King's College, or the early part of 1861. The first reference to it in his biography by Campbell and Garnett is in a letter dated May 21, 1861. He resigned his appointment at King's College as from Easter, 1865, and left the house for good in March, 1866.

The second issue of "The King's Engineer" contains a large amount of matter which will be of interest to past and present students of the King's College, London, Engineering Department. Mr. Wordingham's address on "The Supply of Electrical Energy" we have already referred to, and on the same subject the facetious article on "Tariff Reform" contains a useful lesson. We read Mr. Highfield's reminiscences with great interest.

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Is Electric Baking Economical?

Some Figures Showing That It Is.

By JOHN W. GREGG.

Although it is generally conceded that electrically heated baking ovens have many advantages over those heated by other means, the relatively high cost of electricity on a B.Th.U. basis has led many to believe that the advantages of electric baking are not sufficient to off-set the differences in the relative costs of the fuels. To show accurately that these advantages do more than off-set the difference in fuel costs a series of tests was conducted recently at the market of Charles Weisbecker, Inc., 125th Street, New York City, with a Westinghouse electric reel type bake oven and a gas oven of the same type. Only three of the advantages of electric ovens are considered in these tests. They are :—1. That the electric oven will bake more goods in a given time than will a gas oven of equal shelf capacity ; 2. That the electric oven will save enough material by reducing shrinkage to more than balance the difference in fuel cost ; 3. That products baked in the electric oven retain their moisture longer, and therefore remain fresh and saleable for longer periods after coming from the oven.

Heat Basis Not the Sole Contention.

Before presenting these tests let us observe that electricity cannot be compared to other fuels on a heat unit basis, because this method of comparison disregards the practical application of the heat generated to actual baking and cooking processes. Heat generated by a fuel is not the basis of comparison. The heat actually utilised in baking forms the basis of comparison of fuels.

A test was first made to determine the comparative capacities of the two ovens. The factors involved in this test were the ease with which the ovens could be operated, the speed at which the ovens would bake, and the ability of the ovens to maintain the proper baking temperatures.

Both ovens were operated to produce the greatest possible quantity of goods. The ovens were in operation from 8 a.m. to 4.30 p.m., with a forty-five minute wait in the afternoon because of a lack of material to be baked. Ten runs were made, and the following variety of products was baked in each of the ovens:

Duchess cakes, wine cakes, princess cakes, nut cakes, spice cakes, loop cakes, pound cakes, fruit bread, Boston brown bread, soda bread, small bread, large bread, cottage bread, Parker house rolls, and scones.

A Wide Range of Temperature Necessary.

The baking of these products required a wide range of baking temperatures, and therefore the ease of altering the temperature of the ovens played an important part in bringing about the following results: In ten runs the electric oven baked 818 lb. of products as against 684 lb. in 18 gas ovens. The difference in favour of the electric oven was therefore 134 lb. of products.

The greater output of the electric oven was due to its ease of operation and labour saving features, its fast baking qualities, and its automatic temperature control, which assured maintenance of the proper baking temperature without the attention of the baker. This feature of greater production will be appreciated by every baker, and especially by the baker who needs to conserve floor space.

Savings from Reduced Shrinkage.

Special runs were made on bread and loop cakes to determine the amount of material saved by the electric oven. The results obtained show savings exactly corresponding to those made at other bake shops using Westinghouse electric ovens.

GAS OVEN WEIGHT.

Product.	Before Baking.	After Baking.
6 Loop Cakes ..	.. 24 lb. 0 oz.	22 lb. 4 oz.
12 Small Bread..	.. 10 lb. 8 oz.	10 lb. 0 oz.

ELECTRIC OVEN WEIGHT.

Product.	Before Baking.	After Baking.	Savings of Electric Oven during Baking
6 Loop Cakes ..	.. 24 lb. 0 oz.	22 lb. 9 oz.	5 oz.
12 Small Bread..	.. 10 lb. 8 oz.	10 lb. 4 oz.	4 oz.

These results show savings during the bake, which become very great when applied to a month's production. The Weisbecker Market bakes approximately 3 000 loop cakes and over 24 000 loaves of small bread each month.

SAVINGS EFFECTED.

Loop Cakes.—3 000 by $\frac{3}{4}$ oz. per cake = 2 500 oz. = 156$\frac{1}{4}$ lb.
156$\frac{1}{4}$ lb. by $0.19 per lb. = $29.69 saving per month.
Small Bread.—24 000 by $\frac{1}{4}$ oz. per loaf = 8 000 oz. = 500 lb.
500 lb. by $0.05 per lb. = $25.00 saving per month.

On these two items alone this bakery saves approximately $54.69 each month. In addition, similar savings in material are made on all of the other products baked.

This oven is supplied with power at 3 cents per kWh, and its consumption averages 3 200 kWh per month. Thus the electric power bill is approximately $100 per month. The gas oven in this bakery consumes about 3 900 cub. ft. monthly, and the gas rate is $1.15 per thousand cubic ft. The gas bill averages $45 per month. Assuming that the gas oven bakes as much goods as the electric oven (which is not true as shown by test 1), the difference in fuel cost is $100 - $45 = $55. But on two products alone Mr. Weisbecker saves about $54.69 per month in shrinkage, and this practically pays for the difference in actual fuel costs. The savings resulting rom reduced shrinkage on all other products is profit.

The Keeping Qualities of Bread Baked Electrically.

The bread baked for test 2 was weighed again 5 hours after it came from the ovens, and the electrically baked bread had shrunk less by one ounce than did the bread baked by gas.

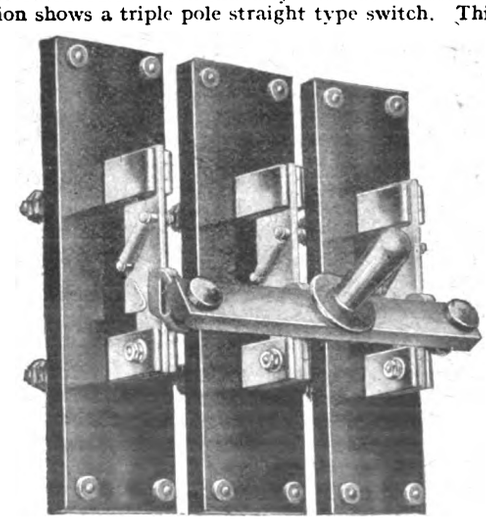
	Gas Oven.	Electric Oven.
Weight on coming from oven	10 lb. 0 oz.	10 lb. 4 oz.
Weight 5 hours later	9 lb. 10$\frac{1}{2}$ oz.	9 lb. 15$\frac{1}{2}$ oz.
Loss in 5 hours	5$\frac{1}{2}$ oz.	4$\frac{1}{2}$ oz.

This shows that the drying out process, which is a large contributor to the staling of bread, goes on much more slowly in the products of the electric oven. Every baker is striving to produce products with long keeping qualities because they are of great concern to the housewife, who always chooses the bread which retains its palatability longest.

Therefore, apart from the quality of the products produced, cleanliness, no fire hazard, and labour saving advantages, the electric oven justifies itself economically on the basis of (1) increased output for surface capacity, (2) reduced shrinkage in materials and (3) decreased loss through stale goods.

Henley's Standard Knife Switches.

A short time ago the British Engineering Standards Committee ssued a specification for air-break knife switches for circuits not exceeding 600 V. A list recently published shows that W. T. HENLEY'S TELEGRAPH WORKS CO. have designed a series of switches to comply with this specification and we understand that they will carry the rated current continuously without deterioration. Our illustration shows a triple pole straight type switch. This pattern



HENLEY TRIPLE POLE STANDARD AIR-BREAK KNIFE SWITCH.

is also made for single and double poles while angle and double throw types are manufactured in addition. The switches, as is evident, are of neat design and robust construction. They have long "flicker" blades which are fitted with substantial springs to give a quick break. When the "flicker" breaks it is parallel with the edge of the break contact, so minimising the effect on the ear.

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Electricity and Agriculture.

A Useful Exhibit at Newcastle.

By far the most interesting exhibit at this year's Royal Agricultural Show, which is now being held at Newcastle-on-Tyne, is that which deals with electro-farming. Needless to say, it owes its initiation to Mr. Borlase Matthews. This exhibit is unusual in that it is intended rather to demonstrate some of the practical possibilities of using electricity on a farm, than to be an ordinary trade exhibit. A good thing in itself is not of much use, and will not be appreciated unless it is widely known. The appliances are taken from Mr. Matthews's farm at East Grinstead, and have mostly been put together there, so that though the style and finish is not up to the resplendent standard of the agricultural implement manufacturer, the more important fact is that the appliances, if used, will contribute largely to increased profits on a farm, and that is after all the ultimate and all important matter.

Out of 45 entries for the R.A.S.E. silver medal at the Newcastle Show, no less than seven are included in this exhibit and in fact, though it was decided not to try the patience of the judges too highly, further new appliances for farmers additional to these seven, are actually being exhibited and some of these have *never* been exhibited at such a show before, which is also unusual at exhibitions.

Making Hay Without Sunshine.

Of the silver medal entries, undoubtedly the one that attracted most interest, was the method of "Making Hay Without Sunshine," to which reference has already been made in THE ELECTRICIAN. This was made the more interesting by an actual rick of green grass being shown under treatment. The apparatus employed consists of a Sirocco high pressure blower fan directly coupled to a Swedish General Electric motor of the agricultural type. This set is mounted on a specially designed stand, that lends itself to easy portability. The former employed in constructing the ducts in the ricks are shown, as well as the necessary thermometer and other fittings.

An Electrically-Driven Threshing Machine.

Another prominent exhibit, on account of its size, is a self-propelled and self-electrically-driven threshing machine. This consists of a ball-bearing de Pol full size thresher mounted on a special body, built on a petrol-electric vehicle chassis. This combination is a great improvement on present methods in that it can be so easily and quickly manœuvred alongside the stack to be threshed. (By present methods it generally takes half a day to get a thresher and engine into position and to line them up properly). The thresher is driven by an electric motor, which obtains its supply of current from the dynamo on the chassis. The dynamo also provides the current for propelling the vehicle. The controller for the electric thresher motor is placed conveniently alongside the feeder so that the machine can be stopped or started whenever he desires by the simple movement of the control handle.

When desired, a small winch, also electrically operated, is employed for the purpose of hauling the whole vehicle out of boggy places. The thresher can easily be dismounted, when a convenient lorry is available for general farm purposes. The electric winch can then be used for assisting in loading the vehicle, or for hauling. Another use for this vehicle, is the supply of electric current for an electric plough, or for any other purposes for which electricity may be required on farms. The chassis is constructed by Tilling-Stevens.

An Agricultural Motor.

Another exhibit is a special 5 H.P. Swedish General Electric agricultural type portable motor, mounted on a barrow. This equipment is fitted with a speed reduction, so that machinery can be driven either off the motor pulley direct, or at a reduced speed off the counter-shaft. On the stand, the motor will be shown operating in turn a chaff cutter, a root slicer, and a combined crusher and grinder, made by Corbett Williams and Co.

Electric Eggs.

A 2 300-egg electric fan-operated incubator is also being shown. Owing to the use of electric fans, the egg trays can be placed in tiers, making the whole machine exceedingly compact, saving much labour and space. There is no need to cool the eggs, and the egg in a corner of a tray gets as good treatment as one in the centre, owing to the uniform mechanical circulation of the air.

A farmer's electric generating plant, which consists of an International Tractor driving an electric generator was also to be seen. By means of special tracks, the tractor driver can easily and automatically line up his tractor against stops, which are provided on the track. Thus, when ploughing and other tractor work is done, it takes a very short time to arrange the tractor for driving the dynamo. For a farmer who has a tractor, further investment in an engine to drive a dynamo is not necessary.

Electric Lighting for Poultry.

In connection with the lighting of poultry houses, an improved form of reflector is shown which increases the lighting effect to a maximum of efficiency, and at the same time reduces the cost to a minimum. Electric lighting on Mr. Matthews's farm results in the production of 20 per cent. more eggs in winter; other electric poultry-keepers get as much as 25 per cent. increase. The lights are controlled by a special clock-switch which has an astronomical feature. The clock switches on at sunset, off at the predetermined hour, say 8 p.m., dims for 15 minutes, and then puts out the lights. It again switches on early in the morning, and off at sunrise. The varying times of sunset and sunrise are provided for, by an astronomical attachment. The lights are shown in operation, in a novel portable poultry house.

A Wireless Set for Farmers.

Realising the importance of wireless telephony for farmers, for weather reports and time signals, after much trouble, Mr. Matthews has succeeded in getting the authorities to broadcast these reports. The next step was to develop a simple wireless receiving set for farmers, and this set has been entered for a silver medal. The method of construction is entirely new, and involves several new principles, It is so designed that it can be used as a crystal set. or a crystal and valve set, or a two valve set. With an attachment (not shown), it can be used as a multiple valve set. All these combinations and permutations can be easily adjusted by any farmer by means of simple, clear, definite instructions, depending upon the distance of his farm from the nearest broadcasting station.

In addition to the above silver medal entries, the following applications of electricity are also being shown:—electrically-driven barn machinery, including chaff cutters, etc. Also a special electric combined churn and butter worker, into which cream is poured and the butter comes out churned, washed, salted, and worked all ready for making into pats. There is also an electric ploughing equipment and other apparatus, all of which should enable the British farmer to see for himself what can now be done electrically.

Station Engineers as Consultants.

Interesting Controversy at Chester.

An unusual position has arisen at Chester owing to a difference of opinion between the Electricity Committee and the Finance Committee regarding the undertaking by the electrical engineer, Mr. S. E. Britton, of private consulting work.

At a meeting of the Chester Town Council last week the following resolution of the Electricity Committee was moved: "That the resolution of the Council of December 13th, 1922, relating to salaries of officers and servants be varied, and that (1) an officer of the Corporation may undertake private work which in the opinion of the committee controlling his department does not interfere with the satisfactory discharge of his duties to the Corporation, and he shall be allowed to retain the balance of any fees received by him in respect of such private work after the cost, if any, incurred by the Corporation, has been defrayed; and (2) every officer shall furnish to the committee controlling his department full particulars of all the private work which he proposes to undertake, and of the fees which he expects to receive, and subsequently does receive in respect of it."

Speakers on behalf of the motion pointed out that many corporations allowed their electrical engineers to take outside work, and that as the development of municipal electricity supply was of national importance every engineer should be engaged in any enterprise which was for the good of the nation, provided that in so doing he was not neglecting the work of his own corporation. On the other hand, it was contended that the proposal was bad in principle, and, if carried, equity would require its extension to minor employees.

The resolution was eventually defeated by 22 votes to 12, but in view of a resolution made by the Council last December, there appears to be no objection to the electrical engineer undertaking advisory work outside, so long as he hands any fees over to the Corporation.

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The National Physical Laboratory.

On Tuesday of last week the annual inspection of the NATIONAL PHYSICAL LABORATORY by the General Board took place, and a large number of visitors were received by Sir Charles Sherrington, President of the Royal Society. All the departments were thrown open to visitors, but in the time available it was only possible to look at a few of the exhibits here and there.

Wireless Telegraph Progress.

In the Department dealing with wireless telegraphy, an elaborate apparatus (but simple in operation) was shown for the measurement of the intensity of the field from a distant transmitting station. This line of investigation is by no means standardised as yet, and we gathered that a good deal of trouble was experienced from interference of one kind and another. Much remains to be done before this kind of work is on a satisfactory basis. Among the apparatus used for standardising in connection with wireless work may be mentioned the self-contained compound multivibrator standard wave-meter, giving standard frequencies from 10 000 per sec. to 1 200 000 per sec. with an accuracy of 5 parts in a 100 000. The whole range of frequencies is controlled by a tuning fork, and is independent of the constancy of any electrical circuit. The apparatus has been worked out to such a form as to enable any frequency to be obtained with great ease by adjusting to any selected harmonic.

Measuring Dielectric Losses.

In the Section dealing with ordinary electrical measurements the method used for measuring dielectric losses at low and telephonic frequencies was interesting. For this purpose a Giebe bridge, modified by Mr. Rosen, is used. As shown in the diagram, two of the arms consist of variable condensers

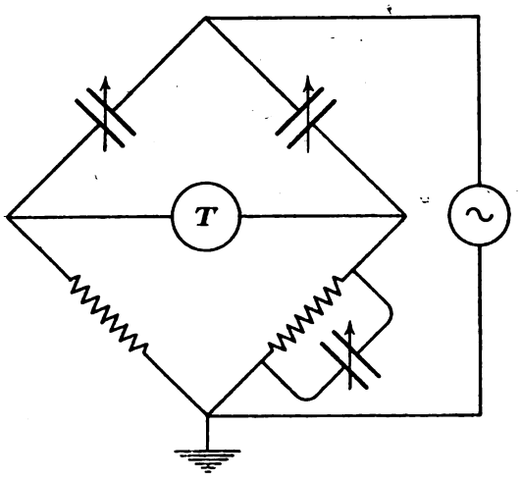

DIAGRAM OF MODIFIED GIEBE BRIDGE

and one arm consists of a variable resistance shunted by a variable condenser. All parts, including the leads, are carefully screened. This method is used for testing small samples of dielectric, such as paper, mica, etc. The specimen is cut to shape and held between two iron plates. These are insulated from one another and are hollow on one face so that mercury can be run into the hollow spaces and come into contact with the sheet of dielectric under test. By this means a mercury electrode is obtained on each side of the specimen. The test is carried out by having the specimen thus mounted in an oven which is controlled both as regards temperature and humidity. We understand that very satisfactory results are obtained in this way.

The usual method of measuring the capacity of condensers by a ballistic galvanometer has been modified somewhat by damping the galvanometer with a shunting coil in both the condenser circuit and the mutual inductance circuit. The mutual inductance is then adjusted until the same throw is obtained for both circuits.

A New Illumination Building.

Turning to more electrotechnical matters, we found that a new illumination building had been erected in which various types of rooms (on a reduced scale) can be set up by using a simple type of structure, and measurements of the daylight illumination can then be made under various conditions.

An interesting demonstration was shown, by projection on the screen, of the action of electrodes in testing oil at high voltages when the oil contains suspended particles. The oil in use appeared to be a little dusty. As the voltage was increased the dust particles became attracted to the electrodes and finally formed a bridge between them, leading finally to a breakdown.

The use of a neon stroboscope was shown for testing the retardation of meter discs. The disc being graduated near the periphery, the graduation appears stationary at a certain speed. The time at which this appears is noted, and the time is again noted when the divisions appear stationary once more, indicating a lower speed, which is a sub-multiple of the first.

To those visitors concerned with telephony the new building in which experiments are being carried out on the production of sounds and on the measurements of sound intensity was interesting, but we could not help being impressed with the idea that at present we know very little about the subject.

The "Usco" Water Sluice Ash Conveyor.

An Interesting Equipment at St. Pancras.

(FROM A SPECIAL CORRESPONDENT.)

There is now being installed at the St. Pancras Electricity Station, by the UNDERFEED STOKER CO., an ash conveyor on the water-sluice principle. As is well known, the mechanical conveying of ash and clinker is one of the most unsatisfactory operations in the whole field of power generation, because of the hard and abrasive character of the material, and particularly because of corrosion, so that the wear and tear and depreciation on any ordinary ash conveyor is extremely severe—for example, at least three or four times as great as that of coal conveying.

The boiler plant at St. Pancras Electricity Station consists at the present time of two water-tube boilers of 40 000 lb. evaporation each, and two other boilers now in course of erection, forming one line of four boilers.

Details of Installation.

The ash and clinker drops over the end of the stokers, which are totally enclosed, into heavy cast-iron ash hoppers, which dip down into a concrete trough which forms the water sluice. This trough is semi-circular in section, with an internal width of about 1 ft. 6 in. and a depth of about 2 ft. 6 in. and runs underneath the boilers common to all the ash hoppers. Rushing along inside this trough is a volume of water at a constant depth of about 6 in., with a flow volume of 600 gals. per minute, which passes into a large underground concrete ash discharge pit.

In the near future another row of four 40 000 lb. boilers will be erected, which will be served by a similar trough, and both troughs are equipped with one main pumping installation, which pumps the sluice water from the ash discharge pit, passes it to the other end of the troughs, along which it flows to the pit again, forming a completely closed circuit with a very rapid flow of water. The power required for the whole eight boilers will be supplied by one centrifugal pump of 16 H.P. running at 936 revs. per min., with a total flow of water in the closed circuit of 1 200 gallons per min., so that the power required is very small. The red-hot ash and clinker drops into the flowing water, is quenched at once, and swept along and discharged into a large concrete tank, where it falls to the bottom, the water passing back to the centrifugal pump through strainers. As the ash and clinker accumulates it is removed from time to time by a large telpher grab, and the whole system is extremely simple, neat and efficient.

Advantages of the Arrangement.

In addition to the small power required, there is also a number of other advantages, chief of which is the almost entire absence of wear and tear, since there is nothing to go wrong. Also the whole arrangement is totally enclosed, so that there is no dust and dirt, no heat, and particularly no escape of foul-smelling steam, whilst the ash and clinker, as soon as it falls into the comparatively cold water, at once breaks up into extremely small pieces. Another curious fact is that in the presence of a large bulk of water in this way the material is alkaline in spite of the fact that ash and clinker when quenched with a small amount of water in the ordinary way is distinctly acid. The amount of make-up water required in the total circuit is very small, and the temperature does not rise much above 140 deg. F.

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Hackney's Latest Cooking Demonstration.

Interested Crowds View a Window Display.

There is nothing a Londoner likes better than free exhibitions. A hole in the road, a broken down motor bus, a boy fallen off his bicycle, all provide a subject for philosophic contemplation and caustic comment. This being so the inhabitants of Hackney are singularly fortunate. For the past week they have been able to enjoy a free demonstration of electric cooking which has been provided for them by Mr. L. L. Robinson.

As our illustrations show, this demonstration takes the form of cooking electrically in the window of the Mare Street showroom

THE DEMONSTRATION WINDOW FROM THE INSIDE.

of the Hackney electricity supply department. A blackboard indicates what is being cooked, gives figures of the small loss incurred by cooking electrically, and adds the pertinent advice to "Try this on your gas stove." The lady demonstrator can be observed doing things, and from time to time succulent food can be seen, if not tasted and smelt. Small wonder is it, then, that our photographer has been able to record the attitude of expectant wonderment which is passing across the faces of certain of the lady inhabitants of the district. If they do not go home and worry and worry until they also can get electric cookers, which they can easily do in Hackney, we shall be very much surprised.

SOME IMPORTANT PEOPLE IN HACKNEY ARE INTERESTED.

The only people who do not like this method of advertising are the police and the gas people. Their reasons are different, but are quite intelligible. The latter we need not worry about and no doubt even the former can be squared. In fact the Commissioner of the Police is always asked to the annual conversazione of the Institution of Electrical Engineers.

"Punch," as the old story goes, may not be as good as it once was, but this year's "Punch Summer Number" is better than ever, whether we consider the literary matter, the illustrations, or the general get-up. It makes us think that we really may have a summer after all. There is nothing essentially electrical in it, but probably our readers will think none the worse of it for that, for they are but human beings.

Lighting and Selling.

An Instructive Lesson from a Biscuit Display.

It has always been recognised that it is easier to sell by demonstration than by precept, and this is particularly true in connection with the sale of appliances for the lighting of shop windows. One may talk and write to the point of exhaustion without convincing the average tradesman that his lighting is not all that it might be. A demonstration, either in his own window or in a special demonstration window, will, however, very quickly make the shopkeeper realise the many advantages which may be secured by the use of modern methods.

The picture accompanying this note is reproduced from a photograph (taken with a Brownie camera) of the demonstration window which has been fitted up in the showroom of the BRITISH THOMSON-

HOW LIGHTING CAN BE USED TO SELL BISCUITS.

HOUSTON CO.'s Liverpool office. The goods in the window were supplied and arranged by Jacob and Co., the well-known biscuit manufacturers.

Three separately switched systems of lighting are installed. Firstly, in order to show how a window should *not* be lighted, two bare 100 W gasfilled lamps are suspended on flexible cords in the middle of the window. Secondly, there are three 100 W gasfilled lamps in Jupitor X-ray reflectors fixed along the top front edge of the window. This exemplifies the correct method of lighting a window by means of concealed units. Thirdly, there are two more 100 W Mazda gasfilled lamps in Jupitor reflectors fitted with X-ray colour attachments. These two units are intended to be used in addition to the other three Jupitor units in order to produce appropriate colour effects. Slides of various colours can be fitted into the colour attachments, and one colour may be substituted for another within the space of a few seconds.

This demonstration window has proved highly successful as a means of interesting tradesmen in the question of correct lighting and the advantages of coloured illumination. Electrical contractors are encouraged to bring their customers to see the demonstration, which rarely fails to induce them to spend money on new lighting equipment for their own windows.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

"ALL-ELECTRIC HOUSES AND CONTROL."

To the Editor of THE ELECTRICIAN.

SIR,—I have noted a letter from Messrs. A. P. Lundberg and Sons in your issue of June 15th under the above title. I must say I am still unconvinced. The cost of multiple switch wiring is not a trifle, and the undoubted convenience accruing from it must be looked upon as somewhat of the nature of a luxury when considering such a small and compact house as the one in question. Naturally one would always prefer to ascertain one's client's means and tastes, if that were possible, but, failing this, I do think that where there is any doubt economy should always be allowed to prevail.—I am, etc.,

PHILIPPE ERNEST PERONNE.

London, E.C.,
July 2nd.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

G.E.C. "Freezor" Fan Campaign for 1923.

Service from the manufacturer to the retailer can be limited, or it can be of a wide and useful nature. In the merchandising field the service a manufacturer can render is of equal importance as the question of price, and while no attempt is now being made to set up a theory that prices can be entirely ignored for the sake of service, it is undoubtedly a sound policy to deal with those manufacturers who persistently make "service" the link between themselves and the retailer. It often so happens that keen prices

IF SUMMER COMES.

can be obtained with service, and this is so with the GENERAL ELECTRIC CO. Particularly does this apply to their fans, as is proved by their price list and other publicity matter just published.

The catalogue V3 is now enlarged to 44 pages, and in addition to a fully illustrated description, with prices, of all types of "Freezor" fans, contains new features of the greatest value. One of these new features is a 12-page introduction which gives a full technical description of all the principal types of "Freezor" fans. The list contains particulars of desk and bracket fans, of both the rigid, adjustable and oscillating type, ships' and railway fans, ceiling fans, exhaust fans and speed regulators.

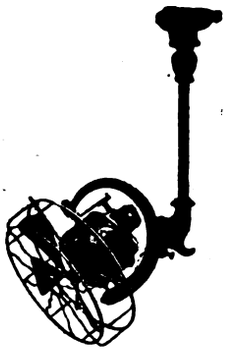
The folder V3013 which we reproduce in monochrome, is a new three-colour design which is also repeated on a new showcard and poster, both of which are now available. Supplies of the folder can be obtained overprinted with retailer's name and address.

Among the other sales aids provided are supplies of novelty parachutes and window circles, all of which will be distributed to retailers upon application.

We have therefore the three main essentials for a big turnover—service, price, and sales aids.

Ediswan Fans for 1923.

We have just received from the EDISON SWAN ELECTRIC CO., their fan catalogue for 1923. As in past years the catalogue contains an extensive range of fans, including, as it does, desk and bracket fans (with and without oscillating movement), ceiling fans and exhaust fans. Prices are competitive, and the fact that the makers can give the trade "delivery from stock" should be remembered. The great number of voltages and frequencies which a fan manufacturer has to cater for means a heavy load in stock values for smaller manufacturers to keep assembled, and it is only firms with the standing of Ediswan who can render the trade the important service of immediate delivery.

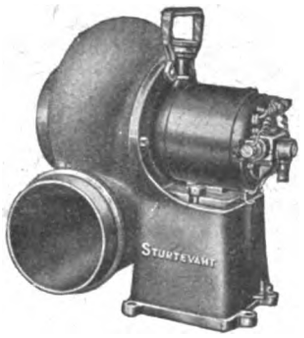


AN EDISWAN OSCILLATING FAN.

As we mentioned, the Ediswan campaign this year includes practically every type of fan. We illustrate an oscillating ceiling fan, which is of an uncommon design. Centre fixing for a ceiling fan is not always available, therefore this fan has been designed for suspension in a corner of the room. It oscillates in an arc of 160 deg. which can be varied in four stops down to an arc of 40 deg. The angle of the fan can be varied by thumbscrew adjustment. Two sizes are manufactured in both the a.c. and d.c. types, viz., 12 in. and 16 in.

"Big Business" in Fans.

In these columns recently we stressed the importance of big business in fans, and obviously, in citing the several manufacturers who can help the contractor with this business, we should have included STURTEVANT ENGINEERING CO. The fact that we did not do so was due to lack of space. We return to the subject again this week with a twofold object—viz., to emphasise this idea of "big business" and to comment on the product of this concern.



A READY-TO-RUN VENTILATING FAN.

Contractors who resolve to think boldly on this question must give much study to the various apparatus of this company. In catalogue No. 1065, it is revealed that, compared with the business now done, there is an El Dorado. This is suggested by the ready-to-run ventilating fans; and from our illustration it will be apparent at once that this is a ventilating outfit of distinct design. The essential feature is the fact that these fans are capable of handling comparatively large volumes of air against moderate resistance, and are ready for operation by connection to an ordinary B.C. lampholder. An outlet for the sale of these fans is in the workshop or household; in fact, there are a multitude of situations where they will prove a better proposition to put forward than the table fan.

"Crypto" Battery-Charging Rectifier.

The "wireless" boom has brought in its train a crop of apparatus for accumulator charging. The claims made by each and every manufacturer are bewildering, and a new problem is looming ahead for the contractor and retailer, even if it is not already here. The problem is to know the best apparatus to handle as a line of merchandise, because two main factors must govern the design—viz., reliability (an important feature with "domestic" apparatus, which battery-charging equipment is rapidly becoming) and efficiency. Prices must also be attractive; and it is only the best manufacturers that can tune in to these three factors. It is but a commonplace to remark that the CRYPTO ELECTRICAL CO. are one of several manufacturers who can be relied upon to sell apparatus on these three foundations, and it is therefore important that all retailers

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should give particular study to the "Crypto" commutating rectifier which has recently been placed upon the market. It is not the purpose of this note to give a technical description of the

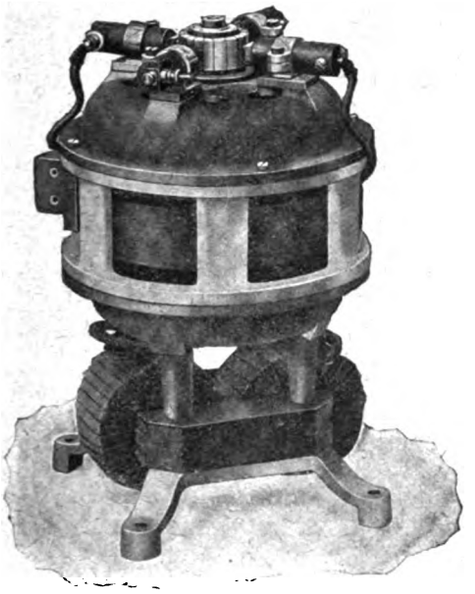


FIG. 1.—THE NEW "CRYPTO" RECTIFIER.

apparatus, this can be obtained from the "Crypto" descriptive list No. 445. But we illustrate the rectifier in Fig. 1; and it will emphasise the importance of studying the market for this device

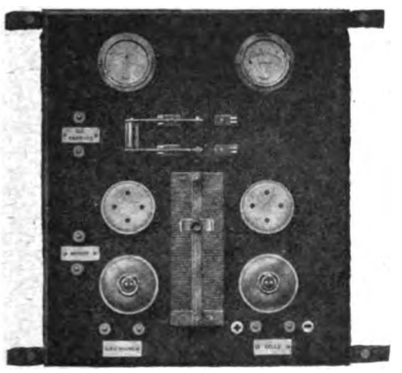
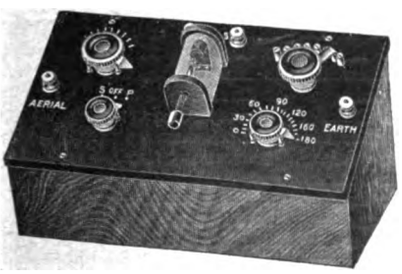


FIG. 2.—"CRYPTO" BATTERY CHARGING SWITCHBOARD.

if we mention that the 5 A, 10 V or 15 V size is listed at £7 10s., and the 10 A, 15 V size at £10. Fig. 2 illustrates a very necessary complement—viz.: a small switchboard, listed at £3 5s.

An "Acme" Production.

We illustrate a crystal set offered to the trade by the ACME PRODUCTION CO. It is similar in construction to many sets now on the market, being designed primarily for local broadcasting.



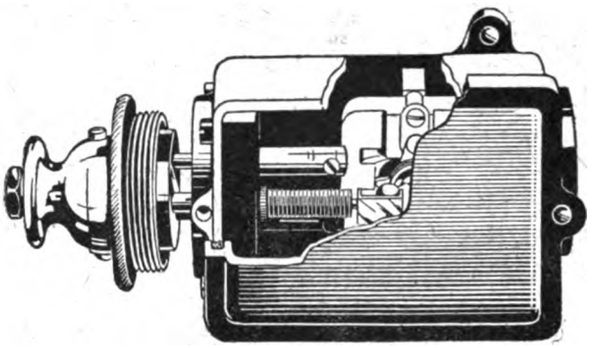
AN "ACME" OF BROADCASTING.

The set has, however, a wave length adjustment from 300 to 3 000 m. This is a feature which appeals to many amateurs, and there should therefore be a good turnover for retailers with this set, which is listed at £5 5s.

A Simplex Interlocking Switch Plug.

When the matter is reviewed by the buyer, it is curious how patent it becomes that for certain devices there is a limited market to buy in, that is assuming that he wishes to confine himself to the best makers. This condition is peculiar to ironclad interlocking switch plugs.

We illustrate an ironclad interlocking switch plug manufactured by the SIMPLEX CONDUITS, LTD., whose specification proves that a sincere attempt has been made to provide a thoroughly sound device. The switch part is of "Crabtree" manufacture (a further testimony of a good article), and the plug is of the two-pin and

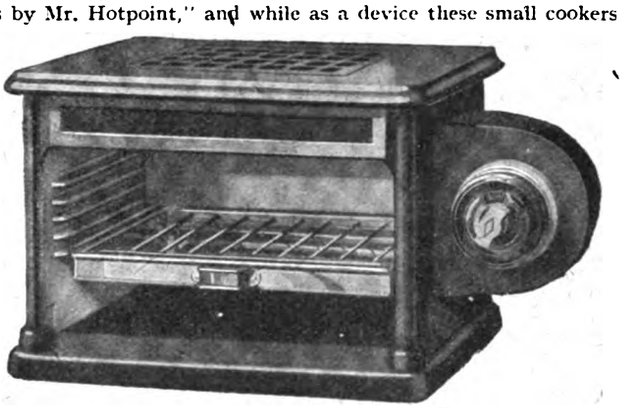


A SIMPLEX SWITCH PLUG.

earth type, and is made entirely in brass. The gland fitted on the plug is suitable for twin cab tyre cable with an earthing strand. A locking ring is also provided, and completes a device which is listed at 28s.

"One of a Hundred Comforts."

The "Falco" breakfast cooker, which we illustrate, is one of the "hundred comforts" manufactured by the HOTPOINT ELECTRIC APPLIANCE CO. It is included in "The Home of a Hundred Comforts by Mr. Hotpoint," and while as a device these small cookers



THE WAY TO A HAPPY BREAKFAST TABLE.

are commonplace, it is these simple but reliable devices which form the backbone of a sound merchandising programme. The cooker which we illustrate is essentially a device built on these two fundamentals—viz., reliability and simplicity.

A Product of the Electrical Appliance Co.

A crystal set is manufactured and offered to the trade by the ELECTRICAL APPLIANCE CO. at a list price of £5 15s. 9d., including aerial equipment and one set of headphones. The set has some points of interest to pull business at the list price mentioned because the manufacturers have succeeded in producing a simple crystal set which is a "little different." A particular feature is the use of a three-way switch, which is employed for the purpose of: (*a*) connecting the aerial to earth when the set is not in use; (*b*) "broadcasting" wave lengths; and (*c*) receiving the Paris time signals.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

"Bencolites" are described in leaflet No. 627 recently published by the BENJAMIN ELECTRIC CO., LTD.

The CRYPTO ELECTRICAL CO. have kindly sent us a copy of their List No. 445 describing the "Crypto" commutating rectifier for battery charging. We hope to be able to comment on this apparatus at an early date in our "Merchandise to Sell and Profit By" columns.

The WESTERN ELECTRIC CO. continue to render every help to wireless retailers by their publicity campaign. The intensity of the campaign is typified in two publications recently issued, one being "Stepping Stones" and the other "The Wonders that Pass Your Home."

Siemens "Zed" fuses are not new, but all readers of THE ELECTRICIAN will be interested in the new and most comprehensive list just published by SIEMENS AND ENGLISH ELECTRIC LAMP CO. The same company also announce the publication of Catalogue No. 63 on fans.

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Parliamentary Intelligence.

Postmaster-General v. Liverpool Corporation.

On June 28th Mr. F. GRAY asked the Prime Minister whether his attention had been called to the recent action between the Postmaster-General and the Liverpool Corporation and the comments of the judges in the House of Lords; and whether he would take steps to prevent the growing practice of Government Departments of appealing against adverse decisions, which enabled them, by using the resources of the country, to deter claimants, except wealthy corporations, from taking action in the courts of justice in respect of well-founded claims?

The ATTORNEY-GENERAL: I have been asked to reply. The answer to the first part of the question is in the affirmative, though the present Law Officers were not personally engaged in the case, the appeal having been lodged in the time of their predecessors. The importance of the case cannot be measured by the amount at stake. It involved a point of law which was regarded as being of exceptional importance to the Postmaster-General, upon which the judgment of the Divisional Court in favour of the Postmaster-General was reversed by the Court of Appeal. In answer to the last part of the question, so far as I am aware, there is no such growing practice.

Sir L. WORTHINGTON-EVANS, on Tuesday, informed Mr. LENG-STURROCK that £1 686 of public money was expended on costs in connection with this case.

Electrical Developments in Palestine.

On Monday Mr. BECKER asked the Under-Secretary for the Colonies if any progress had been made this year towards harnessing the latent water power in Palestine under the Rutenberg concessions; and had any electrical energy been produced?

Mr. ORMSBY-GORE: Yes, sir. I am informed that considerable progress has been made under the Auja Concession, which, as the House is aware, is the only concession that has actually been granted. Power-house, cables and transformers have been installed and net-work erected in Tel Aviv and Jaffa, where the current is now available. In anticipation of the supply, 225 applications for connections have been received in Tel Aviv and Jaffa up to June 28th, including many from Arabs. Supply of current began on June 28th.

City and South London Tube Strike.

Colonel ASHLEY, replying on June 28th to Mr. MCENTEE, who asked whether any steps were being taken to bring about a satisfactory settlement to the dispute on the City and South London Tube Railway, said: I understand that the dispute arose out of a reduction of wages which was agreed to by the Civil Engineering Construction Conciliation Board. I understand that the unions concerned are not represented on this board, but that the board has offered to meet in order to hear the claims of the men provided that work was resumed.

Wireless Apparatus on Ships.

In reply to Mr. LINFIELD on June 27th, Lord WOLMER said that all ships required by law to carry wireless had to comply with certain minimum requirements as regards both wireless apparatus and operators. These requirements were laid down in the Merchant Shipping (Wireless Telegraphy) Rules, 1920. He did not think that as the result of recent legislation there had been a relaxation of these rules because of the fees imposed upon shipowners in connection with wireless telegraphic installations.

Cost of Wireless Stations.

Sir B. CHADWICK was informed by Sir L. WORTHINGTON-EVANS on Monday that the approximate capital expenditure upon the following wireless stations was: Leafield, £115 000; Cairo, £136 000; Northolt, £43 000; and Stonehaven, £31 000.

Empire Wireless Communication.

Replying to Mr. BECKER on June 26th, Sir L. WORTHINGTON-EVANS said: Before the Marconi Co. can proceed with the stations which they purpose to erect in this country for Empire communication, it is necessary that the conditions of the licence to be issued to them for the purpose should be settled. I am in negotiation with the company on this question, and I hope that a satisfactory agreement will shortly be arrived at. Orders for certain of the plant required for the Government station which it has also been decided to erect were placed some time ago; there is no intention of expending public money in excess of the amounts which have been or may be voted for this purpose on the Estimates.

In answer to Mr. BECKER on June 28th, Capt. KING said the conditions now being negotiated with the Marconi Co. would not exclude competition by other companies, nor would they create a monopoly for that company.

On Monday Sir L. WORTHINGTON-EVANS informed Mr. MACLAREN that the terms of the proposed licence now under discussion to enable the Marconi Co. to establish an Empire wireless chain would certainly contain no provision precluding the Government or any wireless company from establishing a similar wireless installation.

Replying to further questions on Tuesday, Sir L. WORTHINGTON EVANS said he could not undertake that an opportunity for discussion would arise before the new licence became operative. The company at present held no licence covering wireless communication with any countries outside Europe except the United States and Canada. The licence which was now under negotiation would cover the erection of stations in Great Britain only, and would not be exclusive. There was no intention to exclude private enterprise in wireless telegraphy in any part of the Empire.

London Electric Light Charges.

Traders' Petition for a Reduction.

A deputation from the CITY OF LONDON RETAIL TRADERS ASSOCIATION last Saturday presented to the Lord Mayor a petition praying that steps might be taken without delay with the object of bringing about a reduction in the cost of electric light in the City.

The petition sets forth that lighting charges constitute a specially heavy item of expenditure in the case of shops; that the present maximum charge per kWh for electric light is 8d., as compared with about half that figure in pre-war days; the charges in the City compare unfavourably with those in other parts of London and the provinces; that the companies are still enjoying privileges conceded to them as special war-time measures; and that the higher rate is due fundamentally to the absence of competition.

A member of the deputation said the petition contained the signatures of 732 companies and private traders carrying on retail business in the City.

He emphasised that light played a much more important part in the business of a retail trader than in the case of banks and insurance companies, mercantile offices, and so forth, as the retail trader must usually display his goods to the general public to the best possible advantage and for longer hours. He gave various comparative figures, pointing out that in Coventry the charge was 5½d. per kWh, less 5 per cent. for prompt payment, and in Birmingham 5½d. less 5 per cent., and urged that the situation in London was due to the existence of a monopoly.

Eventually the petition was referred to the Streets Committee for further consideration.

Power Engineers' Salaries.

New Schedule Issued to E.P.E.A. Members.

The current issue of "The Electrical Power Engineer" states that the revised schedule about which there has been so much discussion and disagreement is now in the hands of the members of the Electrical Power Engineers' Association. The basis of classification is now the maximum demand (not plant capacity). This will be determined from an average of six weekly readings taken over a period of half-an-hour with the addition of a "margin" of 75 per cent. The effect of this alternative basis will result in a reduction in salaries of from 1 to 2 per cent., owing to the fall in the cost of living. In addition, probably about 10 to 15 per cent. of the members will suffer a further reduction, owing to the alteration in classification. The salaries of those employed at a few undertakings may be increased slightly. Our contemporary remarks that the new schedule is better drafted than the old, and "says what it intends to say with a moderate degree of precision." Certain alterations have been made in such matters as holidays, sick leave, cost of living and classification.

Forty Years Ago.

"The Electrician," July 7th, 1883.

THE MAGAZINES.—In this month's "Nineteenth Century" Viscount Bury deals with "House Lighting by Electricity."

* * *

AN INCOMBUSTIBLE INSULATOR.—A patent has recently been taken out for an incombustible insulating material. The inventor combines paraffin and castor oil with india rubber, and then mixes the compound with oxychloride of zinc or lead. By combining the paraffin and oil with the rubber, he states that he is able to incorporate with them a greater proportion of the substances used for rendering them inflammable. The inventor's name is A. Parkes, and the number of the patent 5 388 for 1882.

* * *

FUNERAL OF THE LATE MR. SPOTTISWOODE.—At noon on Thursday the remains of the late President of the Royal Society were laid in Westminster Abbey, the Dean of Westminster having acceded to the very numerously and influentially signed memorial asking that this honour might be paid to the mortal remains of one who so well deserved it. Amongst the pall bearers were Sir William Siemens, representing the British Association; Sir William Armstrong, the Institution of Civil Engineers; Dr. Evans, the Royal Society; the Duke of Northumberland, the Royal Institution; Mr. Childers, Her Majesty's Government; Mr. Andrew Cockerell, the Prince of Wales, and representatives of the other scientific societies. Mr. Spottiswoode is buried in the north of Poet's Corner. He is not the first of his name who has been deemed worthy of such a resting place, as one of his ancestors, Archbishop Spottiswoode, appears to have been buried in the Abbey many years ago. It is needless to say that electrical science was numerously and worthily represented at the graveside.

M.P.'s Visit to Wireless Station.

A handsomely produced and illustrated brochure has been distributed by Marconi's Wireless Telegraph Co., as a souvenir of a visit to the Ongar and Brentwood Wireless Stations and Radio House by members of the INDUSTRIAL GROUP of the House of Commons on Wednesday of last week. A concise account is given of the features of interest at each station and the photographic reproductions include views of the central power house and the continuous wave transmitter at Ongar, and the new aerial system at the Brentwood receiving station.

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Municipal Tramway Finance.

Further Facts and Figures for the Past Year.

In studying the accounts of municipal tramway undertakings for the past financial year it is interesting to note that widely differing policies with regard to fares have achieved success in different localities. At BRIGHTON, for example, where there has been considerable controversy as to the policy of penny fares, Mr. Marsh, in his annual report, mentions that twopenny fares remain "easily the backbone of the traffic," bringing in two-thirds of the revenue, the lower rate yielding 12 per cent. only. At ABERDEEN, on the other hand, during the year ending May 31st, the number of passengers carried on the system was 39 885 812, and the number of penny tickets purchased was 30 238 042. There is no great difference between the populations of the two places, that of Brighton being over 140 000, and that of Aberdeen under 160 000. The cynic might suggest that the explanation lies in a dislike on the part of the Aberdonian to spend two pennies when one will serve.

A more detailed study of the accounts of the two systems shows that at BRIGHTON a surplus was obtained on the year's working of £3 414, in spite of a great deal of work done on renovating the track. The surplus for the previous year was £5 538. The total revenue was £124 424 (a decrease of £787), and the total working expenditure £104 988 (an increase of £2 099), leaving a total gross profit of £19 981, as against £22 761 in 1921–22. Capital and income tax charges absorb £16 567, as against £17 223 in the previous year, leaving, as already stated, £3 414. This is transferred to the reserve fund, which, owing to an expenditure of £6 561, part of the cost of postponed track renewals, now has a balance of only £518.

At ABERDEEN the revenue amounted to £184 750, an increase of £248. The cars ran 146 000 more miles and carried 319 118 more passengers, the receipts averaging 18·4d. per car mile, as against 19·5d. in 1921–22, and the passengers carried per car mile having been 16·6, against 17·5. Traffic wages have worked out at 5·5d. per car mile, compared with 6·1d.; permanent way repair wages at 0·75d., compared with 0·36d.; and the car repair wages at 1·1d., as against 0·91d.

Big Profit at Bradford.

A record profit was made by BRADFORD Corporation tramways during the past financial year. The figure was £104 600, as against £56 000 in the previous year, when the minimum fare was 2d., 1½d. stages having been introduced on November 1st last. A large increase in the number of passengers carried resulted from the reduction, but receipts fell from £669 000 in 1921–22 to £650 000 in 1922–23. Working expenses have, however, been considerably curtailed, hence the large profit. Traffic expenses fell from £234 000 to £211 000; general administration expenses, including rates and taxes, fell from £61 000 to £49 000; repairs and maintenance cost £40 000 less, and power £8 000 less. The amount spent on renewals was, however, £37 200, against £32 400 in 1921–22.

In view of the high costs of production it has been considered prudent to write down the capital expenditure during the year by a contribution from revenue of £47 000, in order that the capital charge for the work done during the year may represent approximately what would be the value of the asset after the abnormal conditions have passed away. After making this contribution there has been transferred to the renewals account a sum of £20 406 in respect of the year. The reserve in the renewals account at the beginning of the year was £109 600, and thus at the end of the year it stands at £130 000. Of this amount £13 000 has been appropriated to the relief of the current year's rates. It is estimated that £40 000 will be spent on renewals during the present year, so that at the end of the year there will probably be a credit balance of £77 000, plus any profits which may accrue on the working of the undertaking during the period.

Warrington and Wolverhampton.

At WARRINGTON a gross profit was made of £11 755, against £6 995 in the previous year. The total income was £53 350, against £52 854, and expenditure fell from £45 859 to £41 595. The loan charges, less interest received, were £7 321, leaving a net profit of £4 434, as against only £173 in the previous year. The chairman of the Tramways Committee, in presenting the accounts, intimated that the question of a reduction in fares was being very carefully considered.

The total gross profit realised by the WOLVERHAMPTON Corporation tramways was £30 458, compared with £25 368 the previous year. Income declined from £121 096 to £106 300, but expenditure was also reduced from £94 417 to £74 843. After paying interest and loan charges, the sum of £16 373 is transferred to reserve and renewals account. The average fare paid by passengers was 1·69d., and the average fare charged per mile was 1·333d. Fares, however, were reduced at the beginning of the present financial year.

Sheffield Trams Help the Rates.

At SHEFFIELD, as in the foregoing case, both income and expenditure declined, the gross profit being slightly larger than in the previous year. Income was £854 451, a decrease of £49 543 and expenditure amounted to £641 614 a decrease of £55 473. The gross profit was thus £212 836, and the net profit, after deducting interest on loans, income tax, etc., amounted to £94 516, an increase of £11 394, as compared with the previous year. Of the net profit, £13 214 is assigned to rate relief, and £67 489 goes to the renewals fund. Experiments made on certain routes with lower fares have resulted in a definite loss in revenue, but the principle is to be extended to other routes for three months.

An improvement on the year's working is recorded at COVENTRY where the deficit of £18 449 of a year ago has been reduced to £5 836. Capital expenditure to the amount of £60 061 was incurred during the year, chiefly in connection with the renewal and doubling of the permanent way. Including the value of reconstruction stores in hand the total capital expenditure up to the end of the year was £442 837.

A Surplus for London.

Although the revenue was smaller a substantial reduction in working expenses resulted in a surplus of £230 251 for the LONDON County Council tramways, against a deficit of £88 757 for the preceding year. The total debt incurred up to March 31st last amounted to £16 417 401, and the net debt outstanding at that date £9 135 944, after allowing for debt paid, sinking fund balances, etc. The amount of capital expenditure which up to March 31st, 1923, had become obsolete owing to the electrification of the horse tramways was £2 024 688, but the debt has been reduced to £790 576 by the ordinary process of repayment and by proceeds of sales. Certain expenditure amounting to £291 294 incurred in connection with electric traction has also been rendered obsolete. This includes £104 312 in respect of part of the purchase money of the undertaking in London of the London United Tramways. Apart from this latter item of £104 313, the repayment of the expenditure rendered obsolete in connection with electric traction is being provided for over short periods of years specially approved by H.M. Treasury, and the balance of £386 will be cleared off during the year 1923–24. Arrangements have been made for the institution of cheaper fares for children from July 9th in consequence of which it is anticipated that the number of adult passengers will also be increased. Anticipated results of the working for 1923-4 show an estimated net surplus of £78 617, assuming the total receipts to be £4 825 000 with working expenses at £4 019 445.

Ipswich Deficit Reduced.

A diminution of income accompanied by a saving of £5 315 on expenditure resulted in a deficit of £3 193 on the IPSWICH Corporation tramways, as compared with a deficit of £7 367 for the previous year. The reduced expenditure was mainly due to wages reductions and to the fact that fewer renewals were carried out on the permanent way and cars owing to the proposed utilisation of railless 'buses.

At DUNDEE the tramway revenue was £154 092, a decrease of £8,977 on the previous year, but working expenses at £134 174 were reduced by £2 216. The cars ran 26 614 more miles and carried 467 088 passengers less than in the former period. Approximately nine miles of overhead wires have been renewed. Proposals for a reduction of the 3d. fares to 2½d. were approved at a recent meeting of the Tramways Committee.

Institution Notes.

THE ASSOCIATION OF CONSULTING ENGINEERS has elected Mr. J. Mitchell Moncrieff as chairman for the ensuing year.

THE WAYGOOD-OTIS ATHLETIC CLUB is holding its 14th annual sports and garden party on the club ground at Whitefoot Lane, Bromley Road, Bellingham, to-morrow (Saturday).

The General Purposes Committee of the London County Council has authorised the payment of 3 000 Belgian francs (about £37) in respect of the Council's subscription to the INTERNATIONAL TRAMWAYS UNION for the year 1923, on condition that the Union prints an English version of the papers published by it.

A representative gathering of the rejuvenated BATI WALLAHS SOCIETY attended the races of the British Motor Boat Club in Chelsea Reach on Saturday last. Afterwards they went for a short cruise which finally brought them to the Castle Hotel, Richmond, where they dined. We understand from those who know that the function as a whole was most successful.

An appeal fund committee has been formed to raise funds to strengthen the finances of the INSTITUTION OF RUDDER INDUSTRY to allow of the immediate development of its activities. Among the developments contemplated are the extension of lectures to additional centres, the foundation of a technical entrance examination, and the publication of a Bulletin. Promises of donations totalling over £500 have already been received.

In its report to the London County Council on Tuesday the Education Committee stated that after considering arrangements for the award in conjunction with the INSTITUTION OF ELECTRICAL ENGINEERS of national diplomas to students in technical schools and colleges in England and Wales, it has been decided to give permission to the Council's technical institutes to enter candidates, the Council paying the school fee on behalf of institutes from which candidates are entered.

The Annual Conversazione of the INSTITUTION OF ELECTRICAL ENGINEERS was held on Thursday, last week, at the Natural History Museum. The guests, numbering about 1 500, were received by the President and Mrs. Gill, and included a number of representatives of the Services, Government Departments and kindred institutions. The evening was pleasantly spent in listening to an excellent musical programme, and in renewing old, and in making new acquaintances. We did not think the company was quite so large as has been usual in recent years, but this did not detract from the comfort of those present.

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Imperial Notes.

AUSTRALIA.

Electricity Supply by N.S.W. Railway Department.

The New South Wales Railway Department intends to establish a generating station at Middle River, Marrangaroo, to supply electricity in western centres as far as Dubbo, and in mountain towns.

The First Australian Turbo-Alternator.

At the N.S.W. Railway Commissioners' Ultimo (Sydney) power house, the Chief Commissioner recently started the first of two 2 500 kW turbo-alternators built at the Clyde (N.S.W.) works of the English Electric Company of Australia. These are the first turbo-alternators of Australian manufacture, but the company is now constructing a set with a capacity of 18 750 kW.

The State and Electricity Supply.

In New South Wales, as in Victoria, there are complaints in municipal circles of State interference in the matter of electricity supply. It appears that Cobramatta Council has decided not to accept the offer of Melbourne Corporation to supply electricity to Cobramatta, as the price asked is considered too high, and an offer has been received from the Railway Commissioners to furnish the current required. Melbourne Council considers this to be a breach of the agreement under which it purchases electricity in bulk from the Commissioners.

New Projects in New South Wales.

Among recent developments are proposals of the Parkes Council to establish a municipal electricity supply scheme estimated to cost £19 000, and of the Guyra Council to invite tenders for the erection and equipment of municipal electricity works. Bathurst Council is borrowing £40 000 at 5½ per cent. interest for its projected electricity supply undertaking, and the Blackheath Council has decided to borrow the £7 700 due to the Katoomba Electric Supply Company for the purchase of its works at Blackheath. Murrurandi Council has abandoned its municipal electricity scheme and expressed its readiness to grant Mr. N. Gee a 20-years' concession for electricity supply in the town.

From particulars of the Nymboida hydro-electric scheme which have been submitted by Sir W. G. Armstrong, Whitworth and Co. to the Clarence River Council, it appears that the power house will contain three 400 kW turbo-generators, and current at 33 000 V will be transmitted to Grafton on an overhead line. Capital expenditure is estimated at £96 770, and annual costs at £12 174.

CANADA.

Interchanging Telegraph and Cable Traffic.

It is stated by Mr. C. H. Mackay, president of the Postal Telegraph-Commercial Cable system that his company has executed an agreement with the Canadian Pacific Railway for the interchange of telegraph and cable traffic. Under this arrangement, which holds good for ten years, all telegraph and cable business collected by the C.P.R. offices in Canada for despatch to all parts of the world will be handed to the Postal Telegraph Cables, while the latter organisation will hand to the C.P.R. all similar traffic destined for Canada.

INDIA.

Import Duty on Wireless Telegraphy Apparatus.

A notice issued by the Government fixes the Customs duty leviable on apparatus for wireless telegraphy imported into India at the rate of 2½ per cent. *ad valorem*. The importation of such apparatus by other than a duly licensed person under the Indian Telegraph Act is prohibited except under licence from the Director-General of Posts and Telegraphs.

Electric Lighting of Ootacamund.

The lighting scheme for Ootacamund should, according to the contract, have been completed by April 4th last, but delay occurred owing to the necessary materials not having arrived in time, and to some misunderstanding between the Government and the municipality. Mr. E. J. B. Greenwood, electrical inspector to the Government of Madras is now supervising the work, and it is hoped that the town will have electric light before the end of this month.

Rangoon Tramway and Supply Developments.

In submitting their report for the year ended December 31st last, the directors of the Rangoon Electric Tramway and Supply Co. state that in order to meet increased demand for energy considerable extensions are in hand at the power station and to the mains. While the progress of the supply department is considered satisfactory the turnover of the house wiring and supply department was less than in 1922, owing to the big drop in prices of all electrical fittings and accessories. The gross profit was £128 309, and after all necessary deductions have been made, and £12 969 brought forward has been added, there remains an available balance of £68 228, of which the preference dividend absorbs £15 000 and the interim dividend £8 333, leaving a balance of £44 895.

NEW ZEALAND.

Progress of New Zealand Government's Undertaking.

The sixth generator installed at the Lake Coleridge power station was recently tested on load. This unit brings the generating plant up to the maximum contemplated in the original scheme—viz., 12 000 kW. The connections to the system amount to about 9 000 kW.

Foreign Notes.

EUROPE.

Electrical Engineering Developments in Poland.

Satisfactory development in the Polish electrical engineering industry is reported by the Commercial Secretary at Warsaw, who states that the number of types of articles manufactured in Poland last year showed a decided increase, as compared with the previous year. Telegraph and telephone apparatus, wireless equipment and transmission valves, cables, electric lamps, dynamos and motors, switch gear and household acccessories are now being made in the country, but the majority of the electrical apparatus sold on the Polish market, apart from the Polish productions referred to, is of German and Austrian origin. A Dutch concern has opened an electric lamp factory near Warsaw, and is considering the opening of a glass factory to manufacture the bulbs.

Swiss Railway Electrification Finance.

The view that the electrification of the Swiss Federal Railways, which is now progressing steadily, is promoting the declining tendency of the Swiss franc is stated by the Basle correspondent of the "European Commercial" to be widely held in business circles. In the first place he states the expenditure entailed—far more than 200 million francs up to date—has an effect on capital investments abroad, lessening as it does the purchase of foreign coal and the consequent demand for foreign means of payment. Another factor, working more or less in the same direction financially, is the circumstance that the whole sum needed by the Federal railways has been advanced by the National Bank, which has thus had no funds available for investments in foreign means of payment, while the private banks, which, in the opinion of the circles above referred to, ought to have been asked to participate in supplying the funds for electrification, can find no employment for their idle money other than foreign exchange operations.

Railway Electrification in Sweden.

The electrification of the Swedish State Railways, more especially the important Western trunk line, Stockholm-Gothenburg, continues to attract keen attention. The cost of the electrification of the latter line, according to the Government proposal of 1920, was calculated at 105 000 000 kroner, of which the actual electrification accounts for 75 000 000 kroner and electric locomotives for 30 000 000 kroner. The work, however, was not taken in hand then, and in the meantime the cost of material has fallen. There are three alternatives, and the one it is now proposed to carry out entails a cost of 38 000 000 kroner, against the 75 000 000 kroner, of the previous calculation. Quotations are now much lower, especially for copper, which accounts for about 10 per cent. of the 38 000 000 kroner. The weightiest reason for starting electrification immediately, says "Engineering," is the fact that the Lilla Edet State hydro-electric power station on the Göta River, somewhat below Trollhättan, is approaching completion, and this was purposely built with a view to railway electrification. The State Telegraphs seem to view the impending railway electrification with some misgivings; they fear that their low voltage circuits will be interfered with, but the State Railways guarantee that all necessary precautions will be taken.

LATIN AMERICA.

New Brazilian Hydro-Electric Generating Plant.

The Brazilian Hydro-Electric Co., a subsidiary of the Brazilian Traction, Light and Power Co., of Rio de Janeiro and Sao Paulo, Brazil, has ordered from the Westinghouse Electric and Manufacturing Co. seven power transformers and a large amount of switch gear for a new plant located on the Parahyba River, about 100 miles north-east of Rio de Janeiro. The power from this plant will be fed into the existing system of the Rio de Janeiro Tramway, Light and Power Co., which is another subsidiary of the Brazilian Traction, Light and Power Co. The initial installation at the new station consists of two 25 000 kVA vertical water-wheel generators, but it is designed for an ultimate capacity of five of these units.

Obituary.

Dr. Louis Bell.

We regret to record the death of Dr. Louis Bell, the well known American electrical engineer, which occurred at West Newton, Mass., on June 14th. Dr. Bell had been in poor health for some time.

Louis Bell was born on December 5th, 1864, and was educated at Dartmouth College and the John Hopkins University. In 1878 he was appointed professor of physics at Purdue University, and while holding that position organised an electrical engineering department. In 1890 he became editor of the "Electrical World," and in 1892 was appointed chief engineer of the power transmission department of the General Electric Co. (U.S.A.), designing the first three phase transmission plant for general service.

Dr. Bell will, however, be principally known for his work on illumination, and in his consulting practice, which he conducted for twenty-seven years, his advice and knowledge of this important subject has had a profound effect upon its development. During the war he invented a system of signalling by ultra violet rays, and his last work was done in connection with the Sperry searchlight in the detection of helium.

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Electricity Supply.

Extensions and Developments.

A scheme for the electric lighting of LLANISHEN and district is estimated to cost about £20 000.

MAIDSTONE Town Council has received sanction to a loan of £2 139 for the motor converter for the electricity works.

DUNDEE Electricity Committee is introducing a new system of street lighting, which provides for the abolition of a number of gas lamps.

CHESTER Corporation has received from the Commissioners sanction to borrow £3 000 for the laying of additional mains in Hoole and Newton-by-Chester.

In connection with the Kemp Town sub-station BRIGHTON Lighting Committee recommends that sanction be obtained from the Commissioners for an expenditure of £24 800.

In view of the successful results from the hiring of electric cookers, GLASGOW Electricity Dept. is being asked to provide electrical equipment for houses on the hire-purchase system.

BARNSTAPLE Town Council has applied to the Electricity Commissioners for a loan of £1 000 for relaying public lighting mains,, £852 for feeder and distributing cables, and £1 700 for mains services, and meters.

One unit at the BARTON power station which was described and illustrated in our issue of June 15th, was put under load last week. It is proposed formally to open the station in October, when the second unit will be ready.

HASTINGS Town Council has adopted the recommendation of the Electricity Committee, of a scheme for the erection of a new power station at Broomgrove, with a capacity of 14 500 kW, at an estimated cost of £130 000.

The provision of central electric lighting standards throughout Edgware Road and Maida Vale, London, to be erected and maintained by the two councils jointly, is being considered by the MARYLEBONE and PADDINGTON Councils.

The Mersey Power Co., which supplies ELLESMERE PORT industries with current, is now laying mains for the supply of electricity to houses and shops. To meet this competition, the Council has reduced the price of gas by 1s. per thousand cubic feet.

The Conference of GREATER LONDON Municipal Electricity Authorities has protested against any local authority's undertaking being refused extension of its generating plant and being forced to take a bulk supply when it could itself generate more cheaply if further plant were installed.

Alterations in Charges, Proposed and Actual.

BRIDLINGTON Electricity Committee has recommended a reduction of 1d. per kWh in the cost of electricity for lighting purposes.

HOYLAKE AND WEST KIRBY Urban Council has reduced the charge for electricity for power from 3½d. to 3d. per kWh, for the first 500, and from 3d. to 2½d. beyond.

STAMFORD Urban Electric Supply Co., announces that in future the minimum charge will not be enforced where the consumption of electricity in any half-year exceeds 25 kWh.

DARWEN Electricity Committee has reduced the prices of electricity supplied to tradesmen to 6½d. per kWh up to 300 kWh per quarter, and 6d. per kWh over 300 kWh per quarter.

Reductions in the selling price for power and heating purposes from 70 per cent. to 50 per cent. above pre-war charges, and for lighting from 50 per cent. to 25 per cent. above pre-war charges, are recommended by the ROTHERHAM Electricity Supply Department.

The Electricity Committee of EDINBURGH Town Council has agreed to recommend the following reductions in the price of electricity :— Domestic rate for lighting in private houses, 4½d. to 4d. per kWh; for cooking and heating, 1½d. to 1d. Certain reductions are recommended where current is used for power and heating in industrial establishments. It is also proposed to reduce the price of lighting of street lamps.

Tapping New Areas.

Satisfactory progress is being made with a scheme to supply electricity for PETERSFIELD.

PREESALL Council has decided to ask the Blackpool Corporation if it can supply the Council with electricity in bulk, and, if so, upon what terms.

DEAL Town Council is considering a proposed application by Sir Charles Bright and Partners for powers to supply electricity in Deal and adjacent areas.

THURSTONLAND District Council is to support the Honley Electricity Bill, under which Honley District Council seeks power to supply the Thurstonland district with electricity.

Reigate Town Council has received a communication respecting a bulk supply of electricity for distribution in HORLEY and district, and the matter is to be considered at the July meeting of the Council.

The Commissioners have granted an order to the COOKHAM Electricity Co., to supply electricity in the parishes of Cookham, Bisham, Wooburn, Little Marlow, Hedsor, and Great Marlow. The laying of mains, with other preliminary work, is already in hand.

Further consideration of MORETON'S suggested means of obtaining electricity, took place at a special meeting of the local Council, attended by Mr. G. P. Shallcross, the Birkenhead Borough electrical engineer. Should an arrangement be come to with the Birkenhead Corporation, it will be proposed to lay the main from Upton Road, along Sandbrook Lane to Moreton Village, scheduling certain streets from that point. Mr. Shallcross pointed out that Birkenhead's authority to carry out the work could be obtained under a fringe order, pending a Parliamentary order.

Inquiries Orders, and Miscellaneous.

BLACKPOOL'S share of the cost of the recent electricity inquiry at Preston, is estimated at £500.

Application is being made for an Order to extend the LEICESTER area of supply to certain districts outside the city.

ACCRINGTON'S share of the cost of the recent inquiry at Preston regarding the Mid-Lancashire electricity supply was £701.

Application is to be made to the Commissioners by the MAIDSTONE Town Council for an Order authorising the supply of electricity outside the borough.

HENLEY-ON-THAMES Town Council has formally sanctioned a draft order of the Thames Valley Electric Supply Co., to supply Henley and district with electricity.

RETFORD Council is applying to the Commissioners for a Special Order authorising the supply of electricity for public and private purposes within the borough, and the rural district of East Retford.

ADLINGTON District Council is objecting to a proposal of the Lancashire Electric Power Co., to apply for a Special Order for the supply of electricity in Adlington on the grounds that the proposed minimum and maximum charges are too high, and that certain of the proposed distributing mains are too limited in extent.

ELGIN Town Council authorised a company to erect standards and overhead wires, but some of the landowners object to overhead wires in the outskirts. Permission for the transference of poles from the streets to back gardens has been refused, and requests are now being made that the wires be placed underground.

The Electricity Commissioners give notice that they intend to hold a local inquiry at the Town Hall, Preston, on July 31st, with reference to the scheme constituting the Mid-Lancashire Electricity District, and establishing the Mid-Lancashire Electricity Advisory Board. Objections to the Secretary, Electricity Commission, Whitehall, by July 23rd.

The Commissioners have made a Special Order which provides for the amalgamation of the undertakings authorised by the BANSTEAD, WALTON-ON-THE-HILL, AND KINGSWOOD Electric Lighting Order, 1914, and the Chipstead and District Electric Lighting Order, 1915. It also provides for the transfer of the amalgamated undertaking to the South Metropolitan Electric Tramways and Lighting Co.

The Minister of Transport proposes to confirm the Special Order authorising the Midland Electric Light and Power Co. to supply electricity in COALVILLE, ASHBY-DE-LA-ZOUCH, ASHBY WOULDS and SHEPSHED urban districts, certain parishes in ASHBY-DE-LE-ZOUCH rural district and the parish of Ibstock in MARKET BOSWORTH rural district. Objections to the Secretary, Ministry of Transport, Whitehall, London, and to John Kennedy and Co., 25, Abingdon Street, Westminster, by July 14th.

Personal Items.

Rotherham Borough Council has been recommended to increase the salary of Mr. E. CROSS, the electrical engineer, from £1 000 to £1 250.

Councillor MORRIS has been appointed to the Standing Sub-Committee of Burnley Tramways Committee, in place of the late Councillor Knape.

Among the names in the Prime Minister's list of honours is that of Mr. JOHN LEE, controller of the Central Telegraph Office of the G.P.O., who becomes a C.B.E. (Civil Division).

Mr. C. Y. KNIGHT, chief London representative for the Morgan Crucible Co.'s carbon brush department, has removed to 45, Leinster Avenue, East Sheen, London, S.W.14; the telephone number is Richmond 2017.

Mr. ROGER T. SMITH, chief electrical engineer to the Great Western Railway Co., has been appointed chairman of the new Advisory Committee appointed to investigate the development of electricity supply in the South Wales and Monmouthshire area.

Sir PETER PEACOCK, chairman of the Warrington Electricity Committee, last week was the recipient of a handsomely framed series of photographs of the members of the Electricity and Tramways Committee and the officials, as a souvenir of the starting up of the 6 000 kW set at the electricity works.

Mr. E. P. BENNETT, formerly joint general manager for Simplex Conduits, Ltd., Birmingham, and who has recently completed a world tour in the interests of Simplex Conduits, Credenda Conduits Co., J. A. Crabtree and Co., and other manufacturing concerns, has now joined the firm of Cargills, Ltd., export merchants, Balfour House, 119–125, Finsbury Pavement, London, E.C.2, as manager and buyer for the electrical and general engineering departments.

Mr. S. E. BRITTON, the new president of the Incorporated Municipal Electrical Association, received his early training with Crompton and Co., at Chelmsford, his first public post being with the Southampton Electricity Supply undertaking where he was assistant electrical engineer. He then went to Barking as chief engineer, and resigned this appointment to inaugurate the supply of electricity to Motherwell. After three years as borough electrical engineer there he was appointed city electrical engineer for Chester, which position he has held for 19 years. Mr. Britton, who has been a member of the I.M.E.A. since 1901, and has served two terms of three years on the Council, rendered valuable service during the war to various Government departments.

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Tenders Invited.

GREAT BRITAIN.

WONFORD HOUSE HOSPITAL, EXETER.—Electric wiring and fitting. Specifications, etc., from Chas. E. Ware and Son, 18, Bedford Circus Exeter.

EDINBURGH CORPORATION, July 9th.—Three months' supply of house service fuse boxes. Specifications from the Engineer and Manager, Electricity Department, Dewar Place, Edinburgh.

EDINBURGH CORPORATION, July 9th.—One 1 000 kVA three-phase to two-phase Scott-connected transformer voltage ratio 6 700/2 100. Specification (No. 51) from the Engineer and Manager, Electricity Department, Dewar Place, Edinburgh.

MANCHESTER CORPORATION, July 10th.—Tramway special track work. Specifications from the General Manager, 55, Piccadilly, Manchester.

HALIFAX CORPORATION, July 11th.—Electric wiring and fitting in 74 houses at Beechwood Road. Particulars from the Borough Engineer.

HULL CORPORATION, July 11th.—Electric light installation at Fenchurch Street depot and cart works, Wincolmlee. Specification from the City Architect.

COMMISSIONERS OF H.M. WORKS, ETC., July 12th.—Electric wire and cable. Forms of tender from the Controller of Supplies, King Charles Street, Westminster, S.W.1.

CROMARTY CORPORATION, July 13th.—Removal of electric light plant from Newton Camp to a site in Cromarty. Particulars from Mr. P. Hay, Estate Office, Cromarty.

ILFORD EDUCATION COMMITTEE, July 16th.—Electric light wiring at Christ Church Road cookery centre, and Newbury Park Handicraft centre. Tender forms from Mr. A. H. Shaw, Electrical Engineer to the District Council.

HOYLAND COMMON WORKING MEN'S CLUB, YORKS, July 17th.—Electric light installation. Particulars from the Secretary, Mr. H. Dickinson.

WEST HAM CORPORATION, July 17th.—One 1 500 kW two-phase turbo-alternator, auxiliary plant and accessories. Particulars from the Engineer and Manager, Electricity Department, 84 and 86, Romford Road, London, E.15.

METROPOLITAN ASYLUMS BOARD, July 18th.—Electric light wiring, etc., in the kitchen block and nurses' A home at the Southern (Lower) Fever Hospital, Dartford. Specification, etc., from the Board's Offices, Embankment, London, E.C.4.

ST. PANCRAS (LONDON) BOROUGH COUNCIL, July 19th.—Low tension d.c. switchboard. Specifications, etc., from the offices of the Electricity Department, 57, Pratt Street, Camden Town, N.W.1.

SOUTHPORT CORPORATION, July 19th.—Relaying with new rails, etc., about 1 738 yards of (equivalent) single track tramways. Specification from the Borough Engineer.

GLASGOW CORPORATION, July 23rd.—Electric light wiring in the second section of the Coplawhill housing scheme. Specifications from the City Electrical Engineer.

LEEDS CORPORATION, July 31st.—Steam turbine, three-phase alternator and exciter of about 10 000 kW capacity, running at a speed not exceeding 3 000 revs. per min., and auxiliaries for surface condensing plant. Specifications from the Manager, Electricity Department, 1, Whitehall Road, Leeds.

AUSTRALASIA.

NEWCASTLE (N.S.W.) CITY COUNCIL, July 26th.—High tension switch and control gear, etc.

COMMONWEALTH OF AUSTRALIA, July 31st.—Cable distributing terminals (schedule Q.591); August 7th.—Bells, cords and terminals (schedule V.132) and switchboards (schedule V.131); August 14th.—Telephone parts (schedule V.133). Tender forms and particulars from the Supply Officer, Australia House, Strand, W.C.2. Tenders close in Australia on the dates mentioned, but may be lodged in London three days before the closing dates.

VICTORIAN RAILWAY COMMISSION, August 8th.*—14 046 tons of rails and 960 tons of fishplates.

VICTORIAN ELECTRICITY COMMISSION, August 25th.—Transformers required in connection with the Morwell power scheme. Specification (No. 23/93) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

SYDNEY CITY COUNCIL, September 24th.—1 775 d.c. meters, 5 to 150A, and 36 200 s.p. meters, 5 to 50A.

SYDNEY CITY COUNCIL, November 19th.*—Storage batteries regulating switches, copper connections, charging boosters and switchgear.

NEW ZEALAND.

AUCKLAND CITY COUNCIL, July 11th.—Three sets of manganese steel special work for tramway junctions, 14 sets of manganese steel points and crossings, 1 460 tons of rails, with fishplates, bonds, etc. Specifications can be seen with Downie Bros., 7, Fenchurch Avenue, London, E.C.3.

URUGUAY.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO, August 15th.*—Electrical accessories.

* Particulars from the Department of Overseas Trade.

London Electrical Engineers' War Memorial.

We understand that it has been decided to erect at the old Headquarters of the Corps, 46, Regency Street, London, S.W., a memorial to all members of the London Electrical Engineers, R.E. (T.), who gave their lives in the Great War.

Owing to the great difficulty of arriving at an authentic list of the names of those who died, it has been decided to word the Memorial as follows:—

> IN MEMORY OF THE OFFICERS, NON-COMMISSIONED OFFICERS AND MEN OF THE LONDON ELECTRICAL ENGINEERS WHO GAVE THEIR LIVES IN THE GREAT WAR. 1914-1918.

Mr. Cecil Thomas, R.M.S., has submitted a design for a Bronze Memorial Tablet, and the work has been put in hand at an estimated cost of £80, towards which sum about £20 has already been subscribed or promised.

It is hoped that *all* past members of the Corps will contribute, even if the amount is small, since it is felt that everyone will wish to take his part in erecting a worthy Memorial.

Lieut.-Colonel K. W. E. Edgcumbe, R.E. (T.A.), is acting as Treasurer of the Fund, and subscriptions should be sent to him at 46, Regency Street, S.W.1, as early as possible.

Telegraph and Telephone Notes.

As the result of the cheaper telephone charges in operation since Sunday the Post Office has thousands of applications on hand for telephones to be installed at the new rental, reduced by 10s. a year. There are now more than 1 050 000 telephones in the country, and the number of new ones installed in 1922-3 (namely, 165 119) is said to constitute a record.

An automatic telephone exchange was opened at Southampton last Saturday, when the existing manual exchange was taken out of service. A public telephone exchange was first introduced in Southampton in 1886 and, after several removals, during which various improvements in the working of the system were made, notably the introduction of the first underground telephone cables in the district in the year 1897, the present exchange was installed, in 1902, in the specially designed telephone building which is still used. The automatic plant has been set up in the same building as the magnetic equipment which it will supersede.

Rights and Uses of Profits.

An interesting discussion on the rights and uses of profits took place at a conference of the INDUSTRIAL LEAGUE and COUNCIL held last week-end at Blunt House, Oxted, the residence of Sir Ernest Benn. Sir Alfred Mond, who opened the discussion, said the right of capital to its remuneration was frequently questioned at present. But capital must have some inducement to take the risk of loss. Profit on industry was a legitimate profit which would have to be made in any form of social organisation. If there was no return on capital it was obvious that industry could not go on. The first and most legitimate use of profit was the further development of commerce and industry, and he felt very strongly that the profits of a concern should be used to help to ameliorate the conditions of those engaged in it. Among others who took part in the conference were Mr. L. B. Atkinson (Cable Makers' Association), Mr. D. A. Bremner (British Engineers' Association), Mr. B. Cope (Municipal Employers' Association), Sir Henry Gibson, and Sir George Paish.

British Producers and Public Contracts.

Addressing the annual meeting in London last week of the BRITISH EMPIRE PRODUCERS' ORGANISATION, Mr. B. H. Morgan (the chairman) said they had long felt that one of the best ways of expressing Empire preference and of removing unemployment would be for all Governments, municipalities, and other public bodies to give their contracts exclusively (except where utterly impossible) to Empire firms using Empire materials and labour. In some of the departments the practice was being partially adopted, notably the Admiralty. As a result of their action, many Government and municipal contracts had been kept in British hands, but they did not consider the position satisfactory yet. They were only on the threshold of this matter and did not intend to leave it until they had achieved the acceptance of the definite rule which they had suggested.

Tramway Managers' Conference at Hull.

The annual conference of the Managers' Section of the MUNICIPAL TRAMWAYS' ASSOCIATION concluded at Hull on Friday last with a meeting at the Guildhall which was attended by delegates from all parts of the country. In the afternoon, at the invitation of the Hull Corporation Tramways Committee, the delegates and their friends took a steamer trip down the Humber to Spurn, those present including Mr. A. D. Willoughby (chairman of the Tramways Committee), Mr. C. P. Sherwood, Mr. P. Priestley (general manager, Liverpool Tramways), Mr. Beckett (secretary, Municipal Tramways' Association), and Mr. Rayner (general manager, Hull Tramways). Tea was served on deck and a musical programme was provided by the Hull Tramways Band.

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Electric Traction.

Tramway Extensions and Developments.

The EDINBURGH Tramway Department proposes to construct eight new cars in its own works.

Sanction has been refused by the City Corporation to a scheme of the LONDON County Council for tramways in Farringdon Road and in Holborn and Charterhouse Street. The question of sanctioning tramways over Southwark Bridge has been referred back.

HULL TRAMWAYS COMMITTEE has decided that the manager and engineer shall interview the Minister of Transport in respect of a proposal to borrow £100 000 for track renewals. In view of the possibility of accidents the Ministry is advocating the provision of a greater space between cars than at present allowed.

Further consideration of a proposal for extending the light railways at SOUTHEND-ON-SEA by the construction of a loop estimated to cost £2 860 has been postponed pending the submission of the electrical engineer's report on alternative schemes for the extension of the existing tramways or the provision of trackless trolley cars.

MANCHESTER Tramways Department has decided to make a limited use of the " one-man " tram, whose crew of one, as in the motor omnibus of similar type, not only drives the car, but collects the fares of the passengers as they enter by the front platform. The design of the new trams, each of which will hold 32 passengers, has been prepared by the Tramways Department and approved by the Ministry of Transport.

An extension of the SUNDERLAND tramway system from Sea Lane to Whitburn is recommended by the Sunderland Corporation Tramways Committee, but the suggested linking-up with South Shields tramways via Cleadon is in abeyance for the present. The Committee is also recommending the Town Council to extend the system via Durham Road to Silksworth, a distance of 2⅝ miles.

Fares, Receipts and Passengers.

ACCRINGTON Tramways Committee has decided not to adopt a suggestion for the issue of yearly contract tickets.

BURNLEY Tramways Committee has effected reductions of from a penny to a halfpenny on several routes, and has extended one of the penny stages.

HASLINGDEN Tramways Committee has called for a report upon the number of passengers carried on the penny fare system since its inception last April.

After successful trials on the Woodseats route, the twopenny tram stages have been reduced by the SHEFFIELD Corporation to three-halfpence on all routes.

Receipts on LONDON tramways controlled by the " Underground " group totalled £42 400 during the week ended June 23rd, compared with £47 342 for the corresponding week last year.

From April 1st to June 14th, BLACKPOOL Corporation trams carried 6 571 506 passengers, an increase of 646 574 on the previous year; the receipts, £52 617, were £115 more than last year.

Although the general revision of fares takes place in September the Tramways Committee of EDINBURGH Town Council is asking for an immediate reduction to 3d. of the fare from Waterloo Place to Joppa.

In spite of the HALIFAX Tramways Committee's statement that it is unable to reduce fares at present efforts are being made in certain quarters to effect reductions from August 1st of 25 per cent. on all fares over 1d. It is also suggested that all penny stages should be lengthened by 25 per cent.

On Monday revised fares on the BRIGHTON tramway routes came into operation. The long-distance 4d. fare has been reduced to 3d., and some of the 2d. charges have been lowered to 1½d., but the bulk of the 2d. fares remain unaltered. A novelty has been introduced in the form of return tickets. It is estimated that the changes will involve a loss of £5 000 per annum in revenue.

Figures for the first week's working of the BRADFORD Corporation Tramways Committee's experiment in issuing weekly transferable passes have been so satisfactory that there is every possibility of an extension of similar facilities to all routes, if progress is maintained on the Lidgett Green route. The net increase in receipts for the week, as compared with the corresponding period in May, was in excess of £39 on takings of £545.

The T.O. tickets which were introduced by the LONDON " Underground " at Golder's Green and Hammersmith a short time back are now to be extended to give similar facilities to residents in the Ealing Broadway and Boston Manor areas commencing July 1st. They will enable regular travellers to travel by bus or tram to the Ealing Broadway and Boston Manor stations, and proceed by rail to certain other stations on the Underground lines. The one ticket covers the whole journey.

A concession made by the Corporation of GLASGOW, which will entitle children up to 14 years of age to travel on the tramway cars to the various termini for a penny or a three-farthing token during July, came into force on Monday. This privilege will be limited to specified periods of the day when the heavy normal traffic is over. The reduced fare will be in operation from Monday to Friday each week, and also on two Saturdays and two Sundays. On the remaining Saturdays and Sundays of the month children will pay the usual fares.

Electric Railway Items.

For the week ended June 23rd, receipts on the MERSEY RAILWAY amounted to £4,362, bringing the total for the first 25 weeks of the year to £113,566.

Wireless News.

Economical Long Distance Signalling.

Hints of forthcoming developments in wireless telegraphy and telephony were thrown out by Senator Marconi on the occasion of the visit of a party of M.P.s to the wireless stations at Brentwood and Ongar last week. He stated that the results of experiments he had been making on the West Coast of Africa had gone far to convince him that by means of radically new devices which he had tested between England and the tropics, long distance signalling would become more rapid, more efficient and more economical. He anticipated a complete revolution in many of the methods hitherto employed for long distance transmission. Details of the invention are not yet available, but it is known that in the course of tests Senator Marconi succeeded in transmitting messages up to a distance of 2 250 miles not only with a very much smaller amount of power and energy but faster and more cheaply than by existing methods. He telegraphed on his new system from Cape Verde Islands to Marconi House in London with the use of less power than an ordinary message from Paris to London.

Control of Wireless Aerials.

At the Conference of the Urban District Councils' Association of England and Wales at Llandudno on Saturday last, it was unanimously decided that the executive council should be instructed to consider the question of the control by local authorities of the erection of wireless aerials. One of the speakers said that this matter had become of vital importance owing to the enthusiasm of wireless amateurs, who were not as competent as telegraph linesmen to fix overhead wires and apparatus with that regard to safety which was imperative, especially in the case of wires suspended over a public thoroughfare. Among the risks were damage by fire, insecurity, masts in dangerous proximity to public roads, and fences and chimneys becoming dangerous through attachments of aerial apparatus.

The New Government Station.

In connection with the negotations for the purchase by the Government of 800 acres of land at Hillmorton, near Rugby, for the erection of a high-power wireless station which will form part of the Imperial chain, it is rumoured that orders have already been placed for eight masts for aerials, each one of which is to be 820 ft. high.

Ships' Lifeboats and Wireless.

The " Trevessa " disaster has raised the question whether the Board of Trade should not insist upon ships' lifeboats carrying wireless equipment. The problem, " The Times " gathers, is more one of expense now than of technical achievement, for Marconi's Wireless Telegraph Co. claims to have a ship's lifeboat wireless transmitting set with a range of fifty miles, and a receiving radius of more than that figure. This is, in fact, already fitted in certain of the lifeboats of the big ocean liners. Altogether about forty ships have them fitted in their lifeboats. For transmission, of course, a strong current is necessary either from batteries or a dynamo, and in the case of motor ship's lifeboats it is possible to utilise the boat's power unit to generate the necessary current. The Marconi set is, however, self-contained, as it has its own small motor on the lines of the little outboard motors used on river-craft.

Miscellaneous Wireless Items.

THE SHEFFIELD RELAY STATION of the British Broadcasting Co. has been making experimental transmissions of signals from the London station.

In the offices of the United States Shipping Board at Bush House, London, is a wireless installation for receiving messages from the U.S. Government station at Annapolis.

Business Items.

Mr. H. M. BRYDEN, late of Bryden and Currie, electrical engineers, announces that he is carrying on business in Orbiston Street, Motherwell.

VICKER-PETTERS, LTD., Ipswich, announce that they have appointed Mr. A. P. Laughland, Union Chambers, Temple Row, Birmingham, as their Midland representative.

The HART ACCUMULATOR CO., Stratford, London, E.15, announces a further reduction of 10 per cent. off list prices of its motor-car starter and lighting batteries from July 2nd. This reduction applies to all classes of batteries both for home and export trade.

Books Received.

" Les Economies de Combustibles: Conduite Rationnelle des Foyers." By Pierre Appell. (Paris: Gauthier-Villars & Cie.) Pp. xiv.+342. 17 fr.

" The Production of Air-Dried Heat: Report of the Fuel Research Board, 1922-3." (London: H.M. Stationery Office.) Pp. 146. 5s. net.

" German, British and American Standards Compared." By Friedrich Nettel. (Berlin: Julius Springer.) Pp 42. 2s. 6d. net.

" Electricity Supply Accounts." By George Johnson. 3rd Ed. (London: Gee and Co.) Pp. xx.+181. 10s. 6d. net.

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Companies' Reports, Dividends, etc.

CONSOLIDATED ELECTRICAL CO.—The directors regret that the results of the company's operations for the year to March 31st last, coupled with depreciation in the company's investments, render it advisable to defer payment of the half-year dividend on the preference shares, due on July 1st.

EDISON SWAN ELECTRIC CO.—At the annual meeting last week the report dealt with in our previous issue was adopted and the capital reduction scheme approved. Mr. C. F. Spencer, who presided, said without the scheme any profits would have to be utilised in writing off the existing deficiency of £765 741 until it was extinguished, and consequently the prospect of the payment of any dividend would be remote. With regard to the current year's trading it would be seen when the accounts were presented that substantial profits had been earned.

CROMPTON AND CO., LTD.—The result of the year's trading after providing for depreciation, interest on debentures, directors' fees etc., is a loss of £7 185, which, deducted from the carry forward of £18 083, leaves a balance of £10 898. Deducting the interim dividend on the preference shares paid on January 11th, 1923, £900, there remains an available balance of £5 998 which the directors recommend should be disposed of as follows: To pay a dividend of 3½ per cent. on the preference shares, making with the interim dividend 7 per cent. for the year, £4 908, leaving a balance to be carried forward of £1 090.

GENERAL ELECTRIC CO.—Payable on July 20th, a dividend is announced for the year ended March 31st last of 5 per cent. (1s. per share), less tax. For the previous twelve months a similar distribution was made. The report to March 31st shows that the net profit was £751 486, which, with £217 024 brought forward, gives a total of £968 510. After deducting £688 790 for debenture interest, depreciation, dividends on the "A" and "B" preference shares, and contribution to pension fund, there remains an available balance of £279 720 which, after deduction of the ordinary dividend, leaves £174 121 to be carried forward, subject to corporation profits tax.

EDMUNDSON'S ELECTRICITY CORPORATION.—A record net profit of £52 103, constituting an increase of £20 744 on the previous year, is shown in the report for the year to March 31st last. The amount available, with £15 512 brought in, is £67 615, against £45 512, and the directors recommend dividends of 7 per cent. for the year on the preference and ordinary shares, carrying forward £22 815. The distribution on the ordinary shares will be the first since the year ended March 31st, 1906, when 4 per cent. was paid. Last year the cumulative preference shares received two years' dividend on account of arrears, and the non-cumulative preference received 3 per cent. The annual meeting will be held at Winchester House, London, E.C., on July 11th.

Cable, Telegraph and Telephone Companies.

CHILI TELEPHONE CO.—Announcement is made of a dividend of 3s. per share on the ordinary shares, payable on July 26th.

BELL TELEPHONE CO. OF CANADA.—A dividend of 2 per cent. on the capital stock for the past quarter is payable on July 14th.

WESTERN UNION TELEGRAPH CO.—The quarterly dividend on the common stock is unchanged at 1¾ per cent., payable on July 16th.

INTERNATIONAL AUTOMATIC TELEPHONE CO.—A slightly better result than in the previous year was reported by Sir Alexander Roger (the chairman) at the annual meeting on Monday. The profit, however, was not sufficient to pay any dividend on the ordinary and deferred shares.

AUTOMATIC TELEPHONE MANUFACTURING CO.—Sir Alexander Roger, in his speech at the annual meeting on Monday, said they had executed substantial automatic telephone orders abroad and reasonably good progress was being made in this country. Dealing with wireless telegraphy he said that for a time the demand assumed boom proportions, and although sales at present had fallen off, he thought that in all probability wireless would settle down to a steady business.

ORIENTAL TELEPHONE AND ELECTRIC CO.—At the annual meeting on Tuesday, Sir Henry Babington Smith said a new local company had been formed at Madras. In regard to Indian licences agreements between the Bombay and Bengal companies and the Indian Government had been signed. A proposal to increase the preference and ordinary capital by 200 000 and 300 000 shares respectively was approved, and the dividend and bonus announced in our previous issue was confirmed.

Supply and Lighting.

ST. JAMES' AND PALL MALL ELECTRIC LIGHT CO.—The directors have declared an interim dividend at the rate of 7 per cent. per annum on the preference shares and 10 per cent. per anum on the ordinary shares for the half year ended June 30th, payable on August 2nd.

SOUTH WALES ELECTRICAL POWER DISTRIBUTION CO.—The report summarised in our issue of June 15th was adopted at the annual meeting last week. Mr. Foster Brown (the Chairman) said the year had been adversely affected by a continuation of the trouble with the machinery at the Treforest power station through running overloaded. With the object of overcoming these difficulties, the Treforest Consumers Co. had ordered a new 15 000 kW steam turbine set, and that set was expected to commence work within the next few weeks. Although the company's output was up 2½ million kWh compared with 1921, the revenue was down £53 000. The unsatisfactory result of working was explained by the fact that the revenue per kWh sold dropped by 26½ per cent., while the cost per kWh sold dropped by only 22½ per cent., the benefit of the fall in price of coal, labour, etc., being counteracted by the uneconomical conditions under which the power station was run in 1922. Arrangements were in hand for the provision of additional new plant. Sir Leonard Llewellyn, Messrs. P. B. Lawson, R. Rutherford, F. A. Smith, P. D. Tuckett, and W. North Lewis were elected directors of a united board for the South Wales and Treforest Companies. An extraordinary general meeting was held subsequently, and a resolution was passed authorising the creation and issue of prior lien debenture stock of £500 000.

Traction Companies' Results.

CLONTARF AND HILL OF HOWTH TRAMROAD CO.—An interim dividend at the rate of 3 per cent. per annum is announced.

BRISBANE ELECTRIC TRAMWAYS INVESTMENT CO.—The directors propose a dividend of 4s. per share, free of tax, on the ordinary shares, making 8 per cent. for the year, and to carry forward £39 325 subject to corporation profits tax. A refund is to be made to preference shareholders in respect of income tax over-deducted from previous dividends.

BRAZILIAN TRACTION, LIGHT AND POWER CO.—The net revenue for 1922 totalled $6 851 968. Quarterly dividends on the preference and ordinary shares absorbed $2 731 511, leaving $4 120 457. The total gross earnings of subsidiary companies in Brazil were 197 749 105 milreis. The net earnings from operation before provision for depreciation were 124 505 503 milreis, an increase of 29 400 010 milreis. The increase in gross and net earnings, both in Brazilian and Canadian currency was due almost entirely to the growth of the business, there being little change in the average value of milreis for the year. The surplus revenue added to $5 719 813 brought forward gives a total of $9 840 270. The sum of $3 000 000 has been transferred to general reserve, leaving $6 840 270 to be carried forward.

New Issues.

SEATON AND DISTRICT ELECTRIC LIGHT CO.—In connection with the recent issue it is announced that sufficient subscriptions have been received to enable the board to go to allotment.

TOKYO ELECTRIC LIGHT CO.—The subscription list in connection with the offer of £3 000 000 6 per cent. sterling bonds at 94 per cent. was closed early on the morning of the opening, the offer having been heavily oversubscribed.

ENGLISH ELECTRIC CO.—It is announced that the whole of the £1 250 000 6 per cent. convertible debenture stock recently issued to provide for the redemption of the company's 8 per cent. notes has been applied for by noteholders and shareholders.

LIMA LIGHT POWER AND TRAMWAYS CO.—On Monday an offer was made of £1 500 000 6 per cent. first mortgage debentures at 90 per cent., redeemable on or before July 1st, 1950, by means of an accumulative sinking fund. The directors announce that they will redeem at par on December 31st next all the outstanding 5½ per cent. first mortgage debentures.

New Companies.

VICKERS (IRELAND), LTD.—Private. Cap., £5 000 in £1 shares. Electricians, etc. Reg. office: 32, Nassau Street, Dublin.

B.C.C. SYNDICATE, LTD.—Private. Cap., £2 000 in £1 shares. Mechanical and electrical engineers, etc. Solicitors: Nash, Field and Co., 12, Queen Street, E.C.4.

MILLIGAN'S WIRELESS CO., LTD.—Private. Cap., £10 000 in £1 shares. Manufacturers of wireless apparatus and plant, etc. Reg. office: 23, Renfrew Street, Glasgow.

P. G. ALLDAY AND CO., LTD.—Private. Cap., £15 000 in £1 shares. Manufacturers of and dealers in electric-light fittings and lamps, etc. Reg. office: 117, Northwood Street, Birmingham.

FRECASTLE ELECTRICAL IMPORTS, LTD.—Private. Cap., £500 in £1 shares. Importers and exporters of electrical and mechanical goods, etc. Reg. office: 13, Back Cheapside, Bolton.

Miscellaneous.

MANCHESTER Electricity Committee has elected Ald. Dagnall, Ald. Walker, and Councillors Hill, Massey, and White as its representatives on the South-East Lancashire Electricity Advisory Board, which will hold its first meeting on July 19th.

It is stated that although the E.T.U. REPRESENTATIVE has resigned from the Joint Industrial Council of the Devon and Cornwall area of the Electricity Supply Industry, another member has been appointed to take his place, and further meetings will be held next month.

The report of the Public Control Committee submitted at a meeting of the London County Council on Tuesday states that under the heading of power and heat there was an INCREASED ELECTRICITY CONSUMPTION of 186 million kWh between the years 1909 and 1919. It is pointed out that improvements in the electric lamp have considerably increased the efficiency of current for lighting purposes, and although the use of electricity under this heading has increased, the amount of current required is not appreciably greater.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

FROMANT, H., 104, Euston Road, N.W., electrical engineer. £15 11s. May 14th.

MAYER, H. G. AND CO., 15, Aldersgate Street, E.C., electrical factors. £12 0s. 11d. May 4th.

STOODLEY, P. W., AND CO., 60/61, London Road, Camberley, electrical engineers. £10 3s. 1d. May 18th.

WHITE, H. A., AND SON, 45, South Hill Park, Hampstead, electrical engineers. £23 9s. May 15th.

Deeds of Arrangement.

BEVAN, Frank Henry, and GUMBLEY, John Percy, trading at 51, Summer Row, Birmingham as, BATOMETA CO., electrical engineers. Filed June 19th. Trustee, C. T. Appleby, 26, Corporation Street, Birmingham, C.A. Liabilities unsecured, £614; assets, less secured claims, £243.

GOLDENBERG, Bernard, 16, John Dalton Street, Manchester, and 26, Great Clowes Street, Broughton, electrical factor. Filed June 22nd. Trustee, G. H. Blair, 4, Chorlton Street, Manchester, I.A. Liabilities unsecured, £575; assets, less secured claims, £183.

POOLE, Thomas George, trading as PULFOR ELECTRICAL CO., 101, Moor Street, Birmingham, electrical engineer. Filed June 20th. Trustee, G. A. Goodway, Carlton House, High Street, Birmingham, accountant. Liabilities unsecured, £401; assets, less secured claims, £170.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

CHUDLEIGH ELECTRIC LIGHT AND POWER CO., LTD. Registered June 13th, £1 000 debentures; general charge.

ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD. (late ELECTRICAL ENGINEERING AND AGENCY CO., LTD.), London, W.C. Registered June 19th, £1 000 mortgage, to L. J. Hitchcock, 849, Harrow Road, N.W., electrical engineer, charged on leasehold offices on 1st floor, 109 and 111, New Oxford Street, W.C. *Nil. October 26th, 1922.

NAPIER-KIMBER, LTD, W., electrical contractors. Registered June 7th, debenture to bank; general charge. *£7 400. August 5th, 1921.

OXFORD ELECTRIC CO., LTD. Registered June 15th, £60 000 debenture stock, redeemable at 103½ per cent. in certain events (secured by Trust Deed dated June 1st, 1923), present issue £50 000; charged on properties in Oxford, also general charge, except uncalled capital in respect of any shares hereafter to be created or issued. *£75 000. March 16th, 1923.

RAWCLIFFE (W. T.), LTD., Salford, electricians. Registered June 18th, £2 000 (not ex.) debenture, to R. S. Owen, Lyndhurst, Stockport, director; general charge. *Nil. December 31st, 1921.

SOUTHWARK ELECTRIC CO., LTD. Registered June 13th, £685 18s. 9d. debenture, to Southern Electric Co., Ltd., 138, Southwark Street, S.E.; general charge.

WATFORD ELECTRIC AND MANUFACTURING CO., LTD. (late THOMAS KESNOR AND CO., LTD.). Registered June 11th, £3 000 debenture, to Mrs. E. A. Wilson, Friern House, Clarendon Road, Watford; general charge (subject to £5 000 mortgage); also registered June 11th, £4 000 2nd debentures; general charge (subject to £5 000 mortgage and £3 000 1st debenture). *£5 000. November 27th, 1922.

WHITSTABLE ELECTRIC CO., LTD.—Registered June 7th, £1 000 debentures part of £10 000; general charge. *£5 366 13s. 4d. December 23rd, 1918.

Satisfactions.

CHIPPING NORTON ELECTRIC SUPPLY CO., LTD.—Satisfaction registered June 13th, £4 000, registered November 23rd, 1914.

FULLER'S UNITED ELECTRIC WORKS, LTD., Chadwell Heath.—Satisfaction registered June 13th, £150 000, registered October 22nd, 1921.

NAPIER-KIMBER, LTD., London, W., electrical contractors. Satisfactions registered June 18th, £400 registered December 2nd, 1913; December 17th, 1913; and February 12th, 1914; and £2 500 and £4 500, registered March 10th, 1921.

WATFORD ELECTRIC AND MANUFACTURING CO., LTD. (late THOMAS KESNOR AND CO., LTD.).—Satisfaction registered June 8th, £8 000, registered January 29th, 1923.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Winding-up Petition.

HERD AND SMITH, LTD. A petition for winding-up has been presented and is to be heard at Government Buildings, Victoria Street, Liverpool, on Friday, July 13th, at 10 a.m.

Companies Winding-Up Voluntarily.

BRITISH RADIO-WIRELESS MANUFACTURING CO., LTD. G. W. Burgess, 14, St. Mary Axe, London, E.C.3, chartered accountant, appointed liquidator.

HENRY GROVES, LTD., 69, Broad Street, Birmingham. A. E. Skidmore, 55, Newhall Street, Birmingham, chartered accountant, appointed liquidator.

HERD AND SMITH, LTD. C. Hodgson, 70, Central Buildings, 41, North John Street, Liverpool, certified accountant, appointed liquidator.

ROSS (LAWFORD), LTD. John M'Nicol, chartered accountant, 59, Bath Street, Glasgow, appointed liquidator.

Bankruptcy Information.

BRITISH RADIOPHONE CO., Downing Street, Bulwell, Nottingham, makers of wireless apparatus. First meeting, July 6th, 11 a.m., Official Receiver's Offices, 4, Castle Place, Nottingham. Public examination, August 2nd, 10 a.m., County Court House, St. Peter's Gate, Nottingham.

MEARNS, Edward Enoch, 14, St. Bede's Road, East Boldon, county of Durham, electrical contractor. Receiving order, June 30th. Debtor's petition.

WRIGHT, Robert, trading as ROBERT WRIGHT AND CO., 34-36, Oxford Street, London, electrical engineer. Receiving order, June 28th. Creditor's petition. First meeting, July 12th, 11 a.m.; and public examination, August 21st, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

Notices of Intended Dividends.

BALE, George Wilfred (separate estate), trading with Thomas Reginald Watt Wyness as WYNESS AND BALE, 13, Commercial Street, Brighouse, electrical engineer. Last day for receiving proofs, July 18th. Trustee, C. H. Baker, 1, Albion Street, Leeds.

WYNESS, Thomas Reginald Watt, and BALE, George Wilfred, trading together in co-partnership under the style of WYNESS AND BALE, 13, Commercial Street, Brighouse, electrical engineers. Last day for receiving proofs, July 18th. Trustee, C. H. Baker, 1, Albion Street, Leeds.

WYNESS, Thomas Reginald Watt (separate estate), trading with George Wilfred Bale as WYNESS AND BALE, 13, Commercial Street, Brighouse, electrical engineer. Last day for receiving proofs, July 18th. Trustee, C. H. Baker, 1, Albion Street, Leeds.

Prices of Metals, Chemicals, etc.

TUESDAY, July 3.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£69 0 0	—	—
Electro Wirebars	„	£72 0 0	—	£1 0 0
H.C. Wire, basis	per lb.	10 5/16d.	—	¼d.
Sheet	„	10¼d.	—	¼d.
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2 3/16d.	—	⅛d.
Brass 60/40—				
Rod, basis	„	7½d.	—	—
Sheet, basis	„	10d.	—	¼d.
Wire, basis	„	10½d.	—	¼d.
Pig Iron—				
Cleveland Warrants	per ton	£5 17 6	—	2s. 6d.
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 10 0	—	—
Lead Pig—				
English	„	£25 5 0	—	£1 0 0
Foreign or Colonial	„	£23 17 6	—	£1 5 0
Tin—				
Ingot	„	£177 0 0	—	£11 17 6
Wire, basis	per lb.	2s. 4½d.	—	1½d.
Aluminium Ingots	per ton	£120 0 0	—	—
Spelter	„	£28 5 0	—	5s.
Mercury	per bottle	£10 15 0	—	—

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2¾d.
„ (Roll-Brimstone)—„ £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. „ £26 per ton, £7 10s.
Boric Acid (Crystals). „ £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2½d.; plantation 1st latex, 1s. 1⅜d. to 1s. 1½d

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

183 117 J. T. ELLSWORTH. Electrolytic process of recovering zinc from complex ores. (12/7/21.)
195 564 C. T. MARKS, S. G. HIGGINS and A. E. FOXLEE. Electrical advertising, signalling and displaying apparatus. (20/7/22.)
195 653 L. SATCHWELL. Manufacture of grid resistances. (16/12/21.) (Cognate Application, 6467/22. Divided Application on 191 934.)
195 573 T. G. THOMSON and A. SMITH. Incandescent lamps. (17/10/22.)
195 577 H. G. BARTHOLOMEW and M. L. D. MCFARLANE. Telautography or photo-telegraphy. (19/9/21.) (Divided Application on 24825/21. Cognate Application, 4389/23; a Divided Application on 3892/22.)
195 654 VICKERS, LTD., Sir J. MCKECHNIE, and L. H. BATEMAN. Electrically-operated driving and reversing mechanism. (4/1/22.)
195 656 C. C. CULVER. Radio localisers. (29/9/21.)
195 657 C. P. RYAN. Relays for reception of signals or vibrations. (10/4/22.)
169 724 Dr. E. F. HUTH GES. and Dr. J. OPPENHEIMER. Transmission of signals by electric oscillations guided or carried by line wires. (2/10/20.)
175 245 GES. FUR DRAHTLOSE TELEGRAPHIE. High frequency telephony. (5/2/21.)
172 325 AKT.-GES. BROWN, BOVERI ET CIE. Prevention of occurrence of higher harmonic currents in working of metal-vapour rectifiers. (6/12/20.)
195 691 E. Y. ROBINSON. Vacuum tubes. (6/12/21.)
195 698 E. B. MOULLIN. Measurement of alternating voltages of any frequency. (7/12/21.)
195 708 J. F. LYMBURN. Incandescent lamps. (28/12/21.)
195 718 H. SEFTON-JONES (C. LORENZ AKT.-GES.). Wireless transmission by aid of a signalling-key. (30/12/21.)
195 722 A. KIRK and R. C. MILLIKEN. Cleats and cleat bases. (3/1/22.)
195 739 BRITISH THOMSON-HOUSTON CO. and A. P. YOUNG. Magneto-electric machines. (4/1/22.)
195 743 E. C. R. MARKS (GOODMAN MFG. CO.) Explosion-proof fuses. (4/1/22.)
181 675 PHILIPS' GLOEILAMPENFABRIEKEN. Electric discharge tubes. (13/6/21.)
184 766 PHILIPS' GLOEILAMPENFABRIEKEN. Electric discharge tubes. (15/8/21.) (Addition to 181 675.)
188 627 PHILIPS' GLOEILAMPENFABRIEKEN. Electric discharge tubes. (5/11/21.) (Addition to 181 675.)
195 762 CALLENDER'S CABLE AND CONSTRUCTION CO., LTD., and G. S. BOOTHROYD. Electrically bonding metallic sheathed wires or cables. (9/1/22.)
195 763 J. STONE AND CO. and C. E. ADAMS. Electro-magnetic switches for train lighting. (9/1/22.)
195 764 D. A. EVANS and H. HODGSON. Cooling or ventilating enclosed electric motors. (9/1/22.)
178 071 LE CARBONE, SOC. ANON. Brushes of agglomerated graphite for electrical machines. (7/4/21.)
195 775 S. O. COWPER-COLES. Electrolytic apparatus for production of seamless articles. (10/1/22.)
195 782 WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO., INC.). Wave filters. (12/1/22.)
175 254 PHILIPS' GLOEILAMPENFABRIEKEN. Gasfilled electric glow discharge tubes. (10/2/21.)
195 790 W. M. EDWARDS. Electric light baths. (17/1/22.) (Cognate Applications, 6262/22 and 27612/22.)
175 256 GES. FUR DRAHTLOSE TELEGRAPHIE. High-frequency telephony. (11/2/21.)
195 796 E. J. QUINN. General character signal-transmitting device for wireless, flashlight and land line telegraphy. (19/1/22.)
195 799 A. WILSON. Electric heaters for chicken and other incubators, chicken brooders, etc. (20/1/22.)
175 260 AUTOMATIC TELEPHONE MFG. CO. Telephone systems and impulse senders. (9/2/21.)
195 813 THERMAL ELECTRIC WORKS (HACKBRIDGE), LTD., and E. SWAINSON. Heat-deflecting device for electrical rheostats, etc. (2/2/22.)
195 814 G. CASTAGNOLI. Variable inductances for wireless reception apparatus. (3/2/22.)
195 815 F. E. PERNOT. Means for laying and picking up submarine cables. (3/2/22.)
195 817 T. MCKENNA (DICTOGRAPH PRODUCTS CORPORATION.) Telephone signal device. (7/2/22.)
195 824 AUTOMATIC TELEPHONE MANUFACTURING CO and A. E. HUDD. Electro-magnetic mechanisms. (13/2/22.)
195 827 M. P. FAVRE-BULLE. Apparatus for regulating amplitude of pendulum in electro-magnetic clocks. (17/2/22.)
195 832 METROPOLITAN-VICKERS ELECTRICAL CO. and C. W. MAJOR. Explosion-proof electric motors. (23/2/22.)
195 838 WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO., INC.) High-frequency signalling systems. (27/2/22.)
195 845 J. STONE AND CO. (BURY, R. R.) Locking devices for incandescent lamps and fittings. (4/3/22.)
195 861 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electric drives for sound-reproducing machines. (23/3/22.)
177 781 SIEMENS AND HALSKE AKT.-GES. Telephone systems. (31/3/21.)
195 865 P. T. NIELSON. Hand tools for connecting wires to insulators. (29/3/22.)
177 803 O. POEBING. Regulation of hydro-electric power stations. (1/4/21.)
195 878 G. MOREL. Incandescent lamps and switches therefor. (5/5/22.)
195 879 TELEGRAPHIE GES. SYSTEM STILLE and Dr. C. STILLE. Electro-magnetic sound boxes. (6/5/22.)

APPLICATIONS FOR PATENTS.

June 18th.

15 729 R. W. ANSTEY. Determining position of ships, etc., by wireless signals.
15 734 R. W. PERRY. Electric conduit tubes.
15 736 LANCASHIRE DYNAMO AND MOTOR CO. and C. P. BRAMLEY. Rotors of electrical machines
15 738 G. H. ATKIN. Electrical contact maker.
15 764 APEX RADIO CO and H. HOUGHTON. Apparatus for crystal reception of wireless telegraphy.
15 765 A. B. JOHANNING. Sound-distributing device for use with telephone receivers.
15 770 FORGES ET ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE JEUMONT. Terminal or junction box for insulated h.t. cables. (26/7/22, France.)
15 777 METROPOLITAN-VICKERS ELECTRICAL CO. Current-collecting devices. (5/7/22, U.S.)
15 779 O. D. EDMONDS and E. A. SENNITT. Multiple two-way switches.
15 782 G. T. GURR. Crystal detectors.
15 791 L. SANCHEZ-VELLO. Electrical appliances in moulded glass. (23/6/22, France.)
15 806 IGRANIC ELECTRIC CO. and F. NOBLE. Variometers and vario-couplers.
15 807 R. W. LUNT. Electrostatic voltmeters.
15 810 J. WACE. Telephone earpieces.

June 19th.

15 856 CABLE ACCESSORIES CO. and A. CRAWFORD. Switches.
15 860 F. H. GREEN. Switches.
15 869 J. E. S. TRELAWNY. Swivel joints for electric leads.
15 871 W. H. HUNT and R. H. LEWIS. Wireless receiving set.
15 873 H. W. CLOTHIER and J. MIRREY. Oil immersed switch fuses.
15 885 A. H. RAILING and A. E. ANGOLD and W. WILSON. Electric relays.
15 890 F. C. TILLEY. Vapour lamps.
15 892 H.T.C. ELECTRICAL CO., M. COOPER, C. F. HURST and A. H. TRIGGS. Holder for electric lamps or valves.
15 893 WESTERN ELECTRIC CO. and G. E. NASH. Wireless receiving set.
15 894 WESTERN ELECTRIC CO. (DEAKIN). Telephone systems.
15 895 M. B. COHEN. Fuses for vacuum tubes, etc.
15 901 and 15 902 E. Y. ROBINSON. Vacuum electric tubes.
15 911 H. KIRSCHFELDT. Wireless transmission and augmentation of energy for power purposes.
15 916 FELTEN & GUILLEAUME CARLSWERK A. G. Electric conductors. (7/7/22, Germany.)
15 924 J. P. PRANGNELL. Thermionic valves.
15 933 MARREC, LTD., and Y. MARREC. Receiving systems for electromagnetic waves, etc.
15 934 C. G. and H. G. STYLES. Tuning wireless circuits.

June 20th.

15 941 H. A. H. NIJLAND. Testing electrical apparatus.
15 947 HEENAN AND FROUDE and G. H. WALKER. Ventilation of electric l machines.
15 974 S. KOTERA. Electrode or pole for electrolytic cells.
15 976 A. C. D. SMITH. Valve holders for wireless telephony, etc.
15 979 ENGLISH ELECTRIC CO. and T. ZWEIGBERGK. Electromagnetic control devices.
16 000 WESTERN ELECTRIC CO. (WESTERN ELEC. CO., INC.). Wire-drawing machine.
16 007 R. C. ARTER. Control of automatic sub-stations. (24/7/22, U.S.)
16 008 R. C. ARTER. Control of generating stations. (24/7/22, U.S.)
16 014 C. S. FRANKLIN. Thermionic valves.
16 025 S. R. QUIGLEY. Wireless set.
16 028 GENERAL ELECTRIC CO., LTD. Incandescent lamps. (5/1/23, Germany.)
16 029 GENERAL ELECTRIC CO., LTD. Illuminated signs. (11/10/22, Germany.)
16 031 W. M. BRUCE. Electric translating devices.
16 034 KLEINSCHMIDT ELECTRIC CO. Tape-pasting device. (28/6/22, U.S.)
16 036 BRITISH THOMSON-HOUSTON CO. (GENERAL ELEC. CO., N.Y.). Electrical machines.
16 037 F. G. GALLEY and G. P. KENT. Flashing electric signs.
16 038 O. J. LODGE and E. E. ROBINSON. Thermionic valve circuit.
16 046 O. Y. IMRAY (RADIOTIVE CORPORATION). Diaphragms.
16 047 GENERAL ELECTRIC CO., LTD. Illuminated signs. (15/2/23. Germany.)

June 21st.

16 050 F. STOKES. Chains for suspending electric light bowls.
16 057 ELECTRO-METALLURGICAL CO. Heat-treated zirconium steel. (25/1/23, U.S.)
16 066 R. WHALEY. Telephone connections.
16 074 W. H. BROWN. Terminal for electrical instruments.
16 081 R. J. COMLEY. Variable condenser.
16 094 M. A. CODD. Moving magnetic systems.
16 095 C. J. COLEMAN. Telephone receivers.
16 096 C. J. COLEMAN. Wireless telephony, etc.
16 101 R. O. MCGOWN. Electric connectors, terminals, etc.
16 103 H. A. MADGE. Apparatus for reception of wireless signals.
16 133 METROPOLITAN-VICKERS ELECTRICAL CO. and N. P. HINTON. Electric condensers.
16 135 J. BAR. Device for testing safety fuses (14/9/22, Switzerland.)
16 137 R. R. OSMAN. Wireless telegraph apparatus.
16 146 ELECTRIC TRACTION DEVELOPMENTS, LTD., and E. H. SMYTHE. Insulating protecting covers for conductor rails.
16 147 PHILIPS GLOELAMPENFABRIEKEN. Discharge tubes. (21/6/22, Holland.)
16 152 EASTERN TELEGRAPH CO. Compensation of variations in periodicity of vibrating reeds, etc.
16 161 W. J. MELLERSH-JACKSON (SUBMARINE SIGNAL CORPORATION) Electric retardation lines.
16 169 BRITISH THOMSON-HOUSTON CO. (GENERAL ELEC. CO., N.Y.) Registering mechanism.
16 170 BRITISH THOMSON-HOUSTON CO., R. D. PARRY and H. TRENCHAM. Automatic electric regulators.
16 171 BRITISH THOMSON-HOUSTON CO. and K. F. KINGWELL. Machines for shaping wire.
16 173 W. J. MELLERSH-JACKSON (SUBMARINE SIGNAL CORPORATION) Sound producing devices.
16 174 C. W. LAIRD and P. M. MENTEYNE. Electrically insulating wire.
16 178 AUTOMATIC TELEPHONE MANUFACTURING CO. Telephone systems. (25/8/22 U.S.)
16 179 C. S. FRANKLIN. Aerials for wireless signalling.
16 184 W. J. MELLERSH-JACKSON (SUBMARINE SIGNAL CORPORATION). Apparatus for detecting underwater sounds.
16 188 W. J. MELLERSH-JACKSON (SUBMARINE SIGNAL CORPORATION). Sound-receiving devices.
16 191 SUBMARINE SIGNAL CORPORATION. Signalling by oscillations of audible frequency. (11/11/22, U.S.)

June 22nd.

16 198 H. J. BOYD and W. C. ROUSE. Switches.
16 207 O. E. WHEELER. Supports for wireless panels.
16 220 H. B. STOCKS. Rotary current distributors.
16 227 H. GREEN. Induction motors.
16 231 METROPOLITAN-VICKERS ELECTRICAL CO. Current collecting devices (5/7/22, U.S.)
16 233 A. E. CHRISTIE (SANHUEZA). Telegraph and telephone apparatus.
16 252 P. A. D. MARTI. Continuous recording oscillograph. (7/9/22, France.)
16 258 WESTERN ELECTRIC CO. (SCHREIBER). Electric relays.
16 265 A. SCHMIDT. Gas electrode. (22/6/22, Switzerland.)
16 273 RELAY AUTOMATIC TELEPHONE CO. and F. M. WARD. Electric switching apparatus.
16 285 C. H. F. MULLER. Electric discharge devices.
16 289 STILL AND SONS and E. H. STILL. Electric switching means for water-heating apparatus.
16 290 C. A. PAINTON and H. H. BERRY. Electric cooking appliances.
16 292 BRITISH THOMSON-HOUSTON CO. Safety devices for power-driven clothes wringers.
16 293 BRITISH THOMSON-HOUSTON CO. Enclosed furnaces.
16 300 T. WATSON. Wireless transmission and reception.
16 314 C. B. KERSTING. Plug in electric coils.
16 315 FULLER'S UNITED ELECTRIC WORKS and L. FULLER. Galvanic batteries.

June 23rd.

16 326 R. S. COLLIS and A. U. B. RYALL. Wireless aerial.
16 333 R. MACLAREN. Regulator for electric radiators, etc.
16 361 L. F. LASH. Crystal detector.
16 362 J. BACKUS. Switches.
16 363 A. BARNETT. Obtaining intermittent unidirectional currents from a.c.
16 364 BRITISH THOMSON-HOUSTON CO. (GENERAL ELEC. CO., N.Y.). Motor control systems.
16 365 BURNDEPT, LTD., and C. F. PHILLIPS. Variable condensers, etc.
16 367 F. WARNER, E. S. BROWN and G. E. STUBBS. Thermionic valves, etc.
16 372 E. C. R. MARKS (PABST CO.). Electric welding.
16 374 AUTOMATIC TELEPHONE MANUFACTURING CO., P. N. ROSEBY and A. S. HUDD. Impedence bonds.
16 379 L. B. TICKLE, H. J. W. BARNES and H. L. RAYNER. Receivers for wireless telegraphy.

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JUL 23 1923

THE ELECTRICIAN

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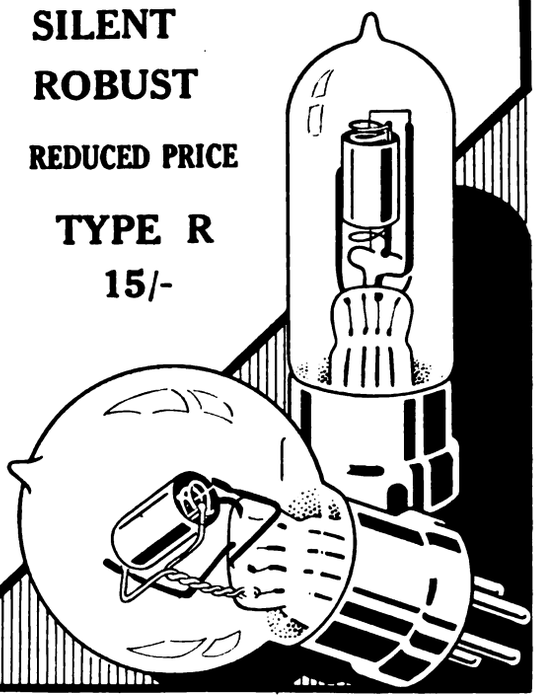

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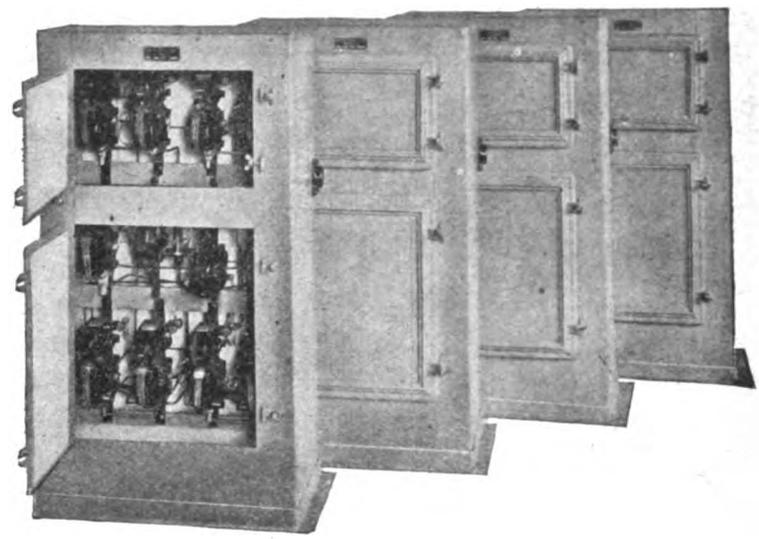

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Harmonic analysis of alternating wave forms.
Measurement of stray magnetic fluxes.
Location of earths on cable networks, &c.

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THE ELECTRICIAN

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Notes of the Week.

The King and Electricity Supply.

THE King has shown his interest in the development of electricity supply by graciously consenting during his visit to Scotland this week to spare time to open the new Portobello generating station of the Edinburgh Corporation. This station, which is built on a site which will have an ultimate capacity of 100 000 kW, will, of course, be of more than local importance, and will play a principal part in the supply of the East of Scotland district. This district comprises the city of Edinburgh, the counties of Mid Lothian and East Lothian, and parts of Linlithgow and Peebles, and in it the Edinburgh Corporation is the predominant partner. Incidentally, it will enable the historical rivalry between Edinburgh and Glasgow to be maintained on an electrical basis, and everyone will watch with interest the relative expansion and the comparative results obtained at Portobello and Dalmarnock. As an engineering job, Portobello is mainly interesting on what may be called the civil side. The station is only 25 ft. above sea level, and full advantage has been taken of the ample water supply available for cooling purposes by running two tunnels well out to sea. The use of tunnels instead of pipes is justified by the greatly reduced cost of construction, which only worked out at about £28 per yd., excluding the cost of the shafts.

Working for Boiler House Economy.

THE present plant in the station consists of three 10 000 kW turbo-alternators, and the design follows modern practice both as regards coal supply and ash disposal and as regards the provision of a very complete range of boiler-house equipment for measuring coal, steam, and water flow, carbon dioxide, steam pressure and temperature, and all the other factors which are so necessary to the economic operation of a generating station. The instruments necessary for the general control of the boiler house have been divided into two main groups for recording and indicating respectively. The former are placed in a specially built cabin (one cabin for every two boilers); the latter are collected wherever possible on one board and placed in a convenient position in front of each pair of boilers. In this way a close control can be kept on every operation by the person most concerned with its proper functioning. The switchgear is of the British Thomson-Houston cellular type, and is installed in a separate switch house. Every care has been taken to ensure continuity of supply by means of duplicate busbars and oil switches and by the divisions of the busbars into four sections. We shall hope in our next issue to give fuller details of the equipment of this effort to secure for Scotland a modern electricity supply.

The National Physical Laboratory—An Appeal.

WE can heartily advise any one interested in electrical and electro-technical progress to study the voluminous report issued by the National Physical Laboratory each year. The volume dealing with the work undertaken in 1922, of which we give a short account elsewhere in this issue, shows that a large number of investigations are in progress and that a certain number have been completed. A useful phase of the laboratory's activities is to be found in its relations with other bodies. It compares its standards with similar laboratories all over the world and thus obtains a useful check on the accuracy of its results. It assists with its experience and in other ways the work of the various Research Associations which have recently been established in many industries. It is far from being cloistered and confined. In fact, it is in close touch with scientific and technical progress. For all these reasons we hope that its appeal for more space will reach sympathetic ears. All the departments could do more if they had more room to do it in. But the electrical

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department especially is suffering from lack of both space and equipment, so much so that unless steps are taken to enable the Laboratory to keep abreast of modern requirements it will be unable to fulfil its proper functions in the field of national standardisation. We hesitate to suggest further expenditure of public money. But here surely is a service greater generosity towards which would be amply repaid. But to support and increase the usefulness of the National Physical Laboratory is not only a matter for the Government: it is a matter for those industries which the Laboratory helps with its work. William Froude set an example with his tank which we should like to see more widely followed especially in the electrical industry. There is a chance here for real philanthropy which should not be missed.

Two Things Necessary.

Two things are generally essential to a successful development of a domestic load: a low price for current and a well-organised selling campaign, in which term we include all the various factors such as propaganda, hire-purchase, etc. The vital need that these two things should be universally present in all the electricity supply undertakings throughout the country is not yet realised as it should be. We heard the other day of a manufacturer who refused to sell a cooker to a customer because the price of current in the latter's area was 3½d. per kWh. The commercial ethics of such a procedure may not be universally accepted; but we think the salesman was right. Unless gas was exceptionally dear in that district all that would have been gained would have been a little money. Against that gain would have to be set off a dissatisfied consumer and a great deal of conscious or unconscious propaganda against the use of electricity for domestic purposes because of its expense. We therefore argue that to secure the greater use of electricity its price must be brought down. It will be contended that to do this would be financially unsound. Our reply is that the increase in sales would far offset any drop in revenue. This increase in sales will also predicate an increased demand for apparatus and lead to its price being reduced in its turn. It is often said that the high price of the equipment is the real obstacle in the way of domestic electric development. But as the manufacturer's idea is to make profits he is in general only too anxious to reduce prices and increase his turnover. The best way to assist him to do this is to reduce the price of current. At present we have the edifying sight of the pot calling the kettle black, and neither of them trying to get any whiter.

"Profits" and Price Reduction.

THAT such a reduction is often possible without bringing the undertaking to financial ruin is amply evidenced by the results of the year's trading of the Hull Electricity Department. The "profit" was no less than £100 000 as against an estimate of about £26 000, itself a large enough sum for a municipal trading venture. As the "Hull Daily Mail" rightly remarks, "On the face of it the result is highly satisfactory, but the question is whether the consumers have not been called upon to pay more for current than they should have done." Since the profit represents nearly one-third of the total revenue there is no possible doubt whatever about that. Two points in connection with this matter cannot therefore be too highly stressed, and in stressing them we take Hull as an example of what too often is happening elsewhere: The unsoundness of making a "profit" out of a public department either for the relief of the rates or for other purposes, and the absolute necessity of bringing down the price of current if there is to be any adequate electrical development. We are glad to see that this is being realised at Hull to the extent that some revision of the present tariffs is under consideration, but the movement should be much more general. Attractive prices should be available everywhere in order to kill the cost bogey and to assist the electrical manufacturer.

Water-Tube Boiler Construction.

THE subject of boiler-house equipment is of such general interest at the present time that it is not surprising to find that its literature is ever increasing in quantity. Among the most useful recent contributions to the pile is a Paper read by Sir JAMES KEMNAL before the Institution of Mechanical Engineers. In it he recalled that the idea of the water-tube boiler dated back for more than a century. RUMFORD applied the idea on a small scale in 1796, and in 1825 the first boiler consisting entirely of tubes appeared. It was not until about 1880, however, that such boilers began to come into general use. It was mentioned that electrical engineers showed themselves exceptionally progressive and were among the first to appreciate the merits of the new design; in fact, this boiler was used for the first electric-light plant for public incandescent lighting, that of the Edison Co. in Holborn Viaduct. In 1901 a design was evolved for marine work, and of course such boilers are now widely used on all classes of vessels. Sir JAMES referred to the discussion whether it is best to have the tubes inclined almost horizontal or vertical; in the former there is nearly solid water, in the latter a geyser-like action. The author is inclined to give preference to the first type. Other controversial points include the choice between air-heater and economisers. Both lead to economies, but the water-economiser is on the whole the cheaper apparatus, though the air-heater has advantages where very high efficiencies are aimed at.

Atomic Structure.

IN our correspondence columns recently Mr. J. SAYERS contended that engineers would do well to keep in touch with the work that was being done on atomic structure and electrons, and deplored the difficulty that a busy man had to discover exactly what had been and was being done. As regards atomic structure, part of his complaint has been settled by the issue last week of a special supplement to "Nature," in which Prof. NIELS BOHR, professor of physics in the University of Copenhagen, gives a comprehensive account of the present state of our knowledge in this subject. As is well known, Prof. BOHR has taken a leading part in the development of modern conceptions of atomic structure, and he devotes particular attention in his Paper to the interpretation of spectra and the main features of the properties of atomical elements from considerations of the manner in which an atom can be magnified to be built up by the capture and binding of the electrons to the nucleus one by one. In this connection reference may also be made to the useful and informative lectures which are delivered each year before the Royal Institution by Sir ERNEST RUTHERFORD. In our next issue we shall conclude our account of this year's series which were unfortunately interrupted by the death of Sir JAMES DEWAR. They are well worth study by those who are interested in the developments which are taking place in this highly theoretical field. Its relation to engineering and commerce may seem close, but engineers would do well to cultivate a broad outlook towards all that concerns the progress of their profession.

A Hint from the Contractors.

IN a resolution which they have recently adopted the Electrical Contractors' Association raise a question which is of importance in the development both of the all-electric house and the domestic load. Briefly, they are of opinion that it is a dangerous practice to bring the two sides of a three-wire system into a room where portable apparatus is used and consider that for the protection of the public the practice should be discontinued. They also submit that the balancing of one house or flat against another will give a far more effective balance than the methods now adopted by some supply authorities. We are all in favour of safety first in the house and we therefore agree

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with the first proposition. Far the greater proportion of the portable electrical apparatus now in use is of such a capacity that it can safely be connected between one outer and the neutral. Almost the only exception is the large fire, which is certainly portable but is not often carried about, and even when it is used balancing by houses or flats would give the desired result and be much safer. Though we may demur to the statement that the balance will be quite as effective when done by houses there is such a thing as being too meticulous. In fact, we might almost say that with some people "balancing" is rapidly taking the place of "overloading" as a bogey, and the sooner it is realised that it is a spurious rather than a true obstacle to domestic development the better. From their position the contractors are able to call attention to such matters better than anyone else in the industry, and they are to be congratulated on having done so in this instance.

Cable Problems.

It is clear from the discussion on the Paper which Mr. J. E. STORR read at the recent I.M.E.A. Convention that there is likely to be no great rush by supply engineers in this country to convert their present underground transmission systems to overhead lines. The reasons for this are clear; and we have already summarised them. But this determination carries with it an obvious duty—a duty which has to be performed by both the manufacturers and users of cables—that of seeing that the cables they do use are economically designed and produced, and no less economically employed.

Temperature the Controlling Factor.

The problem thus simply stated is not without its difficulties, and these difficulties increase as the pressure employed and the amount of power that has to be transmitted rise. To take one point only, the temperature at which the cables work is of the highest importance. A good deal of light has been thrown on this matter by the investigations carried on under the control of the Heating of Buried Cables Committee at the National Physical Laboratory, while K. W. WAGNER, STEINMETZ, HOCHSTADTER and other workers have also given attention to the subject. It now appears likely that the process of breakdown in a cable is largely, if not entirely, due to the increasing conductivity of the insulation caused by temperature rise, and is not the result of abrupt or disruptive puncture. An interesting secondary result of this theory is the new methods that have been devised for the further study of the nature of the processes of insulation, some accounts of which have been given recently in the American technical journals.

Temperature-Current Relationships.

If we take temperature as being the sole, or the most important, factor in the design and successful operation of cables, as was done by Messrs. S. W. MELSOM and FAWSETT, in the report with which we dealt a few weeks ago, we arrive, as they did, at certain maximum permissible currents for all sizes and types of paper-insulated cables dealt with in the British standard specification and in general use. In other words, we do not alter the present stock sizes of cables, which for manufacturing reasons would be inadvisable, we simply restate the current which they can safely carry for long periods without breakdown. The value of the results thus obtained has been emphasised by us and by others, and cannot well be overstressed. If the current which any given cable can carry under its peculiar working conditions of soil, moisture and other factors, is known, obviously not only a great technical move, but a great economic move forward has been made. This argument remains true even if we allow that heating is not the sole consideration, but that other factors must be taken into account.

An American Method of Attack.

This subject of cable rating is so important to the British electrical industry that it is interesting to find that it has been attacked from another side in the United States. In the report of the Underground Systems Committee, presented at the recent Annual Convention of the National Electric Light Association, it is pointed out that the improvement in the quality of paper-insulated lead-covered cables has made it possible to reduce the thickness of the insulation without reducing the factor of safety of the operation. The insulation on the cables now employed on the Edison system ranges from $\frac{4}{64}$ in. on the smaller sizes to $\frac{6}{64}$ in. on the larger sizes such as 1·6 sq. in. Cables rated at 12 kV in 1920 had insulation of approximately $\frac{13}{64}$ in. plus $\frac{6}{64}$ in. which since that time has been reduced so that only $\frac{9}{64}$ in. plus $\frac{4}{64}$ in. is now required, the margin of safety as indicated by tests remaining about the same as before.

The High Pressure Rectifier as Testing Apparatus.

This success is partly ascribed to the use of direct current instead of alternating current for testing purposes. Various devices have been suggested and used for this purpose, including the Delon rectifier and the two-electrode valve. The latter has been mainly used in the States, and the Committee describe an arrangement which they anticipate will result in the detection of incipient failures and the elimination of weak spots.

What the Two Methods of Attack Show.

These two methods of attack really indicate the same tendency. In the first place they increase our knowledge of the conditions under which the cables operate, and of the causation of failure. Having obtained this knowledge we can either scale down our insulation as is apparently the American practice, or we can increase the amount of power which any given cable can carry. In either case it may be necessary to adjust the existing relationship between the copper and the insulation, though this, as time goes on, is more likely to be necessary if the latter procedure is followed. The British standard specifications were prepared to comply with our knowledge at that time; as that knowledge increases some changes may be not only advisable, but desirable. And the assistance of both manufacturers and supply engineers will be necessary to determine what these changes are to be.

Application to Existing Cables.

It is perhaps only natural that the fresh information on cable operation which we have been discussing should be considered mainly as a basis for future practice. These are economic days. And anything which can be discovered to make a pound's worth of cable do what five pounds' worth did before is likely to receive sympathetic attention. But there is another side to this question which should not be forgotten. The capital sunk in cables in this country which are actually in use amounts to several millions. A great proportion of this cable has in it many years of useful life more than the loan periods allowed for repaying its cost would suggest. While, then, any extensions of a particular system will be carried out in accordance with recent research, it is worth discovering whether this recent knowledge cannot be applied to make a better use of the cable that is already in use. It is common knowledge that many of our distribution systems could be worked at a higher voltage than they are at present. Mr. R. B. MITCHELL recently said that the cables on his 240 V network could be safely operated at 2 000 V, and the need for developing the domestic load and possible change overs from direct current to alternating current working make this a matter which is worth considering. The substitution of the reciprocating engine by the steam turbine made it possible to increase the generating capacity of a given amount of floor space. The correlated possibility of getting more out of existing cables should not therefore be neglected.

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Notes on Wireless Matters.

By Prof. G. W. O. HOWE, D.Sc.

Does the weakening of the field near the receiving aerial invalidate the calculation of the received current?

The current produced in any receiving aerial by the passing electromagnetic wave must modify in some degree the magnitude of the electric and magnetic fields in its immediate neighbourhood. Since these fields are used in the calculation of the current set up in the aerial, the question arises as to whether such calculations are correct. Very hazy ideas and misconceptions on this point are prevalent, and have led to ill-founded fears as to the accuracy of the calculations of the strength of the field based upon the measured magnitude of the received current.

In THE ELECTRICIAN of April 20th, 1917, a paper was published under the title "Range of Wireless Stations," in which the author, Capt. Trench, gave definite expression to this doubt, and in a letter in the issue of May 11th, 1917 (p. 234), I commented on this point as follows: "Capt. Trench's suggestion that the receiving aerial abstracts so much energy from the field that the latter is locally drained and therefore unable to induce the calculated e.m.f. is more ingenious than convincing. The oscillation in the receiving aerial certainly modifies the field in its neighbourhood in such a way that the current is reduced, but this reduction is probably identical with that calculated by the inclusion of the radiation resistance in R_2." When writing this I was not aware that the problem had been solved in 1908 by Rüdenberg ("Annalen der Physik," xxv, p. 446); had I known this, I should have omitted the word "probably," since Rüdenberg's results show that my assumption was correct.

Components of Aerial Resistance.

The total effective resistance of the receiving aerial is made up of several components, one being the so-called radiation resistance, which is not a real resistance, but a fictitious one which is assumed to consume the energy

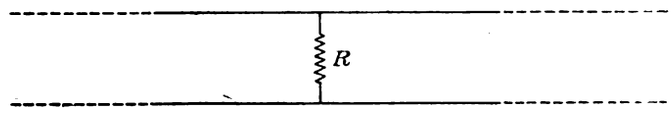

FIG. 1.

which is really radiated out into space when the aerial is acting as a transmitter. If the receiving aerial had no effect on the received wave the e.m.f. induced in it would have a certain value E, and if the aerial is tuned, the current set up in it will be given by the formula $I=E/R$. If R be taken as the effective resistance, excluding the so-called radiation resistance, this formula can only be an approximation, since it neglects the interaction between the aerial current and the received wave. To obtain the correct current we must either reduce E to its actual value as modified by the receiving aerial or we must increase R to its total effective value by adding to it the radiation resistance R_r, *but we must not do both.* If we adopt the latter method we have $IE=I^2R+I^2R_r$, where IE is the total power which the unmodified wave would deliver to the aerial, I^2R the power actually absorbed by the aerial, and I^2R_r the power radiated or rejected. We must not regard this last as being first absorbed by the aerial and then re-radiated; what really happens is that the aerial current so modifies the strength of the field in its neighbourhood that the power actually absorbed is reduced by this amount.

A Transmission Line Analogy.

This is made much clearer by a consideration of the simple analogous problem when the power is transmitted over a line. In Fig. 1 the non-inductive resistance R replaces the tuned receiving aerial, and just as the aerial is coupled to infinite space, so the resistance R is connected to a transmission line which we may imagine to extend to an infinite distance in both directions.

If the line has a characteristic impedance Z_0, that is, if this is the apparent impedance of such an infinitely long line as measured at one end, an alternating e.m.f. E acting upon the resistance R would set up in it a current $I=E/\left(R+\frac{Z_0}{2}\right)$, because in series with R are the two halves of the infinitely long line connected in parallel. Hence, if we measure the resistance of R as we measure that of an aerial, we find that there is a component $\frac{Z_0}{2}$ which covers the effect of the power radiated or transmitted away along the lines and not dissipated in R. If the losses in the transmission line are small the impedance Z_0 is practically

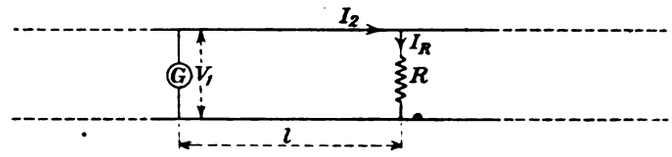

FIG. 2.

non-inductive, and may be treated as a non-inductive resistance.

The Analysis.

If now at some point at a great distance l a generator G supplies power to the line, G may be regarded as a distant transmitting station.

Let V_1 be the P.D. at the transmitting station, then if the resistance R were disconnected, the voltage would fall off along the line in accordance with the formula:—

$$V_l=V_1\,\varepsilon^{-\alpha l}$$

where α is a constant depending on the losses in the line.

If now we assume that R is connected, but neglect any effect that it may have on the voltage of the line, the current set up in R will be—

$$I_R=\frac{V_1\,\varepsilon^{-\alpha l}}{R}.$$

This is obviously only an approximation; to obtain the actual value of the current I_R we note that at the receiving station, where the resistance R is in parallel with the remainder of the line stretching to infinity, the joint resistance will be $\frac{RZ_0}{R+Z_0}$. The relation between the transmitting voltage V_1 and the received line current I_2 is given by the well-known transmission formula:—

$$\frac{V_1}{I_2}=\frac{RZ_0}{R+Z_0}\left(\cosh\,\alpha l+\frac{R+Z_0}{R}\sinh\,\alpha l\right)$$

This enables us to find I_2, but we are mainly interested in the part I_R of this current, which passes through the resistance R, and is therefore analogous to the received aerial current. Now—

$$I_R=\frac{Z_0}{R+Z_0}\,I_2=\frac{V_1}{R\left(\cosh\,\alpha l+\frac{R+Z_0}{R}\sinh\,\alpha l\right)}$$

$$=\frac{V_1}{R\,(\cosh\,\alpha l+\sinh\,\alpha l)+Z_0\sinh\,\alpha l.}$$

If we assume that the distance l is so great that $\varepsilon^{-\alpha l}$ is negligible compared with $\varepsilon^{\alpha l}$, which we must do, since in the wireless case the field at the receiver is very small compared with that at the transmitter, then $\cosh\,\alpha l$ which equals $(\varepsilon^{\alpha l}+\varepsilon^{-\alpha l})/2$ and $\sinh\,\alpha l$ which equals $(\varepsilon^{\alpha l}-\varepsilon^{-\alpha l})/2$ may both be put equal to $\varepsilon^{\alpha l}/2$. We then have—

$$I_R=\frac{V_1}{R\varepsilon^{\alpha l}+Z_0\frac{\varepsilon^{\alpha l}}{2}}=\frac{V_1\,\varepsilon^{-\alpha l}}{R+\frac{Z_0}{2}}$$

$V_1\,\varepsilon^{-\alpha l}$ is not the actual voltage across R, but what it would

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have been if R had had no effect on the line voltage. The actual current I_R is obtained by dividing this voltage by a resistance $R+\frac{Z_0}{2}$, made up of the actual resistance R and the fictitious resistance $\frac{Z_0}{2}$, which we have already shown to be analogous to the radiation resistance of the aerial.

Hence the inclusion of the radiation resistance in the total effective resistance of the receiving aerial makes it unnecessary to allow for any weakening of the electromagnetic field due to local draining of the energy by the receiving aerial. The value of the field calculated from the received current is the ideal value which it would have at that point if the receiving aerial were not there.

Modern Dock Appliances at Glasgow Harbour.*

By D. FIFE, Mechanical Engineer to the Clyde Navigation Trust, Glasgow

Glasgow being the home port of several large steamship companies, much heavy material has to be dealt with, and a number of electrical cranes have recently been installed. These include two 32-ton types, one travelling crane at Rothesay Dock, and one fixed crane at Queen's Dock. At the latter dock an additional travelling crane of 35-ton capacity is in course of erection.

In the original Paper the chief mechanical features of the crane, which has a lifting speed of 50 ft. per min. and weighs (with 66 tons rock ballast) 315 tons, are given. The crane is revolved by a 50 B.H.P. compound-wound motor through phosphor-bronze worm wheel and cast steel spur-gearing. Energy is taken from the Glasgow Corporation mains at 500 V, and a special switchboard affords full control. The cabin also contains a potentiometer regulator for hoisting and tipping motors, controllers for slewing, etc., and indicators showing height of lift and tipping angle of wagon. The control is of the "Crompton" type, a modified form of the Ward-Leonard system.

Supply Arrangements.

To supply direct current at 500 V to the hoisting and tipping motors, a motor generator of 200 B.H.P. is provided in the machinery house, and consists of two direct-current machines which run at a speed of 680 revs. per min. rigidly coupled together and bolted to a cast-iron bed-plate. The motor is of the standard shunt-wound type, provided with interpoles and designed to withstand rapid fluctuations of load without sparking. The generator is of the variable voltage type with separate excited fields. As this machine runs at constant speed its voltage is always in direct proportion to field strength; speed control is accomplished by varying and reversing the shunt current in the generator fields.

A sensitive reversing type potentiometer regulator varies the volts from zero to plus or minus according to the position of the control-lever when hoisting or lowering. In addition, a special limit series-winding is embodied. This differential field winding has valuable safeguarding features, preventing the operator exceeding a pre-determined speed of hoisting or otherwise overloading the apparatus.

Crane Equipment.

The duplicate hoisting and tipping motors are of 180 B.H.P. with a maximum speed of 400 revs. per min. The field is compound-wound. These series turns increase the torque of the motor in proportion to the load lifted. The shunt-field remains constant, and therefore the speed of the hoisting or tipping motors is practically dependent on the voltage across the armature.

Shunt-wound solenoid brakes with dash-pots are provided on the hoisting and tipping gears, and are so arranged that the brakes are applied when the current to the motors is insufficient to sustain the load, or released when the motor current has reached a value capable of lifting the load. The wear of the brakes is thus reduced to a minimum. In a similarly equipped crane, after loading two and a half million tons of coal over a period of seven years, the original brake linings are still in use.

During lowering, braking action is accomplished by regeneration. The generated voltage is reduced by the potentiometer to a value below the volts generated by the hoisting motor which runs as a generator, being driven by the descending load. Accordingly current passes from the hoisting motor back through the motor generator-set to the supply mains. The system gives smooth and effective retardation of the load, and creeping speeds can be obtained when hoisting or lowering. No special skill is required by the operator, and it is almost impossible to cause damage to the electrical portion of the gear by faulty handling of the controller.

Current Changes during Operation.

In the original Paper the author presents a diagram illustrating changes in current and voltage during a complete cycle of operations with a truck (loaded up to 24 tons) during 2·4 minutes. From meter readings over a number of years the energy credited by the Electricity Department amounts to 8 per cent. of that taken. Efficiency tests show values of 67·5 to 71 per cent. In the case of different steamers the tons dealt with per hour range from 155 to 248. In a typical case, involving the handling of 464 255 tons of coal, about 0·19 kWh per ton was consumed. The total cost worked out to 1·23d. per ton, to which electrical energy contributed 0·22d.

Capstans Efficient in Operation.

Experience has shown the "Clyde" free-head capstans, 107 of which are used in Glasgow harbour, to be efficient and moderate in maintenance and repairs. Thus an 18 B.H.P. capstan of this type has handled 2 500 000 tons of coal during the past six years, and has only required slight adjustments. The electrical motors most suitable are of the drip-proof type, of robust construction, with ventilating ducts on end shields. Fuses areunsui table, and self-setting s.p. circuit breakers, interlocked with the controllers, have been installed. Ventilation is most important, and pipes and hoods have been beneficial in keeping equipment free from moisture. Sufficient depth should be allowed below the mechanism for ventilation and access. An improved form of electrical control supplied by the Igranic Electric Co. for large capstans, run by a 35 B.H.P. shunt motor and capable of hauling 15 tons at 25 ft. per min., has answered well.

Pneumatic Grain Elevators.

In the next section of the Paper the author deals with pneumatic grain elevators, driven by 30 B.H.P. motors through steel gearing. The jacking gear, to lift and lower the elevator, comprises screw-jacks at each corner, connected through gearing to 10 B.H.P. motors. Dust-extracting filters are also electrically driven by 5 B.H.P. motors. The exhauster, enabling a vacuum up to 11½ in. to be obtained, is driven by a d.c. shunt-wound motor of 183 B.H.P., with a speed variation from 650 to 810 revs. per min. A special system of speed control consists in a Venturi tube placed in the air-delivery pipe of exhauster, the throat of which is connected to a piston suspended by a tension spring. A spindle is carried up from the piston and engages with a rack and wheels which operate the shunt regulator. A solenoid, fitted to the gear and interlocked with the contactor panel, retains the shunt regulator in starting position until all resistance is cut out and normal speed is attained. The solenoid is then automatically cut out and the shunt regulator takes up a position corresponding to the amount of air passing through the exhauster. The effect is to keep the volume nearly constant over the working range. From data presented on the unloading of bulk grain it is shown that the tons per hour vary from about 75 to 113 for different steamers, from 1·26 to 1·71 B.H.P. per ton being required. The cost for bucket and pneumatic elevators is about 10d. per ton discharged; of this the cost of electrical energy is 0·5d. with the bucket elevator, and 1·92d. with the pneumatic elevator.

Special arrangements for illuminating the decks of vessels by means of two arc lamps are made. The average cost of energy taken from the Glasgow Corporation Electricity Department during the past year has been 1·16d. per kWh.

* Abstract of a Paper read before the Institution of Mechanical Engineers.

Electrical Contractors' Association.

Protest against a Dangerous Practice.

The Council of the Electrical Contractors' Association has passed the following resolution: "That it is, in the opinion of this Association, a dangerous practice to install the two sides of a 3-wire system in one room in a private house or office where portable apparatus is used, and that for the protection of the public the practice should be discontinued. This Association is anxious to do all that is possible to develop the use of electricity for domestic purposes and to make it safe for the public, and submits for consideration that the balancing of one house or flat against another will give a far more effective balance than the manner now adopted by some supply authorities."

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Notes on a Super-Heterodyne Receiver.

By CHARLES R. LEUTZ.

During the past five years considerable expert engineering efforts have been directed towards finding an efficient and satisfactory method of amplifying radio frequency energy at short wave-lengths. A glance at the characteristic curves of the present available detector tubes, will show that a very weak signal cannot be rectified efficiently or completely, in view of this point, additional audio frequency amplification would not be of assistance. All detector or rectifier characteristic curves indicate that the resultant audio frequency current is approximately proportional to the square of the impressed radio frequency voltage. Therefore, the efficiency of the detector decreases rapidly with decrease of signal until a stage is reached at which the detector almost ceases to function.

Failure of Magnifying Amplifiers.

Many types of amplifiers have been devised to magnify the radio frequency energy before applying it to the detector, and many have worked very well on long wave-lengths, either with resistance, inductance or capacity couplings. However, to use the same method of coupling for extremely high frequencies corresponding to wave-lengths of 50 to 200 m. most results has been a complete failure. There is a good reason for this, the low capacity reactance existing between the structural elements of the amplifying tubes acts as the equivalent of a dead short circuit around the coupling medium, and prevents a difference of potential being transferred to exterior plate circuit.

This short circuit can be eliminated by tuning with a parallel inductance, but this leads to difficulties in the form of complicated adjustments and local oscillations. The French and English have constructed special tubes with a view to reducing the internal capacity, by special design. In addition they have designed special transformers, but the efficient results in each case have been confined to a narrow band of wave-lengths, for example, 300 to 700 m.

Any attempt to increase the effective working wave-lengths band, particularly toward lower waves, has resulted in failure. It is obvious that if the receiver is to have a commercial value a range of wave-lengths from say 100 to 850 m. must be available with a minimum amount of adjustment, and with uniform efficiency over the entire wave-length range.

Super-Heterodyne Amplification.

In December, 1919, Major Armstrong gave publicity to an indirect method of obtaining short wave amplification, called the super-heterodyne. The idea is to reduce the incoming frequency which may be, say, 1 500 000 cycles (200 m.) to some suitable super-audible frequency which can be amplified efficiently, then passing this current through a radio frequency amplifier, and finally rectifying and carrying on one or two stages of audio frequency amplification, if desired. Transformation of the incoming signal frequency to the amplifier frequency is usually accomplished by a heterodyne oscillator and a rectifier.

Technical Details.

This action can be readily understood by referring to the wiring diagram (Fig. 1). The primary circuit C–1, L–1, L–2 is tuned in resonance to the incoming signal frequency, say, 1 500 000 cycles. The secondary circuit L–5, L–6, L–7 and C–3 is tuned in resonance to the primary circuit, the coupling between these two circuits being adjusted between L–2 and L–5. V–2 is a rectifier or usual detector tube and V–2 with the associated parts is an external heterodyne oscillator. V–3 to V–8 is a resistance coupled radio frequency amplifier designed to operate efficiently at a frequency of 100 000 cycles, corresponding to 3 000 m., the last stage of this amplifier (V–8) also acting as a detector rectifier. The amplifier on the input side is coupled to the first detector by the tuned circuits C–4, L–8, and C–5, L–9, and on the output side to the detectors and audio frequency amplifier tubes. L–7 is in inductive relation to L–4.

Now assume that the heterodyne oscillator is tuned to 1 400 000 cycles or 1 600 000 cycles, either position will produce a beat frequency of 100 000 cycles. The combined currents of 1 500 000 cycles and 1 400 000 cycles (or 1 600 000) are then rectified by the detector V–2 to produce in circuit (C–4, L–8) a direct current with a superimposed 100 000 cycle component. This 100 000 cycle component is then amplified by V–3, V–4, V–5, V–6, and rectified by V–8, and the resultant audio frequency note amplified by the audio amplifying tubes V–9 and V–10. In the case of continuous wave reception, the best method of obtaining an audible note in the phones is to

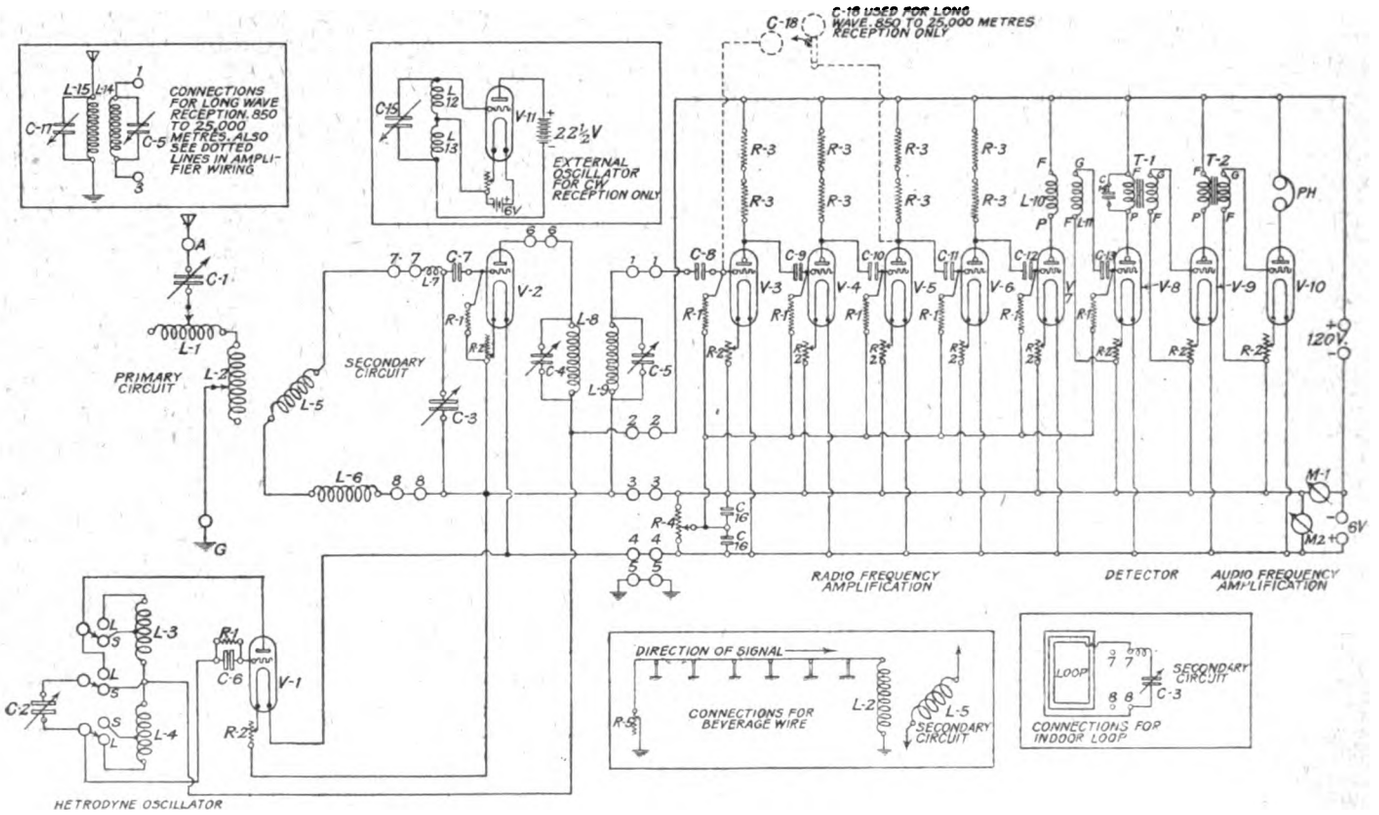

FIG. 1.—WIRING DIAGRAM OF SUPER-HETERODYNE RECEIVER.

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employ a second heterodyne adjustable to 1 000 cycles, either side of the amplifier frequency of 90 000 to 101 000 cycles, and loosely couple this to the amplifier circuit. It is also possible to receive continuous wave signals but producing oscillations in the amplifier, of a slightly higher or lower frequency than the amplifier tuned transfer wave-lengths, oscillations and

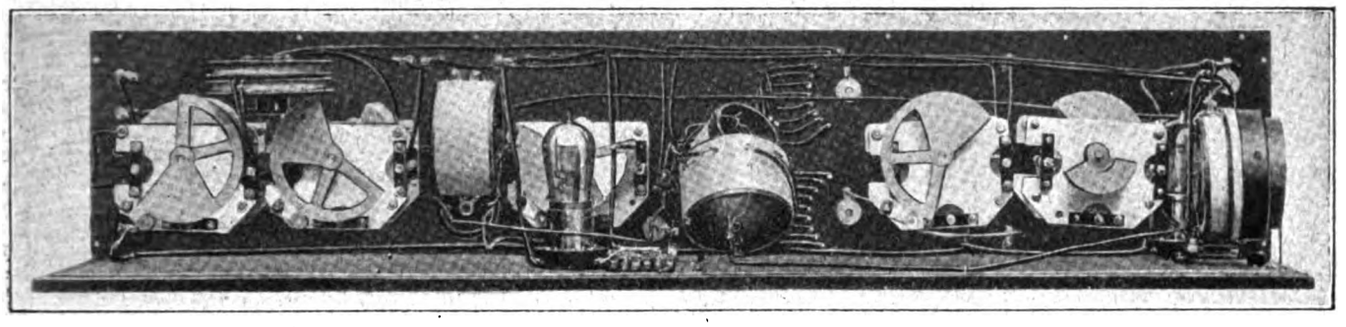

FIG. 2.

also regenerative amplification can be controlled by the special condenser C–18. This special condenser must obviously have a very small minimum capacity, or it would be difficult to stop the amplifier from oscillating.

No Distortion.

Reception of spark and telephone signals can be carried on with equal efficiency and without any distortion, which is odd, inasmuch as heterodyning a spark or telephone signal with an ordinary regenerative receiver will result in loss of note or tone. The efficiency of rectification of the incoming signal when heterodyning depends upon the phase relation with the local current. The efficiency of the rectification is a maximum when the two currents are 180 deg. out of phase or in phase, a minimum when 90 deg. out of phase.

In ordinary heterodyning the initial phase difference will be different for each wave-train from spark transmitters, as the initial phase difference depends on the sparking at the transmitter. The frequency of the two currents are practically the same, and the length of the wave-train is small compared with the time required to form a complete beat at audible frequencies. Different wave-trains are therefore rectified with different degress of efficiency and the plate current becomes irregular resultant in rough notes.

The beat frequency is high in the super-heterodyne, several beats per wave-train being established, and the phase angle between the two currents change through a number of cycles and the initial phase difference need no longer be considered.

The adjustments for 1 CW and telephony are a combination of the previous mentioned adjustments for spark and CW reception, bearing in mind that the amplifier circuits should be damped slightly to prevent distortion due to maximum resonance.

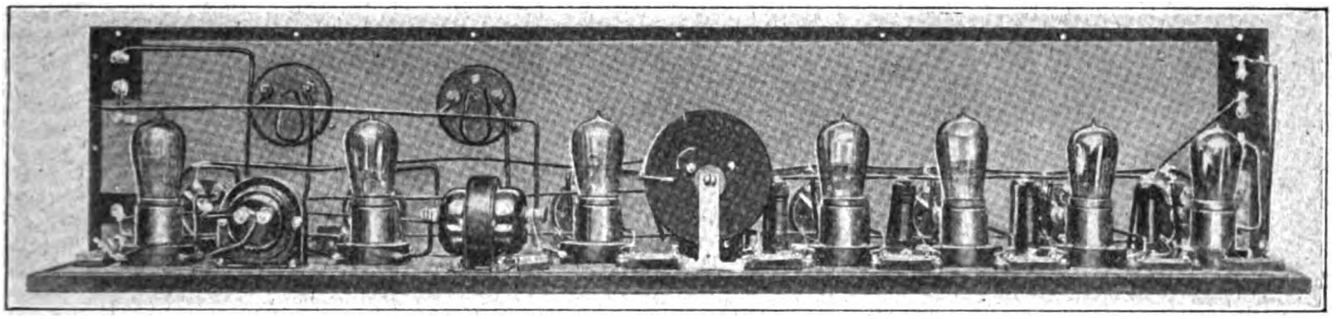

FIG. 3.

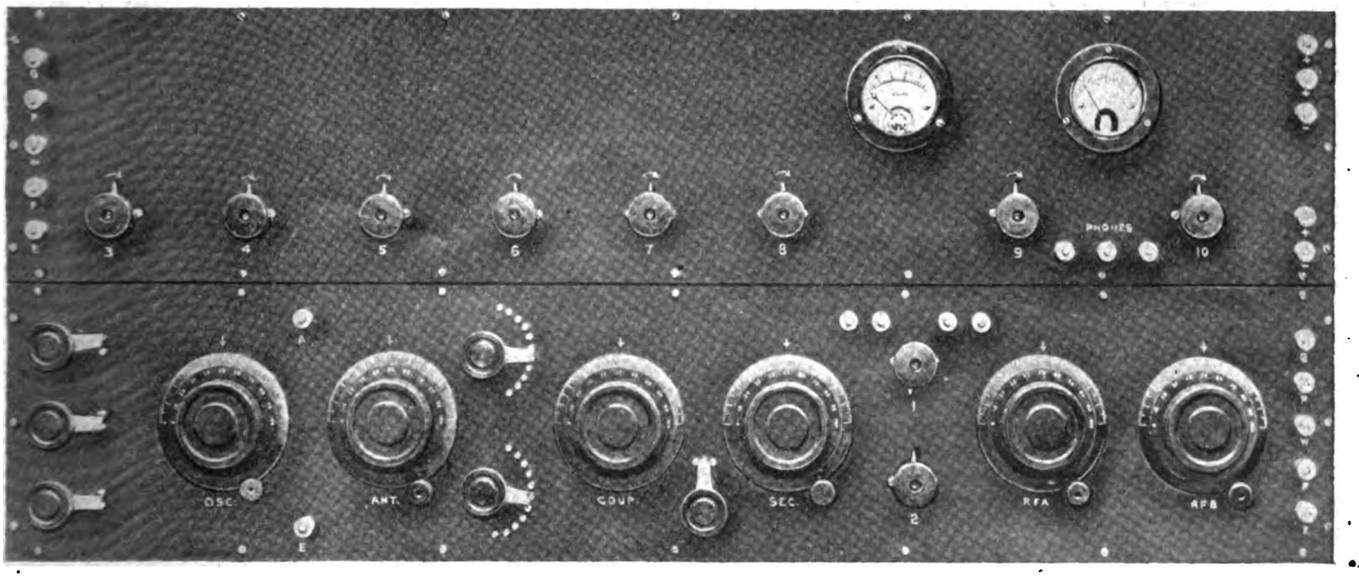

FIG. 4.

Details of Equipment.

The present equipment being used is shown schematically in the wiring diagram and actually in Figs. 2, 3, and 4. The radio frequency amplifier circuit is designed for 300 m.

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Special attention has been paid to the efficient design of the receiver circuits. L–2 and L–5 consist of 180 deg. coupler and give a 180 deg. scale movement to a 90 deg. coil relation. The condenser C–3 has shaped plates to give a straight line wavelength variation. The maximum capacity of this condenser is very low and the values of inductance large in order to develop the largest possible potential on the detector grid. In view of the fact that a loud signal is produced with only a fraction of a volt on the detector grid the ratio of L and C is important. To keep the high frequency resistance low, the coils are designed to have very low values of distributed capacity and the condensers are of special design having only one-tenth the resistance of the ordinary condensers. The inductance L–5 is used in parallel to C–3 to give the first wavelength the range 150 to 450 m. and L–6 is connected in series to L–5, and both in parallel to C–3 for the second range 310 to 850 m.

As the mechanical distance between L–8 and L–9 is increased the tuning becomes sharper and a very high degree of selectivity can be obtained. The output resistors R–3 can be replaced by iron core chokes of proper value. The resistors can also be replaced by inductances and capacities each tuned to 3 000 m., and give an additional advantage of having the amplifier reject all frequencies but the frequency to which it is tuned. The last stage of radio frequency amplification is coupled by the tuned transformer L–10, L–11. A potentiometer is provided for the common grid leak leads on the radio amplifier tubes providing a means to adjust the characteristic curves to a point when maximum amplification is obtained without chance of the amplifier oscillating. The complete equipment is built in two units each entirely shielded with 10 oz. copper. The phone cords are also shielded with Belden braid. The shields are connected to the negative side of the filament battery.

To use a loop the links are taken out at posts 8 and 7 and the loop inserted there, using C–3 to tune. For long wave reception, a large inductance is connected in place of L–9 for the secondary and that coupled to the antenna. The resistance coupled amplifier will function down to 850 m. The long wave reception would not be possible if a tuned radio frequency amplifier was employed. The first rectifier V–2 and heterodyne V–1 are not used, of course, for long wave reception.

Increasing the Signal Audibility.

Material increases to signal audibility can be made by inserting a variometer in the detector plate lead, at posts 6,6, tuning the plate for regenerative amplification. In place of tuning the plate it is also possible to provide inductive coupling between the plate and grid of the detector V–2 in the usual manner.

The results obtained with this unit have been very satisfactory. The antenna used was 125 ft. long and 50 ft. high located in New York City. On 600 m., spark signals from NGE (Miami), NAU (San Juan), NAR (Key West), NAW (Cuba) NAP (Pensacola), NAO (New Orleans), VCE (Cape Race), and ships around the Canal zone were received with sufficient audibility to be heard fifty feet from the telephones. On 360 m. radiophone signals from KYW (Chicago), WOC (Davenport), WWJ (Detroit), WHB (Kansas City) WSB (Atlanta) WHA (Wisconsin) were received with the same signal audibility. On 200 m., a continuous stream of 8th, 9th, 4th and 5th district amateurs were near. All these results were obtained in the late summer with usual heavy static conditions.

The data, photographs and drawing of this design was supplied through the courtesy of the Experimenters Information Service of 220, West 42nd Street, New York.

Wireless Direction-Finding in Steel Ships.*

By C. E. HORTON.

The work described in this Paper is concerned with overcoming the special difficulties which arise in ships. These difficulties are roughly proportional to the size and congestion of the metal structures in the vicinity of the direction finder and are therefore obtained in full perfection in a modern man-of-war.

The magnetic and electric fields which act on the direction finding system can be regarded as composed of :—(*a*) The fields due to the main wave itself; and (*b*) the secondary fields due to currents induced in the neighbouring conductors by the main wave. The induced currents which flow in the metal structures can be resolved into two components :— (*a*) Those which flow in closed conducting loops; (*b*) those which involve capacity currents through the dielectric. Except at short wave lengths components of type (*a*) predominate in large metal structures such as funnels, while type (*b*) are relatively more important in masts, stays and aerials.

To get rid of the (*a*) components two means are available. A position for the aerials so far removed from metal work may be found that the amplitude of the secondary field is very small; or a position for the aerials may be selected in which the metal work is disposed symmetrically around them. For this reason direction finders are nearly always located on the centre line.

By making the aerial system itself a composite one, the electrical centre of the whole may be in a position where no actual coil or aerial could be placed. Where the positions of the frames have to be decided in advance of construction full scale experiments are out of the question.

Suppose the alternating magnetic force between two funnels is considered, which in light cruisers are often of different section. If a large sheet of zinc, say, 8 ft. by 3 ft. by 0·02 in. is taken and a steady current of 20 A passed through it and a region near the centre of the sheet where the flow of current is uniform will be found. If a pattern to scale is cut out to represent the section through the two funnels there are then two holes in the sheet into which the current cannot penetrate. The lines of flow of the steady electric current in the zinc sheet are the same as the lines of magnetic force in the wireless case. The analogy is exact only for very long funnels, but valuable approximate results have been obtained in this way. For example, it is easy to find at what distance from a funnel, or a number of funnels, the field is sufficiently uniform to put a Bellini-Tosi set.

Correcting Quadrantal Errors.

To correct a quadrantal error it has been the custom for some time to place the aerials in the Bellini-Tosi system one fore and aft and the other athwartship, and to make the area of the fore and aft loop less than that of the athwartship loop.

By having a special goniometer it is possible to use aerials of identical shape and size and therefore of identical time constants, and still correct for a quadrantal error without altering the aerial circuits. Such a goniometer has been used recently in one ship. It has two fixed coils *A* and *B* with no mutual induction, each coil lying entirely outside the other. Each coil is constructed after the manner of a Helmholtz galvanometer, so as to give the most uniform possible field. The search coil is a composite system, consisting of two coils *S*1, *S*2, which rotate together, one within the field of each fixed winding, *S*1 within *A* and *S*2 within *B*. *S*1 and *S*2 are joined in series, and arranged so that when the axes of *S*1 and *A* are parallel the axes of *S*2 and *B* are perpendicular, and *vice versa*. The behaviour of this system is precisely the same as that of an ordinary goniometer but it has the advantage that S1 and S2 can be adjusted independently.

Use of the Goniometer.

The goniometer now in use in several ships of the Royal Navy provides a direct reading scale and great ease of manipulation. The scale of the instrument is made to follow the movement of the ship's head by connecting it to the transmitter system of the gyro compass. The reading opposite a fixed mark is always the same as the reading of a master compass. The reading opposite the pointer of the instrument when the zero is obtained is the true geographical bearing of the transmitting station or ship.

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* Abstract of a Paper read before the Wireless Section of the Institution of Electrical Engineers.

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Progress in Automatic Telephony.

Siemens System Installed at Southampton.

Automatic telephony is advancing slowly but surely in this country, the latest example of its adoption to the requirements of a large town being Southampton, where an automatic exchange with an ultimate capacity of 3 150 subscribers' lines has recently been equipped by SIEMENS BROTHERS and Co. The same system is also in use in the well-known docks of the Southern Railway Co., so that, telephonically speaking, Southampton is "all automatic." This form of communication has been available in the town since 1886, the magneto exchange, which is now being superseded, having been constructed in 1902.

In our issue of February 27th, 1914, we gave a detailed account of the Siemens automatic telephone system, but it may be recalled that it employs switches of the "step-by-step" type, the impulses transmitted by the subscriber's dial and the positions to which the switches are set corresponding exactly with the digits of the number called. As far as the subscriber is concerned "dialling" and the rest of the procedure follow the usual lines. Each revolution of the dial causes an impulse to be transmitted to the exchange and wipers to make connection with the appropriate contacts.

The Pre-selector.

The operation of the system mainly depends on a simple rotary switch called the pre-selector (Fig. 1). There are one pre-selector and two relays to each subscriber's line. The

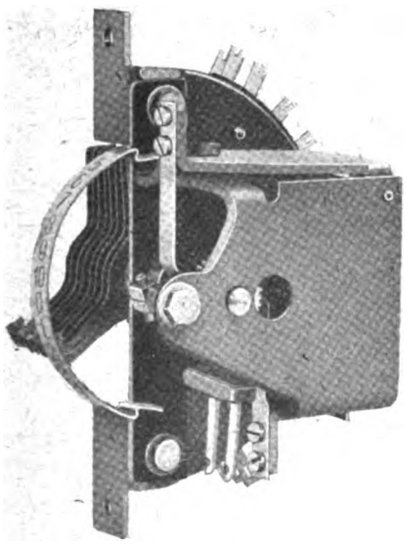

FIG. 1. VIEW OF THE PRE-SELECTOR.

relays control the pre-selector and perform similar functions to the line and cut off relays in the standard C.B. exchanges. The pre-selector searches over ten sets of contacts to find a free line to a second pre-selector. This second pre-selector was originally called the discriminator. Its function is to search for a free circuit to a first selector. By the use of two pre-selectors a greater choice of free paths is given and delay thereby avoided.

Operation of the System.

The selector switches (Fig. 2) have vertical as well as rotary motion. Each is associated with a contact bank having ten rows or "levels" of ten sets of working contacts. The first selector is the switch which is operated by the *first* train of impulses transmitted by the dial. Its wiper arms are raised to the level corresponding to the first digit dialled. They are then rotated automatically until a free link to the next selecting switch is reached. The subscriber's line is now connected through to a second selector switch.

When the subscriber dials the *second* figure, the second selector is operated in a similar manner to the first selector. This extends the line to a final selector, this being the switch which completes the connection. The vertical motion of the final selector is controlled by the *third* train of impulses (corresponding to the "tens" figure), while the rotary motion in this case is not automatic as in the first and second selector switches, but is controlled by the *fourth* and *last* train of impulses sent by the dial. The wipers of the final selector are thus stepped round and come to rest on the contacts of the line required. If the line is disengaged, the calling subscriber will hear a ringing signal, which indicates that the called subscriber is being rung. If, however, the called subscriber's line is engaged, the busy tone is transmitted to the caller.

When the conversation is finished and the calling subscriber hangs up his receiver, all the switches used in setting-up the connection return to normal immediately.

Installation Details.

At Southampton all the automatic apparatus is mounted on open racks of uniform height, and easy access to the apparatus is obtainable on both sides. A clear run is provided for

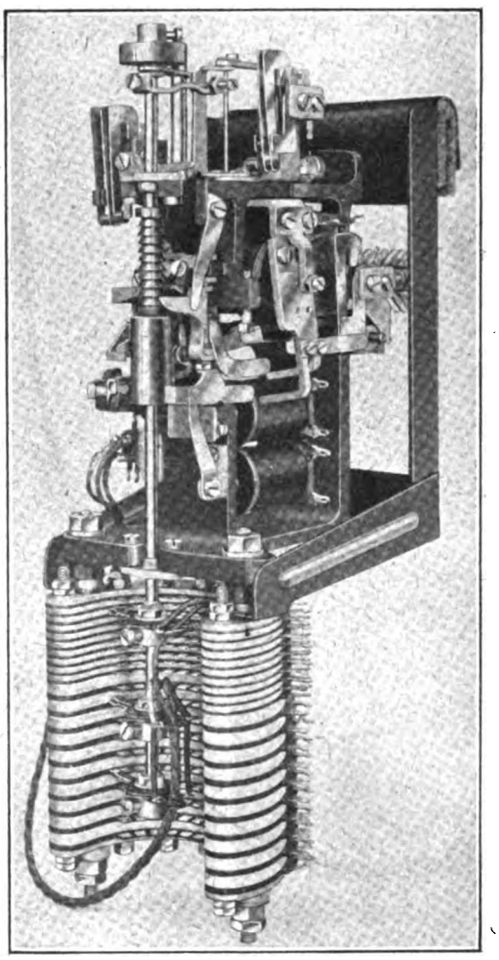

FIG. 2. A TYPICAL SELECTOR SWITCH.

sweeping and clearing, and the use of base angles has been avoided to prevent the accumulation of dirt. The relays controlling the automatic switches are mounted immediately above the switches with which they are associated, and provision is also made for the accommodation of the relays for alarm circuits and other miscellaneous apparatus. There are 34 first pre-selector racks and 5 second pre-selector racks, which are mounted in panels of ten, the contact banks in a panel of pre-selectors being multiplied together by means of base wires. There are 11 first selector racks, each of which has a capacity for three panels of ten switches, and ten second selector racks, each of which has four panels of ten switches. The twelve final selector racks provide accommodation for fifteen switches in each panel.

Link Distributing Frame.

A link distributing frame has been developed with the object of providing, in a compact form, all the facilities necessary for making changes in the grouping of switches when traffic conditions vary. The upper portion of the link distributing frame accommodates terminal strips for terminating the links from each panel of first selectors. The lower

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portion accommodates terminal strips which are cabled to the second selector switches or to other outgoing circuits served from first selector levels. Cross-connections, or jumpers, run between the upper and lower portion of the frame, serve to connect the first selector banks to the second selector switches.

The terminal strips used are of a special design, and allow cable and jumper wire to be terminated on the same tags. They are so arranged that the concentration of links can be effected by means of bare wire commons. This method enables the inter-connecting of the various ranks of switches to be seen at a glance by inspection of the commons. Any desired alteration of the existing grouping can easily be made without disturbing the permanent cabling, simply by removing or rearranging the bare wire commons and cross connections. The frame consists of separate units of the same height as the automatic switch racks, the units being lined up together to form one complete distributing frame.

Power Plant.

The exchange is operated on the common battery principle. Duplicate sets of 60 V Tudor batteries are provided. Each

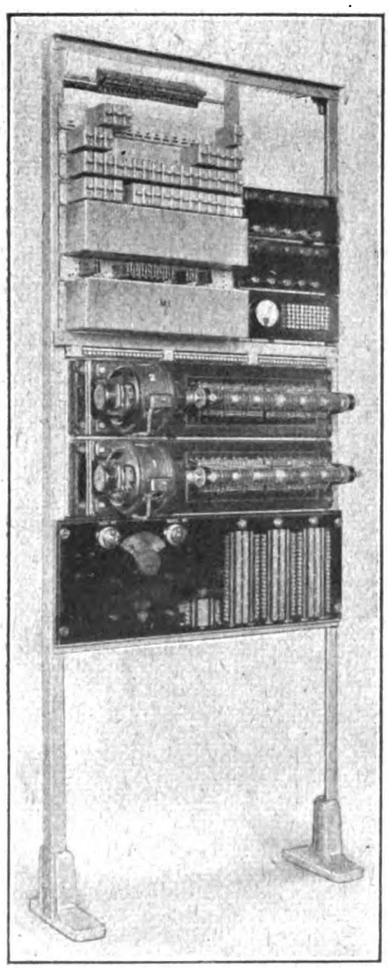

FIG. 3. ONE OF THE MOTOR INTERRUPTER RACKS AT SOUTHAMPTON.

battery consists of 30 cells having boxes capable of accommodating plates for a capacity of 1 353 Ah, but at present fitted with plates giving a capacity of 904 Ah. As the automatic apparatus operates correctly at any voltage between 54 and 66 V, no voltage regulation or voltage alarm devices are required to maintain the satisfactory working of the exchange. The only auxiliary battery needed is that required to enable the subscribers' P.B.X. switchboards to be supplied with power at the correct voltage. This consists of a 13-cell counter e.m.f. Tudor battery.

Two English Electric motor-generator charging sets are installed. Both sets are driven from the public supply mains at a pressure of 400 V d.c. Each machine has a normal output of 8·5 k.W. Two ringing Crompton dynamotors are provided. One of these machines is driven from the 200 V d.c. supply mains, and the other from the exchange battery. Interrupter attachments are fitted on each machine to interrupt the current for the various tone and alarm signals.

Motor Interrupter Racks.

Two motor interrupter racks (Fig. 3) are provided. Each rack is equipped with duplicate motor interrupter machines, switches, fuses and other equipment associated with the driving circuits. These racks also accommodate the distribution fuses which are inserted in the leads between the battery and the various groups of automatic apparatus racks.

The power board is the first of its kind to be installed in any large exchange in this country. It is provided with single-pole switches for all connections excepting those to the public supply mains. By this means the arrangement of the apparatus and wiring is simplified, and the general appearance of the power board considerably improved.

Test Desk.

A new design of test desk (Fig. 4) was recently developed by Siemens Brothers and Co., in conjunction with the engineers of the Post Office, and is being introduced for the first time at Southampton. It has now been adopted by the Post Office as standard for future manual and automatic exchanges. The desk is built up in sections in a similar manner to that

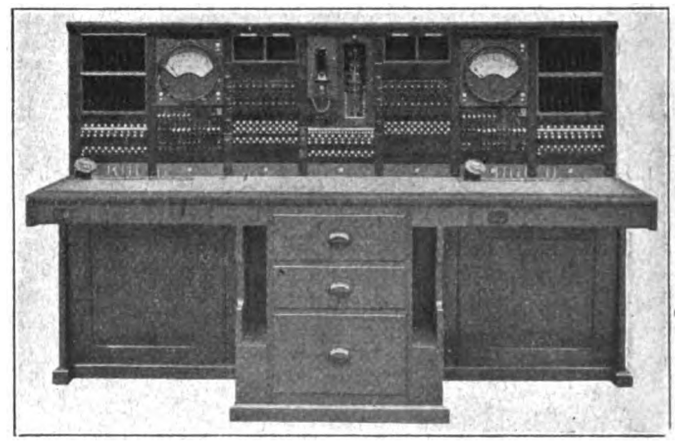

FIG. 4. VIEW OF THE SPECIALLY DESIGNED TEST DESK AT SOUTHAMPTON.

followed in a manual switchboard. It is thus readily extensible and provides particularly good access to all apparatus both at front and rear. Two types of sections are used—a two-panel testing section and a three-panel filing section. End-panels are provided to close in the sections at each end of the desk.

It may be noted that dialling-in first selectors are provided to enable the operator at a large number of surrounding exchanges to obtain Southampton subscribers by direct dialling over the junctions which terminate on these selectors.

Peat for Electrical Generation.

An interesting account of a generating station which is operated mainly by peat as a fuel is given in the Report of the Fuel Research Board for 1922-23. This has recently been published by the Stationery Office, and may be obtained from the usual addresses at a price of 5s. 4d. The station in question is situated on the Auricher Wiesmoor in Prussia, and has a present generating capacity of 21 050 kW. It consumes about 30 000 tons of coal and 60 000 tons of peat per annum. The peat is mechanically handled from the beds to the boiler house by waggons and conveyors, and an interesting delivery arrangement ensures that it is moved into the furnace without jamming. The average result obtained is 3·0 kg. of peat per kWh, though as low a figure as 2·2 kg. has been realised. This station supplies energy to a considerable distance, transmission voltages of 20 000, 40 000 and 60 000 V being used. The present annual output of peat is 60 000 tons, though it is hoped to increase it to 100 000 tons. It can only be won from the beginning of March to the end of July; and this and the drying and storing operations are entirely effected by electrically driven machinery. The report and its appendices are a useful compilation on the treatment and use of peat, and are therefore worth study.

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The National Physical Laboratory.

Electrical Work Retarded by Lack of Accommodation.

The annual report of the NATIONAL PHYSICAL LABORATORY for the year 1922 contains, as usual, a large amount of interesting information regarding the work of this useful institution.

The Executive Committee towards the end of 1922 appointed a Research Committee, consisting of Sir J. J. Thomson, Sir W. Bragg and Sir Ernest Rutherford, to advise and assist them in the organisation of research in the Laboratory. This committee has reviewed the work for 1923–24, and has suggested important additions to the programme. It has also presented a report on the needs of the Laboratory.

Among the more interesting researches in progress may be noted the work on the high temperature scale, the measurements of the conductivity of various materials, and X-ray spectrometry in the Physics Department; the investigation of lens systems in the Optics Division; the experiments on a new method of ruling gratings and on a vibration time standard, in the Metrology Department; researches on the efficiency of gearing in the Engineering Department, and on the physical constitution of metals and alloys in the Metallurgy Department.

Comparison of Standards

The statutory decennial comparison of the standards of the Board of Trade and those of the Laboratory show that the British standard of length has remained constant to a high order of accuracy, and the same applies to the Board of Trade thermometers. Progress has been made in comparing the light standards in accordance with the findings of the International Illumination Commission, and a comparison of the radium standards at Teddington and Washington is also in hand.

Co-ordinating Research.

A large amount of work continues to be carried out for the co-ordinating research boards of the Department of Scientific and Industrial Research, while investigations of other Government departments on such matters as the lighting of public buildings, ship lights and the ventilation of the House of Commons are also in hand. The examination of meter "types" is being undertaken for the Electricity Commissioners, while the various Research Associations continue to take advantage of the facilities provided at the Laboratory.

More Space Required.

Referring to the need for increased space in the Laboratory generally, the report draws attention to the needs of the Electricity Department. This comprises five or six divisions covering work grouped under the titles: electrical standards, general electrical measurements, radio research, electrotechnics (alternating and direct current work) and photometry. Some additional space for the work of the first three divisions has been found in Bushy House of recent years, but the Electrotechnics Building, in which the electrotechnics and photometry divisions are housed, is now completely occupied, and provides no space for further extension. Additions to the equipment are urgently required to enable measurements at very high voltages to be undertaken, in order to meet the modern conditions of power transmission. Recent improvements in methods of lighting, especially the use of the gasfilled lamp, render necessary developments in the photometric methods employed for the determination of the mean candle-power of sources of high intensity. For these and other extensions of the work urgently necessary to enable the Laboratory to keep abreast of modern requirements, no accommodation can at present be found. Unless some steps can be taken shortly to remedy the present position, the Laboratory will be unable to fulfil its proper functions as a national standardising laboratory.

High Temperature Scales.

Turning to the work done, mention may be made of the international comparison of high temperature scales. A comparison is being made between the scale in use in the Nela Research Laboratory of the General Electric Co. (U.S.A.) and that adopted by the Laboratory. Three heavy-current lamps are being used as high-temperature standards, and the work is nearly completed. A large number of determinations of thermal conductivity have been made, not only of materials for use in cold storage installations, but of various other substances, such as woods, fibres, ebonites, insulating cloths and mica. A commencement has been made on the problem of the conditions required for the production of a wireless transmitting valve capable of large output, while other matters under examination include experiments on the cooling power of oil used in transformers. A large amount of useful work has been done in the radiological, sound and optics divisions.

Interesting Electrical Investigations.

In connection with the electrical standards some interesting results are recorded. The Laboratory has given assistance in the provision of a standard mutual inductance for the Japanese Electrical Standards Laboratory at Tokio. This was made to the same design as the Laboratory standard, of which the value is calculable from its dimensions. Comparison of this with the Laboratory standard afforded a valuable check of the accuracy of the accepted value of the latter. The two standards were found to agree within one part in 100 000. Comparisons between tests of standard cells made at the Bureau of Standards and at the Laboratory have been obtained during the past year and show agreement to one part in 100 000.

A 1 Ω coil belonging to the National Bureau of Weights and Measures, Petrograd, was tested at the Laboratory early in the year; it was afterwards compared with the Reichsanstalt standards; the two results differed by less than one part in 100 000. Four standard cells made at the Laboratory were also examined at the Reichsanstalt, and the results showed a mean difference of $25 \times 10\text{-}6$V from the National Physical Laboratory value.

In recent measurements with the ampère balance, made in connection with experiments on the Schuster magnetometer, the probable error in the determination of the ampère was found to be about four parts in 100 000: in the original determinations the error was not more than two parts in 100 000, and the loss of accuracy is due to some deterioration, with lapse of time, in the insulating material employed. The construction of new cylinders for the balance, in which the use of paraffin wax insulation is avoided, has been undertaken. A second Schuster magnetometer is being constructed, at the request of the Astronomer Royal, for use at the Greenwich Observatory.

Standards for Radio Work.

Considerable progress has been made with the provision of standards for radio work, at the request of the Radio Research Board. A method of maintaining accurately the constancy of the wave length in transmission has been devised by Mr. Dye which promises to have important applications. Experiments are proceeding on the properties of iron at radio and acoustic frequencies. The experiments on the variation of the bearing of fixed stations and the measurements of signal strength are being continued. Apparatus has been devised by Mr. Hollingworth for measuring the intensity of received signals, with which interesting results have been obtained.

The Electrical Measurements Division has a considerable amount of work in hand for the Electrical Research Association and for the Admiralty, including the investigation of dielectric losses at high frequencies. Some interesting results have been obtained in the investigation of hysteresis and eddy current losses in sheet steels.

Investigations at Large Voltages and Currents.

In the Electrotechnics Department the demands for investigation involving large voltages and currents continue to increase, and additional and larger generating and transforming plant is being installed. The development of instruments and methods of measurement suitable for high voltages and large currents will thereby be much facilitated. Preliminary work has been done on the measurement of small amounts of power by means of an electrometer designed to operate at high voltages. The instrument has been employed in the measurement of the energy lost in insulating materials, an investigation undertaken for the Electrical Research Association, and it is hoped it will operate at the highest commercial voltages at present in use.

Assistance has been given to the Electrical Research Association in connection with many of their investigations. Among the more interesting is an examination into the effects of the rupture of short-circuit conditions by oil-immersed switches when controlling very large amounts of power. In addition to advice on electrical measurements, apparatus has been developed for recording the hydrostatic pressure generated at various points in the surrounding oil at the moment of operation. Several types of supply meters are being investi-

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gated on behalf of the Electricity Commissioners, who act as approving authority under the regulations previously exercised by the Board of Trade.

Direct Current Work.

In the Direct Current Section a considerable number of special investigations are proceeding for different bodies and private firms. For the Electrical Research Association the experiments on buried cables have been continued. A report was submitted in July, and load tables for all sizes of cable laid direct in the ground have been calculated. The resistivity of porcelain has been investigated for temperatures up to 1 200 deg. C., and the polarisation effect determined with both alternating and direct current measurements. Experiments on fuses have been carried out and a report presented.

Some experiments on accumulators have been made for the Chemistry Research Board. Various investigations relating to cables are in hand for the Admiralty. Experiments have been carried out with a view to international agreement as to the figure to be adopted for the resistivity of aluminium of high commercial purity, and a report on the work has been communicated to the Bureau of Standards and to the Laboratoire Central d'Électricité. The corresponding values determined by these institutions have not yet been received.

Photometrical Researches.

In the Photometry Section, the work on ships' navigation lights has continued, following on the report of the Board of Trade Committee, which was published early in the year, and which recommended the National Physical Laboratory as the examining and standardising institution for details of navigation lamps. The work for the Factory Lighting Committee of the Home Office came to an end with the publication of its Report. An experimental building has been erected for the investigation by means of scale models, of problems arising in the natural and artificial lighting of buildings. The investigation of searchlight carbons for the Admiralty has occupied a large part of the time of the staff, and promising results have been obtained. The work on radium luminous compounds has been continued in conjunction with the Radiology Division. A fresh standardisation of the set of electric sub-standards lamps which run at the highest efficiency has been carried out. The sphere photometer has been taken into use and has given every satisfaction for the measurement of sources of ordinary size.

Work of the Engineering Department.

In the Engineering Department.—The main work of the year in this department has been the research on lubrication carried out for the Lubrication Research Committee. The purpose of the investigation was to study the distribution of pressure in cylindrical bearings for high values of the eccentricity. The results have verified the occurrence of high values of the pressure with continuous lubrication up to as much as 3½ tons per sq. in. The existence of hydrodynamical flow has been demonstrated between surfaces of which the distance apart was of the order of one micron (one-thousandth of a millimetre). Another aspect of the problem has been investigated for the Admiralty to determine the limiting conditions of lubrication in a cylindrical journal as affected by temperature and pressure.

Metallurgical Investigations.

In the Metallurgy Department research on Ferrous Alloys has been commenced for the Alloys Research Committee, and good progress has been made during the year. Numerous preliminary experiments have been necessary to develop experimental methods suitable for the investigation of the constitution of alloys with extremely high melting points. The alloys are prepared in a carbon ring electric furnace, and the first problem has been to prevent contamination of the iron by the carbon of the furnace. For this purpose a muffle has been used glazed with a highly refractory glaze, fired on at a temperature of 1 530 to 1 560 deg. C. These muffles have, however, several defects, and further expedients are being tried. An electrolytic process has been used to obtain iron of the exceptionally high degree of purity required: a preliminary determination of the melting point of pure iron in an atmosphere of nitrogen has given the figure 1 530 deg. C., a value rather higher than that found by former workers. Considerable progress has been made in the study of the iron-chromium alloys. Crucibles suitable for the manufacture of these alloys were only obtained after many trials. The effect of oxygen on iron is also being examined.

Work on light alloys has been done for the Engineering Research Board in continuation of the researches formerly undertaken for the Advisory Committee for Aeronautics. Much attention has been given to methods of casting the aluminium alloy developed at the Laboratory, containing 4 per cent. of copper, 2 per cent. of nickel and 1½ per cent. of magnesium (known as "Y" alloy). The effect of repeated overheating of aluminium has been examined, and it has been established that the phenomenon known as "burning" in aluminium is not due to this cause. The investigation of the constitution of the aluminium-copper-nickel alloys, rich in aluminium, has been completed. The constitution of the aluminium-copper-manganese-silicon alloys is being investigated, and some work has also been done on alloys containing calcium. The research on the cracking of boiler-plates, also undertaken for the Board, has been continued. It is of interest to note that no failure has occurred in specimens submitted to prolonged stress for two years at 300 deg. C., although the stress was above the elastic limit; it appears probable that some corrosion must occur to cause cracking. A summary of the existing knowledge of spring steels is being prepared for the Motor Springs Sub-Committee.

Some useful additions have been made to the equipment, including a 25 kW Ajax-Northrup induction furnace.

During the year a total of 896 934 tests were made, a decrease of 98 766 over the previous year. In the electrical department, however, the tests made were 2 367—an increase of 62.

As usual, a considerable portion of the large volume under review is made up of a statement of work proposed for the year 1923–24, and of the reports of the various heads of departments to the Director.

Education for Industry.

That one of the greatest needs of the electrical industry is the proper education of those who are to take part in its activities is so obvious as to go without saying. But the proper organisation of this education so that the effort that is put into it by both teachers and pupils shall bear the largest possible amount of fruit is a problem not without difficulties. We therefore welcome the issue of a pamphlet by the Metropolitan-Vickers Electrical Co., in which is set out in full detail the courses arranged by them both for trade and, what may be called, professional apprentices. As is well known, from its first inauguration as the British Westinghouse Co., this firm has always paid a great deal of attention to the question of training. From the beginning premiums were discouraged and each apprentice was paid something. In this way the officials of the education department were able to exercise a close control and the apprentice himself was encouraged to do his best.

The Trade Apprenticeship Course.

The pamphlet sets out in details the various courses now available at Trafford Park. The trade apprenticeship course is intended for boys between the ages of fourteen and sixteen who desire to train for artizan employment. They are required to possess a certain standard of education and physical fitness and to ensure this a close touch is kept between the company's Education Department and the local Education Authority. Boys are placed on probation for six months, after which they are apprenticed until the age of twenty-one. They attend the works school and are encouraged to compete for scholarships and to attend evening technical classes.

The College Apprentice.

The college apprenticeship course is of two years duration and is open to those who have obtained an honours degree in engineering and have taken part in the social, athletic or other side of the corporate life of the university. The course is mainly practical, but informal evenings are held at which matters relating to industrial administration are discussed.

A third course is the school apprenticeship course which is for youths over the age of sixteen who are training as school apprentices. It is of four years' duration, but it is not recommended as it is very arduous, practical and theoretical training being conducted together.

Research Scholarships.

In addition to these courses research scholarships, value £130, are available for those who are preparing theses for an honours or master's degree. They are of twelve months' duration, three months of which is spent at Trafford Park and the remainder either at Trafford Park or at the college as may be decided. Facilities are also available for works training during the college vacations, for training assistant foremen, erection engineers, chemists, physicists, metallurgists, to some of which courses men as well as women are admitted. Attention is also paid to social activities and the whole organisation is one that might well be studied and copied.

We note that a number of cups and other trophies have been given for competition. These include the Mensforth Shield presented by Mr. (now Sir) H. Mensforth in 1918. This is awarded by vote and requires qualities which suggest that Admirable Crichtons are not unusual at Trafford Park.

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Reviews.

The Electrical Handling of Materials. Vol. IV.: Machinery and Methods. By H. H. Broughton. (London: Ernest Benn, Ltd.). Pp. xx.+334. 50s. net.

The fourth volume of Mr. Broughton's well-known work on "The Electrical Handling of Materials" shows no falling off from the high standard of the previous volumes, and, although there is in it a certain small amount of overlapping with the previous volume, it will be found by the engineer to be of as great value, and to some specialists of much greater value, than perhaps any of the preceding sections. This will be evident from a perusal of the list of contents, which include large comprehensive and exceptionally well illustrated chapters on elevators and conveyors, belt conveyors, automatic feeders, automatic skip hoists, lessons from America on bulk handling, handling and storing grain; two chapters, handling and storing of coal ore and similar bulk materials, belt shipping plants, coaling stations, also the handling of foodstuffs and general merchandise. Comprised in the various chapters are tabulated data, and in some cases complete data, regarding costs, without which the very excellent descriptive matter and drawings would be incomplete.

We observe that the author in his preface, which is dated May of this year, states that the United States easily leads the world in the production of steel. On the other hand, it is Great Britain which leads the world at present in steel exports, the published figures for March, 1923, showing United States exports as less than half the British.

Unfortunately, at the date of writing this review, the steel works output both for export and home consumption (this applies to all countries) is threatened with a fairly lean time in the near future. It is by the careful study of up-to-date methods, such as are dealt with in Mr. Broughton's book, that the steel works engineer, the electrical engineer, in fact, all engineers associated with the steel, coal and shipping industries, should prepare to meet the world's competition, as it is only by the adoption of the most improved machinery, beginning at the very source of production, and by turning a deaf ear to the temptation of the temporary economy offered by the half-measure expedient of the conversion of existing machinery, that engineers will best prepare to meet that competition and thus enable their firms (or clients) to remain in the ranks of dividend paying concerns.

In the excellent chapter on belt conveyors we consider that an omission has been made in not emphasising the necessity, especially in the case of high speed belts, of providing for sequence starting and stopping of the several sections of the belts on the complete conveyor. It is generally found convenient to drive each section by means of a separate motor, and if sequence starting and stopping, also interlocks, are properly arranged for on the control gear, there is no risk of piling of the material, or damage to belts. This matter is only lightly touched on under belt shipping plants.

Speaking generally, the handling specialities dealt with in each section are most complete. We are, however, of the opinion that in Chapter IV. the author is guilty of a serious omission in failing to include descriptions of blast furnace hoists and chargers. He has confined this chapter in a great measure to descriptions of the fully automatic type of ash and storage bin hoists; whereas the subject of skip hoists merits a discussion of many types of blast furnace chargers proper on account of the great interest taken in the subject by steel works engineers. For instance, no reference whatever is made to the latest types of furnace chargers, such as what is known as the vertical-horizontal type, which is so easily adaptable to existing steel works layouts; or of the semi-automatic Ward-Leonard controlled drop bottom bucket chargers. These two types represent the most up-to-date and most economical types of chargers in this country, and we can only suppose that the author at the time of writing the present volume was not aware of their existence. We understand that in the forthcoming Volume V. of his work the author will include descriptions and data of many types of hoisting and winding plant, and we trust that these subjects will be dealt with more fully.

We would offer our congratulations to the author on the attainment of his ambition to produce a work which shall actually, and not merely in the prospectus and lists of contents, cover practically every variety of electrically driven machinery used for the handling of materials, and, in addition, comprise details of most of the components which form part of the assembly of such machinery. We feel certain that the product of Mr. Broughton's long-sustained effort will meet with the success which it deserves. Chas. E. Raeburn.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

PERMALLOY.

To the Editor of THE ELECTRICIAN.

Sir,—With reference to the article on "Permalloy" which appeared in the June 22nd issue of your magazine, Messrs. Arnold and Elmen having apparently overlooked my own investigations on the magnetic properties of nickel-iron alloys, I would like to point out that I have previously proposed the use of such alloys for constituting the magnetic circuit of certain electrical apparatus such as static frequency multipliers, magnetic amplifiers, telephone loading coils and intervalve transformers. (See French Patents 491 184 of May 20th, 1915, and 510 402 of May 4th, 1919, and, more recently, 16 070 of June 14th, 1922.)

Not only have I proposed, in my own patents, the use of nickel-iron alloys, but there has effectively been built therewith very high efficiency apparatus up to a power of 15 kW at 100 000 cycles. (See "Revue Générale d'Electricité, July 1st, 1922, p. 961, and "Radio-Electricité," June, 1922, p. 245.)

I was already aware that, in a general way, the heat treatment of these alloys, such as annealing them in vacuum, has a great influence on their magnetic properties. The latter treatment has the effect of decreasing the hysteresis as well as increasing the initial permeability, as may be seen in the curves I published in "Radio-Electricité." This holds good for practically the whole nickel-iron series as I have investigated it.

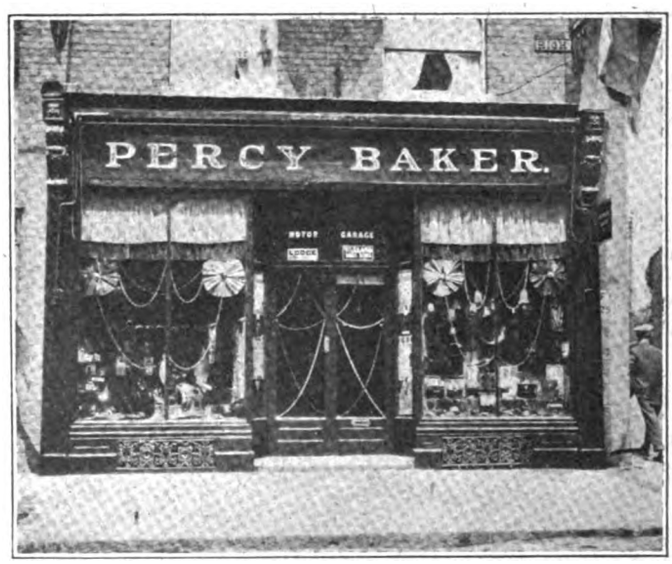
Notwithstanding the most interesting peculiarities of "Permalloy" from a theoretical point of view, the writer does not think that, apart from the above applications, it is likely to find such general practical applications as are anticipated by the authors.—I am, etc., Marius Latour.

Paris,
July 9th.

Carnivals and the Electrical Idea.

An Example from Uxbridge.

Uxbridge has been having a Carnival week at which all sorts of interesting things happened. There was a procession, and a band contest, and a horticultural show, and there were speeches, and the traffic was held up, so that altogether a small country town to which



How an Electrical Contractor Decorated his Window during the Uxbridge Carnival.

London is gradually approaching was able for a short time to enjoy all the advantages and disadvantages of the metropolis.

Now, Uxbridge is up to date in this that it has an electricity supply. And it is fortunate in this that it has at least one go-ahead electrical contractor. As our illustration shows, Mr. P. W. Baker, who has premises in the High Street, took advantage of all these wonderful doings to call the attention of the inhabitants of Uxbridge and the visitors to the carnival to the electrical idea, and the assistance he could give in carrying them out. He showed in his window all sorts of domestic apparatus, including wireless sets, and the general scheme of decoration and the attractiveness of its appeal would have won, we are sure, admiration from Mrs. Hammer. This is a departure which is worth imitating, and we hope will be imitated.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

A Cause for Reflection.

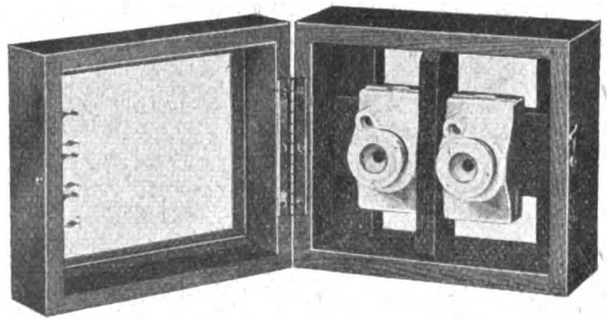
There is much food for reflection in the fact that so many industrial establishments to-day are using the old-fashioned glue-pot, heated on an even more old-fashioned gas ring, but this is not the column in which to analyse the reasons for that state of affairs. Perhaps it is that knowledge is required as to where this profitable merchandise can be bought. We illustrate a thoroughly sound

A SOUND ELECTRICAL GLUE POT.

glue-pot manufactured by BELLING AND CO. The complete equipment will be apparent from our illustration, but a brief description will be of service. It is strongly made of cast iron, and is fitted with an inner tinned pan which has a capacity of two pints. The switch control is on a separate panel with a three-heat switch and four feet of metallic flexible tubing. The loading of this unit is 900 W, and the list price is £4.

A Simple "Zed" Fuse Box.

There are many jobs where a simple double-pole fuse-box is required, but where it is not desirable to install the more common type of bridge fuse. The "Zed" fuse, manufactured by SIEMENS ENGLISH ELECTRIC LAMP CO., is well known; but the fact that these units are made up into simple fuse-boxes is not so familiar.

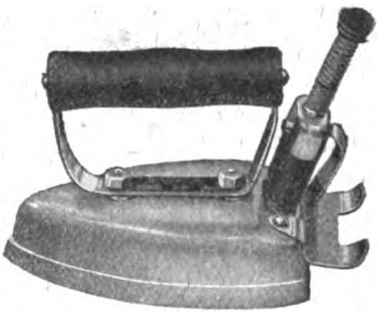


A DOUBLE POLE "ZED" FUSE BOX.

We illustrate the double-pole box, which consists essentially of two S.P. "Zed" units mounted in a polished teak case with glass front and hook fastener. The dimensions of the cases have been carefully designed to allow ample room for the connections and the disposition of the incoming and outgoing cables. These fuse boxes can be supplied in several capacities from 15 A at 250 V up to 100 A at 500 V.

A Recipe for Success.

The recipe for a successful boost with a popular line of merchandise is quite a simple one, the three principal ingredients being dominating publicity, an attractive price and good quality. These three essentials form the basis of the selling campaign just launched by METROPOLITAN-VICKERS ELECTRICAL CO. The publicity is in the form of an artistic folder providing for overprinting, entitled



"COSMOS" DOMESTIC IRON.

"The Cosmos Iron for the Home," and it will undoubtedly make an irresistible appeal to the buyer. The iron is of sound construction

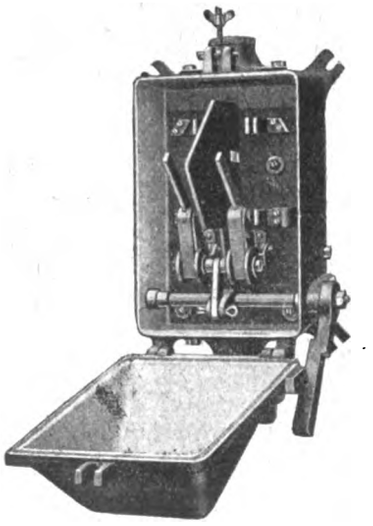
A VIEW OF THE SOLE PLATE.

both electrically and mechanically and the trio of essentials for success is made complete by the attractive list price of 21s.

"Vincent" Switchgear.

Contractors have to be careful in their selection of ironclad switchgear, if only to be sure that any gear installed will be approved by the local supply authority.

The VINCENT SWITCHGEAR MANUFACTURING CO. offer a compre-



A TYPICAL IRON CLAD SWITCH.

hensive range of switchgear, which will enable the contractor to execute a job secure in the knowledge that the switchgear, at least, will not be criticised. At the same time, the prices are competitive, which is an assurance every buyer seems to need, because it is one of the idiosyncrasies of the trade to assume that because a device is keen in price it is scamped in quality. We illustrate a double pole 60 A switch suitable for 600 V. The switch is also made in with triple poles, and both types are made to comply with Home Office requirements.

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The Public Demand for Battery Chargers.

Retailers must realise that a large number of wireless enthusiasts will instal apparatus in their homes to charge their own apparatus. In the past it has been the attitude of the retailer to treat this trend of events with indifference and to deprecate the efforts of manufac-

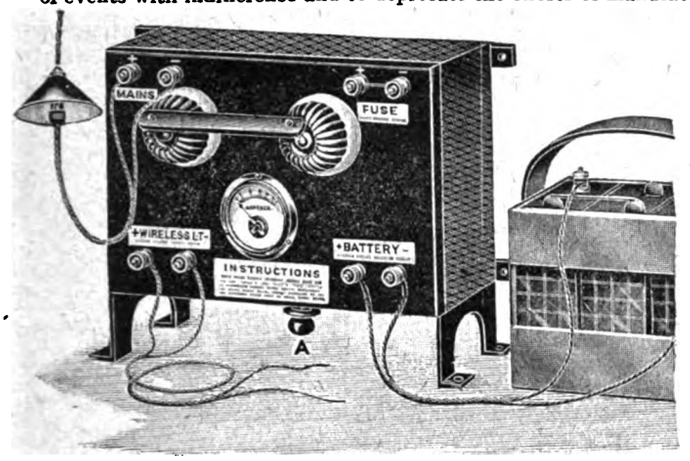


FIG. 1. A USEFUL D.C. BATTERY CHARGER.

turers to place upon the market reliable and efficient apparatus, giving (wisely we think) greater attention to the former than to the latter. It is, however, becoming recognised by retailers that there is good business going a-begging and there is an ever-increasing interest in the apparatus on the market. There is profit in selling this apparatus as retail merchandise in addition to the profits to

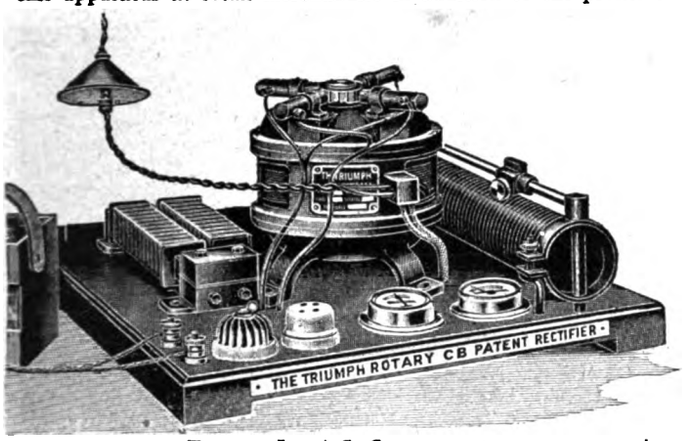


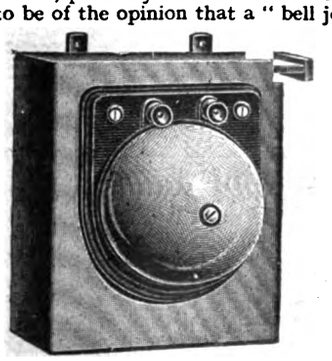
FIG. 2. ITS A.C. COUNTERPART.

be made on an accumulator charging service. We illustrate two sets manufactured by CINEMA TRADERS, Fig. 1 being for d.c. circuits and Fig. 2 being for a.c. circuits.

We shall not attempt to describe the sets in any detail, but the descriptive price list published by the manufacturers is worthy of the attention of all retailers who will face the trend of events and accept it that the public is demanding simple "homely" apparatus for battery charging.

"Hide and Seek" with Bell Batteries.

There are many situations where the bell set which we illustrate would make a very satisfactory job. Contractors have an unhappy reputation on bell work, probably due to the fact that the average contractor seems to be of the opinion that a "bell job" is beneath



A SELF-CONTAINED BELL.

his dignity, or, if he has to submit to the supposed indignity, the finished job is not to his credit. Presumably to express his contempt, the wireman in turn places the cells in the most awkward place he can find, and when the batteries need furbishing up the bell becomes a curse instead of a blessing to the householder. The excuse that is usually put forward for hiding the cells so that they cannot be found is that they are unsightly. This excuse is no longer valid. Several makers offer the trade useful bell sets with the cells in a neat get-at-able box. The set which we illustrate is typical of our argument, and is manufactured by GENT AND CO.

Accumulators—Cheap and Good!

In these columns we have strongly urged the point of view that when buying accumulators the only sound policy to follow is to buy a known make with a reputation for quality. When plans are being laid for merchandising of accumulators this course must be followed, otherwise the retailer will only succeed in building up, not a turnover with profits, but a local reputation for unreliable accumulators, and the profits will disappear in service charges. It must never be lost sight of that when accumulators are sold to the public they (the accumulators) cease to become electrical apparatus.

AN ACCUMULATOR WORTH STOCKING.

They are simply a piece of apparatus bought to render a service, and the average man is more concerned with reliability than weight or efficiency. It will be argued that to secure this business against competition everything must be sacrificed to price. It is, however, lack of knowledge which prompts such an argument. The position to-day is that there are several manufacturers offering accumulators at a price with which the retailer can attract the public. Among such manufacturers is FULLERS' UNITED ELECTRIC WORKS. We illustrate one of their type S.L. accumulators which is an object-esson, and proves our argument. A study of Fullers' prices is all that is necessary.

Something Better for the Cyclist.

It is recognised that it is hard work and "heavy going" to build up a business in lighting sets for pedal bicycles; that is to say, a turnover sufficient to justify the comparatively heavy amount of stock which has to be on the shelf to secure this business. The reason for the failure is not difficult to diagnose, and we suspect that one of the reasons why the cyclist does not take more readily to the "electrical idea" is the trouble which has become so prevalent with cheap lighting sets. As a consequence electricity has earned a bad reputation, and the cycling public will need to be assured before matters can be changed. As in the case of many other merchandising lines, quality will tell in the end, and this is the basis on which the retailer must buy. The "Bipol" set, manufactured by GREENWOOD AND BATLEY, is worth attention from this point of view. This is listed at £2 10s. complete with a cloth-covered case to accommodate the batteries. The same set can also be supplied with a solid leather case at a price of £3 5s.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

The LONDON FACTORS AND AGENTS announce the issue of their nett trade price list for June.

"'Gecophone' Wireless Accessories" is the title of a list just published by the General Electric Co., Ltd.

ABBEY INDUSTRIES, LTD., manufacturers of "Abbiphone" wireless apparatus, recently published a revised edition of their catalogue.

Readers of THE ELECTRICIAN who use the Brookhirst calendar will note with interest that BROOKHIRST SWITCHGEAR, LTD., have issued cards for June, July, August and September.

AUTOVEYORS, LTD., have found it necessary to publish a temporary catalogue on wireless apparatus, pending the issue of a more comprehensive list. Copies of the temporary list are available to trade buyers.

Readers of THE ELECTRICIAN will not be fully posted in the latest developments in the design of tumbler switches until they have studied the price list No. S.41 just published by A. P. LUNDBERG AND SONS.

W. T. HENLEY'S TELEGRAPH WORKS CO. announce the issue of a new list, No. WO2, describing air-break knife switches. The switches are designed to comply with the British Engineering Standard specification No. 109/1923.

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Legal Intelligence.

The London Electricity Scheme.

The case of The King *v.* The Electricity Commissioners, *ex parte* London Electricity Joint Committee and others, came before the Court of Appeal, consisting of Lords Justices Bankes, Atkin and Younger, on Monday, upon the appeal of the companies from the judgment of a Divisional Court composed of the Lord Chief Justice and Justices Avory and Roche (see THE ELECTRICIAN, April 20th, p. 431), discharging rules nisi for *certiorari* and prohibition, which had been obtained against the Electricity Commissioners appointed under the Electricity Supply Act, 1919.

In the Divisional Court the Lord Chief Justice, in giving judgment, discharging the rules, said the case was not one in which there should be prohibition or *certiorari*. Justices Avory and Roche concurred. Hence the present appeal.

Mr. Talbot, K.C., in opening the appeal, said he represented all the companies supplying London. The exact point of consideration arose under the Act of 1919, under which the Electricity Commissioners had power by schemes to establish a joint electricity authority for improving the organisation of the supply of electricity in the district defined by them, and had also the power to enable the authorities to delegate the power to a committee. This scheme compelled the authority to delegate very extensive powers to permanent committees representing the supplying companies and the local authority. The question was as to whether that was within the powers of the committee. If so, whether these writs of prohibition and *certiorari* lay to the Commissioners in respect of such a scheme and if so at what stage. The point he (counsel) took was that the scheme was not within the powers conferred by statute and that it was not a scheme which the Commissioners were authorised to prepare or submit.

At the close of the appellant's case the hearing was adjourned until Wednesday, when the Attorney-General, supporting the judgment of the Divisional Court, submitted (1) that *certiorari* and prohibition would not lie at all; and (2) on the merits that the Electricity Commissioners had ample authority to do what they had done.

The hearing was again adjourned.

Accumulator Dispute Settled.

Mr. J. A. Scott, one of the High Court Official Referees, last week, heard an action in which Accumulators of Woking, Ltd., claimed £174 from Higgins, Ltd., of Deansgate, Manchester, balance of account for goods supplied. Mr. Turnbull, for the plaintiffs, said a defence had been put in in which certain cross claims were made. These had been the subject of negotiation, and the result was that everything had been agreed except one item of £87 2s. and a small sum of £2 8s. The claim arose upon the supply of two accumulators by the plaintiffs to a sub-purchaser on the defendants' behalf. The defence, said counsel, was not that the price was excessive, but that the accumulators supplied were defective, and that defendant was not bound to pay for them in consequence. The sub-purchaser was not satisfied with the batteries and insisted upon defendants replacing them. The question for the Court was really whether they were according to contract. The defendants counterclaimed for £36 11s. Several expert witnesses gave evidence, and a consultation then took place between the parties. After a short adjournment counsel announced that an agreement had been come to by which judgment would be taken for the plaintiff on the claim for £100 with costs, and there would be no order as to the counterclaim. That, added counsel, would settle all matters between the parties. Judgment was entered accordingly.

A Claim for Commission.

On July 6th, Sir Francis Newbolt, one of the High Court Official Referees, had before him an action in which Mr. W. Beresford, of 32, New Street, London, S.E., claimed from Mr. Alfred Grace and H. and E. Lea, Ltd., of Brewer Street, Regent Street, London, W., £282 16s. 7d., balance of commission at the rate of 40 per cent. connected with an electrical business in which the plaintiff was engaged. Mr. Wont, for the plaintiff, said that any difference in regard to figures would be settled on one simple principle which had been agreed between the parties, but there was a question as to liability—whether the liability was upon Mr. Grace or H. and E. Lea, Ltd.

Mr. William Beresford, the plaintiff, gave evidence as to the arrangement he had made with Mr. Grace, and said there was no suggestion on the part of Mr. Grace that Lea, Ltd., was to be his employer. He always understood that he was contracting with Mr. Grace, and he looked upon Lea, Ltd., as a customer. Mr. Grace then gave his version of the arrangement.

Sir Francis Newbolt, in giving judgment, said it was clear that the plaintiff was entitled to 40 per cent. of the profits against both the defendants. There must be judgment for the plaintiff for £267 10s. with costs.

Electric Lamp Patent Litigation.

A motion against Mr. C. Ridley, of Dundas Mews, Middlesbrough, by the British Thomson-Houston Co., came before Mr. Justice Russell in the Chancery Division on July 6th, the motion being for an injunction restraining the defendant from selling incandescent lamps that infringe plaintiff's patents.

Mr. Justice Russell granted an *ex parte* injunction a week ago, and leave was given to serve the defendant with notice of motion that day.

The defendant, counsel now said, had not appeared, and he asked that the injunction might be continued until the trial.

His lordship said he would grant the application.

Sequel to Tramcar Accidents.

The question whether an Exeter tramcar could travel at 20 miles an hour was discussed at Exeter County Court last week, when Mr. L. G. Shapland, of Melbourne Street, claimed £25 damages against the City Council for damage to a motor-cycle caused by collision with a tramcar. The plaintiff contended that the tram approached him at a speed between 20 and 25 miles an hour, but the defence was that the speed of the tram was only four or five miles an hour, and that the plaintiff's machine struck the car in consequence of going over a "pothole." Judge Higgins found for the plaintiff for the amount claimed, holding that the failure of the tram to stop was the cause of the accident.

In the Scottish Court of Session last week, before Lord Morrison, an issue was approved for the trial by jury of an action by Mrs. Sarnacki, 51, Commercial Road, Glasgow, for her daughter, against the Corporation of Glasgow for payment of £200 damages for injuries sustained by the child through being knocked down by one of the defenders' tramcars. The defenders deny that the driver was guilty of negligence or was in any way responsible for the accident.

Parliamentary Intelligence.

West India and Panama Telegraph Co.

Replying to Sir B. SHEFFIELD, on July 5th, Mr. ORMSBY-GORE said the question of taking over the West Indian and Panama Telegraph Company's system has been considered, but the Government was advised that it would not be possible to acquire that system without at the same time acquiring certain engagements by which, in its opinion, it was most undesirable to be hampered.

Wireless Broadcasting.

Sir H. BRITTAIN was informed by Sir L. WORTHINGTON-EVANS, on July 3rd, that he had received very few complaints as to the efficiency of the present system of broadcasting.

Empire Wireless Chain.

Answering questions relating to the proposed licence for the Marconi Co., Mr. BALDWIN, on July 5th, said the negotiations had not reached a point at which it was possible to state whether or not time could be given for the consideration of the conditions of the licence by the House of Commons.

Work of the Industrial League.

The monthly "Bulletin" of the INDUSTRIAL LEAGUE AND COUNCIL for June shows that the valuable work of this organisation is proceeding with unabated vigour. The June programme included three week-end conferences, at which the subjects dealt with comprised "Empire Trade Development," "Statutory Powers for Whitley Councils," and "The Rights and Uses of Profits." A garden party at Moortown, nr. Leeds, an outing to Fountain's Abbey, and a bowling match between sixteen Labour M.P.s and sixteen employers at Norwood were among the social events organised by the League, while, on the other hand, no fewer than ten trade union branch meetings were addressed on behalf of the organisation.

Research Professorships.

Utilisation of Sir Alfred Yarrow's Gift.

On considering the most useful way of employing Sir Alfred Yarrow's gift of £100 000 for the endowment of research, the Council of the ROYAL SOCIETY has decided to use the larger part of the income in the direct endowment of research by men who have already proved that they possess ability of the highest type for independent research. To this end a number of professorships will be founded.

The intention of the Royal Society in founding these professorships is to recognise research as a definite profession, and the professors will be expected to devote their whole time to scientific research, except that they may give a limited course of instruction on the subjects of their research to advanced students.

Electrical Supplies for Malaya.

A Profitable Field for British Manufacturers.

British Malaya is likely in the near future to provide a profitable field for the activities of the manufacturer of electrical machinery in this country, according to Mr. F. Bolton, who was some time ago appointed to report on the possibilities of development. In his report Mr. Bolton stated that the demand for cheap and reliable electric power supplies was urgent, adding that the provision of electricity for domestic use in all towns of any magnitude was very desirable. He stated that it would be practicable to deliver electric power to many consumers of power at about one-half of the cost of the money they are at present spending on fuel alone. Mr. Bolton estimates that the demand for the whole of Malaya should reach in time about 118 000 000 kWh per annum.

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Municipal Finance.

Further Electricity Department Figures.

With very few exceptions municipal electricity undertakings have had a prosperous year resulting in increased profits, or, at the worst, in reduced deficits. From the accounts briefly reviewed below it will be seen that many undertakings can point to a record year, and in none do the figures indicate retrogression on the financial side. Although the purposes to which the surpluses are to be devoted is not yet disclosed in all cases, it is regrettable to note that the tendency to appropriate such sums to rate relief is still marked. Notable exceptions are furnished by Barnsley and Walsall, where this policy has been resisted by the respective electricity officials.

Big Surplus at Manchester.

At MANCHESTER, where all interest and sinking-fund charges in respect of the new generating station at Barton, and high-tension mains therefrom, were met out of revenue account, the year's working left a net surplus of £128 714—which was transferred to reserve—against £44 564 in the previous year. An increase of 17 per cent. was effected in the volume of business, the annual sales totalling approximately 185 500 000 kWh. Similarly gratifying is the position at BARROW-IN-FURNESS, where there remains a surplus of £8 146 as compared with one of £374 in 1922 and a deficit of £2 539 in 1921. Although there was a reduction in the output for lighting, domestic, and traction purposes, this was more than counterbalanced by the increase for power purposes, the net increase for all purposes being 547 598 kWh, bringing the total sales up to 7 434 102 kWh. Probably the most striking feature of the year's working is the fact that this increased output was generated at a total working cost of £10 159 less than during the previous year; while this was largely due to the fall in the price of coal, economies have been effected under practically every item of expenditure.

An increase in the gross profit from £316 802 to £474 581 allowed the BIRMINGHAM electricity undertaking to contribute £12 500 to the rates, after setting aside £102 234 for renewals, and £127 759 for reserve. There was a considerably increased output, the figures for the year being 139 468 153 kWh as compared with 111 038 406 kWh sold in 1922. The average price obtained was 1·797d. per kWh as against 2·252d. per kWh for the previous year.

Despite reductions in charges which were, from the financial point of view, probably somewhat premature, the WORCESTER undertaking showed a record profit of £3 718, which is carried to appropriation account. The total output for the year was 5 670 247 kWh, an increase of 1 086 126 on the preceding year.

A Profit at Todmorden.

Annual losses approximating £5 000 in the past have been superseded by a profit of £469 at TODMORDEN, following the Council's decision to buy electricity in bulk from the Yorkshire Electric Power Co. A reduction of about 10 per cent is being made in charges. At BARNSLEY there was a surplus on the year's working of £8 940, which goes to the renewals fund in spite of local suggestions that part of it at least should be made available for the relief of the rates. Reductions are being made in charges to consumers which will bring the price down to 1½d. per kWh for heating and cooking, and 6d. per kWh for private lighting. A net profit of £5 990, against a loss of £273 is reported from LEIGH, where the gross revenue, the gross profit and net profit was in each case greater than in any previous year. It is also interesting to note that a substantially increased output was obtained with an actual reduction in expenditure. The capital expenditure was increased during the year by £9 429, this amount being mainly expended in instalments towards the cost of new generating plant and auxiliaries, switchgear, converting plant, and also in extensions to the low-tension mains' system. The practice of purchasing all new meters out of revenue has been adhered to, although loan sanctions can now be obtained for the purpose.

Better Results at Blackburn.

Increased revenue coupled with reduced expenditure leaves the BLACKBURN undertaking with a net profit of £12 743 which compares favourably with a loss of £6 161 in the preceding year. The surplus has been utilised in paying off a deficiency of £12 534, leaving £189 to be carried forward. Capital expenditure on the new generating station, up to March 1923, is given in the report as £646 896, this figure including expenditure on rotary converters, switchgear and other apparatus at Jubilee Street. It is anticipated that the cost of the new generating station will be within the £700 000 estimated. The electricity undertaking at BRIGHOUSE, which obtains supplies from the Yorkshire Power Co., has maintained the pre-war prices of 5d. per kWh, and has made a constant profit, which this year has been increased to £1 237, while at KEIGHLEY the year's working resulted in a record profit of £9 959—the next best year, 1922, yielding a gain of £2 918—and a reduction amounting to nearly ½d. per kWh sold has been made in the working expenses of the department.

Walsall's "Anti-Rate Reduction" Policy.

At WALSALL too the electricity undertaking had a most successful year resulting in a profit of £11 071 which, in spite of adverse criticism, the electricity committee very rightly proposes to use in reducing charges to consumers. It is interesting to note from the accounts that the income from the sale of electricity, before the deduction of discounts and bad debts, was within £2 of the corresponding figure for 1922.

Prospects of a Trade Revival.

Sir Eric Geddes on the Present Position in Europe.

Speaking at Bradford last Friday Sir Eric Geddes, President of the Federation of British Industries, expressed the belief that consumption was ahead of production and that we could now go ahead a little. The main difficulty in the way of trade recovery was the European situation, particularly in the Ruhr. He did not believe the Government knew that the trading community maintained that until the Ruhr question was settled unemployment would get worse and worse.

An examination of the trade figures of the country over the past century showed two main features. Firstly, that trade moved in cycles of from five to ten years; and, secondly, that trade as a whole moved steadily upwards—that was to say, that the lowest points and the peaks of the cycles of trade consistently showed a general upward tendency. The years of war upset both the regularity of the cycles and the regularity of their upward progression. At the present time we were emerging from the bottom of a cycle and, in spite of war handicaps, he thought that a mild form of optimism was possibly justified.

He held the view that the cyclical depressions and heights of trade were the outcome of the psychology of the manufacturer and the banker, but principally of the manufacturer. The principal cause of the cyclical fluctuations in trade was a lack of accurate knowledge as to what the world could consume. We saw to-day not only that certain European countries could not purchase from us because they were impoverished and disturbed, but that even those who could purchase from us, owing to depreciated currencies, purchased from the impoverished countries. Not only could Germany not purchase from us, but Italy preferred to purchase from Germany because German cost of production was much lower owing to her depreciated currency. And it did not stop there. India could not purchase from us because Germany could not purchase India's products, and so throughout the world.

The general upward trend of trade which went on through the centuries was, therefore, checked, because of the disturbed condition of Europe, and while he saw fair reason to hope for an upward trend in the cycle of trade, he could at present see nothing but blackness when he looked for a resumption of the upward progression in the general level of trade shown during the last century. Therefore, as first and foremost of all measures which could be taken for the improvement of trade and the reduction of unemployment in this country he would put the settlement of the European situation.

Telegraph and Telephone Notes.

The Western Electric Company will shortly construct telephone lines between ASCENSION (Paraguay) and a number of adjacent towns.

A MODERN SWITCHBOARD to accommodate about 1 000 subscribers' lines was opened at the Esher Telephone Exchange on Wednesday.

Three thousand telephone lines in the London area were put OUT OF ORDER by Monday's storm. Four of the eleven Paris lines were down, as also was one line to Amsterdam, and one to Rotterdam, the damage in each case being on the Continent. By Tuesday evening the majority of the lines had been repaired.

Reporting an interview of Mr. HAMBRO, the English banker, with Signor Mussolini, "The Times" Milan correspondent mentions that Mr. Hambro is interested in the Italian scheme for laying THREE SUBMARINE CABLES across the Atlantic and the Adriatic, and that he is willing to subscribe part of the sum of 200 000 000 lire (at the present rate, about £2 000 000) which is the estimated cost of the enterprise.

As a result of the experience gained in connection with the seventeen automatic telephone exchanges already in operation in England, it has been decided by the postal authorities to develop the telephone system largely in the future by plant of a similar nature. Specifications are being prepared for an automatic telephone exchange at Kirkcaldy, and the Edinburgh telephone system is being reviewed.

The eleventh cable steamship put into commission since the war—the "Mirror," built for the EASTERN TELEGRAPH CO.—will leave for the Red Sea in a few days' time. Her cable-carrying capacity is over 500 miles, and it is said that the cable can be uncoiled and laid in deep sea at the rate of eight miles per hour. It is understood that two more cable ships will join the fleet of the Eastern Associated Companies during the next few months.

London Traffic Advisory Committee.

In order to deal with the urgent question of regulating London traffic it is intended to set up an advisory committee on which will sit representatives of the Ministry of Transport, the Home Office, the London County Council, the City Corporation, the County Councils of Essex, Kent, Surrey and Middlesex, the Transport Workers' Committee, and other interested bodies, to co-ordinate the work of the various authorities concerned and secure unity in dealing with the subject. It is hoped that a Bill embodying the scheme may be introduced in the autumn.

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Foreign Notes.

EUROPE.

British Hydro-Electric Enterprise in Latvia.

Proposals regarding the generation of hydro-electric power from the Duna are being discussed by the representative of a British firm who has, according to a "Manchester Guardian" correspondent, arrived in Riga to negotiate with the Latvian Government, and has already submitted plans for the work.

Increased Electricity Consumption in Paris.

An increased consumption of 24 per cent. over 1921 is revealed by the report for 1922 of the Compagnie Parisienne de Distribution d'Electricité, the total sales amounting roughly to 250 350 000 kWh. That this increase is progressive is shown in the report for the first quarter of 1923, which records an increase of 21 per cent. in that period. Extensions estimated to cost considerably over 500 million fr. are being planned.

Electrification of French State Railways.

According to a report by Mr. J. R. Cahill, commercial counsellor to the British Embassy in Paris, the electrification of main lines occupies a prominent position in French railway development. The present programme of electrification applies mainly to the Southern (Midi), the Paris-Orléans, and the Paris-Lyons-Mediterranean systems, a total length of 8 839 kilometres (one-third of the total length of the French systems). On the Southern Railway the electrification of the line from Tarbes to Bayonne (165 kilometres) and to Dax is nearly completed. The stations supplying power for this line are in the Pyrenees. The Paris-Orléans, which electrified its suburban lines about twenty years ago, is about to electrify the Paris-Orléans-Vierzon section with the Brétigny-Dourdan branch (230 kilometres) as the first part of its programme covering 3 300 kilometres. Power will be mainly obtained from the river Dordogne. The Paris-Lyons-Mediterranean Railway proposes to electrify 326 kilometres in the neighbourhood of Paris and 3 000 in the region of the Rhone, which river will supply its power. The estimated cost of these schemes is put at over five milliard francs (about £72 000 000 at the current rate of exchange). Uniformity of system for the whole country is being enforced; three-phase 50 cycle current will be supplied to the sub-stations in direct current at 1 500 V.

U.S.A.

Pittsburg Electrical Workers as Shareholders.

The Westinghouse Electric and Manufacturing Co. announces a plan whereby all employees may participate in the purchase of a new issue of 20 000 shares of common stock to be paid for on the deferred plan at $53 a share (par value $50). Each employee may subscribe for one to twenty shares of stock and pay for it in ten consecutive monthly instalments. No interest will be charged on the deferred subscription payments. When the final payment on each stock subscription becomes due, dividends at the rate declared and paid on the company's common stock after August 1st, 1923, when the plan comes into effect, will be credited to the account of each subscriber. This plan will in no way interfere with the Insurance Saving Fund now in force. In the latter plan the employee, by depositing two per cent. of his salary in a 4½ per cent. interest-bearing savings fund, obtains additional insurance up to $1 500 over the $500 given by the company after six months' service.

Forty Years Ago.

"The Electrician," July 14th, 1883.

ELECTRIC RAILWAY AT BRIGHTON.—At Thursday's meeting in last week of the Town Council sanction was given to erect temporarily a short electric railway on the beach.

* * *

ELECTRICAL EXHIBITION AT VIENNA.—Lord Sudeley, Sir William Thomson, Sir William Siemens, and Sir F. Abel, C.B., have been appointed British Commissioners for the Electrical Exhibition to be held at Vienna in August.

* * *

ELECTRICAL ACCUMULATORS.—According to "L'Electricité," Messrs. M. J. Arnould and B. Tamine have invented a new accumulator, the performance of which is said to be very remarkable, but the particulars of its construction are not yet made public.

* * *

PARLIAMENT AND THE ELECTRIC LIGHTING ACT.—Commenting on the decision of the House permitting petitions to be lodged in Committee against provisional orders, "The Times" says: "The enlargement of the reference to the Select Committee on which the House of Commons yesterday insisted is justified, perhaps, by the exceptional circumstances of the case, since where all is so novel and uncertain it is as well not to be tied down too strictly by technical rules adapted to more ordinary conditions. But it undoubtedly establishes a precedent which may be dangerous if loosely applied, and though it may justify itself in the end, it is only too likely to retard for a time the progress of public electric lighting."

* * *

WANTED.—Two or three (or more) German Workmen or Students to join with advertiser in any part of London in reading dynamo machine literature. No expenses.—Address, J. W., 21, Herbert Street, New North Road, N.

Imperial Notes.

AUSTRALIA.

Electricity Supply in Ballarat.

Melbourne City Council has been conferring with the Central Coal and Iron Co. in regard to boring operations on the Crown coal at Lal Lal, which it is proposed to use in the generation of electricity for Ballarat. The company has been asked whether it is prepared to put down six bores, or at what price it will sell the lease. Mr. A. G. M. Michell is reporting on the whole question.

Developments in New South Wales.

Blue Mountain Council has adopted a report by Mr. Franki (consulting engineer) on a scheme for electricity supply in Faulconbridge and Springwood, estimated to cost £8 000. It is proposed to extend the Katoomba Co.'s mains to Springwood, and the Shire Council has decided to apply to the Local Government for sanction to a loan of £9 000 to cover the cost of the distribution system. The Twofold Bay Development League is urging concentration upon the Snowy River hydro-electric scheme as a basis of the desired development.

Victorian Electricity Commission's Distribution Powers.

The refusal of the ratepayers to sanction the loan which the Warrnambool municipality proposed to raise for its electricity distribution system, which refusal, as stated in our issue of June 29th, was due to the ratepayers' disapproval of the Council's intention to keep the distribution powers in its own hands, has led to the resignation of nine councillors, who have been nominated for re-election on this issue, and, as six have been returned unopposed, there is already a majority on the Council in favour of the retention of the distribution powers in the Council's hands in preference to handing them over to the Electricity Commission. Presumably, however, the ratepayers can again veto the loan.

Melbourne Municipal Accounts.

The report of the Electricity Committee of Melbourne City Council for the year ended December 31st, 1922, states that kW-hours sold were 53 846 526, an increase of 8 581 686. Revenue was £403 750, an increase of £47 304. General expenditure amounted to £243 626, an increase of £8 971, and gross profit £160 124, an increase of £38 333. After providing for capital charges and depreciation and renewals and writing down coal stocks by £5 000, there remained a balance of £69 088. The sinking fund contribution required £7 070, and other appropriations amounted to £21 263, including special contribution to officers' superannuation fund £5 000, and reserve transfer for undergrounding mains £10 055. The net profit was £40,755. The average revenue per kWh sold was 1·813d. compared with 1·905d. Capital expenditure for the year amounted to £139 928. Three rotary converters supplied by the Metropolitan-Vickers Electrical Co. were admitted free of duty, saving £6 800 to the Council. A considerable part of the suburban area hitherto supplied with single-phase current has been changed over to three-phase. Underground split conductor cables have been laid and the system should be more efficient and reliable than previously.

EAST & CENTRAL AFRICA.

New Electric Supply Projects.

At Blantyre (Nyasaland) the Town Council recommends that a 20-years' electric lighting concession be granted to a company.

The East African Power and Lighting Co. is applying for licences to establish generating stations at Mombasa, near Thika, at Eldoret and Nakuru (Kenya Colony).

SOUTH AFRICA.

Electrical Business Booming.

The "British and South African Export Gazette" gives some particulars of electrical schemes under weigh in South Africa, and states that the purchases of plant, fittings, cable, etc., in the Union of South Africa alone will probably exceed this year the record figure of £1 876 230 established in 1921 for imports of electrical goods. In addition to the projected £1 000 000 power station of the Victoria Falls and Transvaal Power Co. at Witbank, and Pretoria Municipality's new £320 000 power station, Johannesburg Corporation proposes to spend £75 000 on tramways and electricity supply extensions, electric lighting schemes are under consideration at Riversdale, Grahamstown and Molteno (Cape Province) and Frankfort and Brandfort (Orange Free State). The extension of the town-lighting facilities at Gatooma (Rhodesia) is under consideration and a meeting of East London (Cape Colony) ratepayers has authorised an expenditure of £60 000 on additional plant for the local power station. The Union Government has in progress an ambitious railway electrification programme, which will provide power and light for many centres, as well as transport.

"The Henley Telegraph."

To compensate for the lack of a March number, the June issue of "The Henley Telegraph" contains an even larger proportion of good things than ever. There are several bright little essays, including the conclusion of the "From a Suburban Garden" series, an amusing chat on wireless entitled "Radio Bugs," and an eloquent word picture of "A Tropic Morn at Sea." The poetic muse has not been neglected, and three excellent contributions appear, in addition to accounts of the social events held during the last few months. The issue includes a sympathetic memoir of the late Sydney Gedge, who was a director of Henley's from the incorporation of the company.

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Electrical Vehicles for Refuse Collection.

Superiority over Other Types.

After making exhaustive inquiries into the relative merits of petrol, steam and electrically-driven vehicles, and their suitability for refuse collection, Warrington Town Council has agreed that the electric type is best from the point of view of economy and also of efficiency, and proposes to purchase five electrically-operated vehicles. On the other hand, the Edmonton Council has, for reasons which it is difficult to appreciate, abandoned its system of collecting house refuse by means of electric vehicles, and has reverted to horse transport under contract. In this connection "The Commercial Motor" gives comparative figures, showing conclusively that the electric vehicles did their share of the work of collecting and transport to the tip, not only better and quicker, but cheaper. The costs per ton-mile were 33⅓ per cent. lower, whether taken per loaded mile or per ton-mile. The vehicles behaved well and proved extremely reliable.

Electricity Commissioners' Expenses.

A Liverpool Protest.

Referring at last week's meeting of the Liverpool City Council to a request from the Secretary to the Electricity Commissioners for a proportion of the expenses of the Commissioners, Sir Archibald Salvidge said it was time municipalities throughout the country entered their protest against the Government saddling municipalities with the expense of Government officials doing Government work.

Councillor White said that the sum involved was £2 000 per year to be paid by the Corporation, although the Corporation had no power in the selection of the officials concerned. The Tramways Committee were inquiring into the possibility of redress.

British Engineering Standards Association.

Amended Standardisation Rules for Electrical Machinery.

The British Engineering Standards Association announces the withdrawal of British Standard Specification No. 72–1917 from circulation. This document is now under revision, and will be divided into the following sections, each of which will be issued as a separate publication as and when ready: (*a*) Industrial machines, (*b*) large machines, (*c*) transformers, (*d*) rotary converters, (*e*) traction motors. With the exception of the first named, which as B.S.S. 168–1923 has already been published, the sections are all in course of preparation.

Miscellaneous.

The Postmaster-General has decided not to introduce a CASH-ON-DELIVERY parcel post.

A clause prohibiting the DISPLAY OF ILLUMINATED SIGNS will be inserted in all future leases by the (London) City Lands Committee.

During his visit to the works of C. A. PARSONS AND CO., last week, the Prince of Wales inspected a model of the 50 000 kW. turbo-alternator which the firm is sending to America.

MAIDENHEAD Rural District Council has refused permission to the Bourne End Electricity Co. to use overhead cables for an electricity supply which it proposes to take to Cookham.

The fifth annual outing of the staff of the "D.P." BATTERY CO. took place last Saturday, when the party, numbering 47, went by road, via the Derwent Valley, to Buxton by way of Hope and Castleton.

The Finance Committee of the St. Marylebone Council reports that it cannot recommend the Council to make any contribution towards the expenses of the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION in connection with the British Empire Exhibition.

The Minister of Transport has fixed the following fees (payable in advance) for the EXAMINATION AND TESTING OF ELECTRICITY METERS at the National Physical Laboratory:—Original tests of new type, £75; examination of modified form of approved type, £20.

Recent experiments at DONCASTER in the comparative value of gas and electric lighting formed the subject of a report from the Watch Committee, who recommended that the streets that had formed the subject of the experiment should continue to be lighted by electricity.

Any electrical engineer who is thinking of turning himself into a limited company (to use a term to which the author objects), cannot do better than consult a little book by Mr. H. W. JORDAN which is published by Jordan and Sons. It gives full details of procedure to be followed and the pitfalls to be avoided.

Quotations for six different kinds of cable were considered by DUNDEE Electricity Committee recently. In three cases the prices quoted for German productions were cheaper than those offered by British manufacturers; in the other three, British offers were the lowest. The lowest British offer was accepted in each case.

In the paragraph on "Power Engineers' Salaries" which appeared on page 16 of our last issue, it was not made clear that the BASIS OF CLASSIFICATION may be either the kilowatt capacity of the station or the maximum demand, whichever is the greater. The maximum demand for this purpose is ascertained in the way laid down in the paragraph quoted.

Progress in Industrial Heating.

A Useful Congress in France.

A Congress on Industrial Heating has recently taken place in Paris. The object was to show what progress had been made in the economical utilisation of fuel for steam raising and to prepare for further developments, especially the employment of the poorer quality fuel which is found in abundance in France. Among the subjects dealt with were pulverised coal, liquid fuel, gas and the recuperation of waste heat. According to "The Engineer" prominence was also given to the advantages of electric steam generators which are employed with great success in Sweden, Canada and France, and M. Paul Bergeon, Professor at the Institut Electrotechnique at Grenoble, who has done a great deal to perfect this method of steam raising, dealt with the economies being made with steam boilers by utilising surplus current for raising steam and in many cases storing it in accumulators. As illustrating the variety of applications of electrically heated boilers, he stated that at the Fredet works at Brignoud, current is employed to raise steam in a shunting locomotive to a pressure of 170 lb. per sq. in., and it is able to work for three or four hours until the pressure falls to about 42 lb. The current is not, of course, utilised under satisfactory conditions, but as it costs nothing the system is economical. In the opinion of Prof. Bergeon electric steam generators should be employed thoughout the country where surplus current is available.

The proceedings generally indicated that research work is being carried out in all directions with more or less success for utilising all available sources of energy and reducing the amount spent on the purchase of foreign fuels.

The Harrison Searchlight Lamp.

Inventor Claims Award.

A claim respecting a searchlight lamp known as the Harrison lamp was placed before the Royal Commission on Awards to Inventors last week by Mr. H. T. Harrison, electrical engineer, of London. It was stated in evidence that 900 of these lamps had been issued during the war. The Patent Office had a specification by a German named Beck, and efforts were made to construct one, but they failed. Mr. Harrison designed a new lamp which was constructed by Mr. Roach, of Newcastle-on-Tyne, who also claimed an award. Mr. Harrison said he received £2 000 from the Ordnance Council, which he accepted in the belief that he would have certain royalty rights and also foreign rights. Improvements were suggested by Mr. Roach and his colleagues. Commander Henry Harwood said the lamp was made up piece by piece in the dockyard, and the dockyard employees deserved great credit for the part they played. The increased illumination was 3½ times that of the old lamp, and this was due to the Beck specification. The decision of the Commission will be given later.

Make Wembley an Electrical Exhibition.

A Chance Too Good to be Missed.

The electrical industry has an excellent chance of making the British Empire Exhibition at Wembley next year a means of teaching the public what electricity can do for it in the factory, the street, and, above all, the home. As of all these the home is the most important, we are glad to learn that the E.D.A. proposal for a co-operative electricity supply display at Wembley is being enthusiastically supported by the engineers of both municipal and company supply undertakings throughout the country. The industry is, in fact, preparing to demonstrate that just as electricity has been, and is, an all-important factor in assisting the post-war revival of Britain's industries, so it is destined to raise the standard of health, comfort and efficiency in British homes.

Since the launch of the appeal some twenty-three supply undertakings have pledged their support, and definite promises of recommendation have been made by several other authorities and companies. But this is not enough; the weight of whole supply industry must be put into the venture without delay.

Institution Notes.

At the annual meeting of the INSTITUTION OF ENGINEERS, AUSTRALIA, Prof. R. W. Hawken was elected president and Senator J. D. Millen vice-president for the ensuing year.

The annual autumn meeting of the INSTITUTE OF METALS, which will be held this year in Manchester from September 10th to 13th, will open with a lecture to be delivered by Lieut.-Col. Sir Henry Fowler, on "The Use of Non-ferrous Metals in Engineering."

The property of the old INSTITUTION OF ELECTRICAL ENGINEERS has been transferred to the Institution of Electrical Engineers incorporated by Royal Charter, and a special general meeting of members and associates will be held on July 19th, at 5 p.m., to receive the report and accounts of the liquidators.

THE CLEVELAND SCIENTIFIC AND TECHNICAL INSTITUTION has been registered as a company limited by guarantee, and not having a capital divided into shares, the word limited being omitted from title by licence of the Board of Trade. Its objects include the encouragement of technical education of the staffs and employees of the various industrial works in the Cleveland and Tees-side districts of England. The management is vested in a councill which includes one representative of the Institution of Electrica, Engineers.

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Electricity Supply.

Extensions and Developments.

Authority has been given to MAIDSTONE Town Council to borrow £2 139 for a new motor converter.

CARLISLE City Council has decided to proceed with the erection of its new generating station at Willow Holme.

HASTINGS Town Council has sanctioned a scheme for a new power station at an estimated cost of £145 000.

The Electricity Commissioners have granted powers to DUNDEE Electricity Committee to borrow an additional £50 000.

STAFFORD Town Council has agreed to cable extensions to cost £3 800 and the purchase of a turbo-blower at a cost of £100.

For extensions to the generating station at GRIMSBY the Commissioners have sanctioned the borrowing of £57 500 of the £75 000 required.

NEWCASTLE-UNDER-LYME Town Council is seeking permission to borrow £3 000 for the installation of a new rotary converter and switchgear.

BIRKENHEAD Corporation has sanctioned the proposal of the Electricity Committee to ask for a loan of £23 307 for the completion of the high tension electricity main cable round the borough, the erection of a sub-station at Prenton, the installation of rotary converters, etc.

WORCESTER Corporation is applying for sanction for a loan of £400 for a site for a sub-station. Auhority is also asked for a loan of £30 450 for developing the electricity undertaking. Of this amount, approximately £16 000 will be for mains, and £3 700 for transformers.

Consideration of a proposal to increase the Lister Drive power station to about three times its present size at an initial cost of about £500 000 has been deferred by LIVERPOOL Corporation. Another scheme on foot is the holding of an electrical exhibition in the centre of the city, at which expert demonstrations will be given of the varied domestic and other purposes to which electricity can be applied.

Tapping New Areas.

WELLINGBOROUGH Electricity Supply Co. is applying for powers to supply Finedon with electricity.

It is anticipated that the supply of electricity to ROYTON will be inaugurated by Oldham Corporation next month.

A scheme for extending the BRIGHTON mains to Roedean and Rottingdean will probably be proceeded with in the near future.

BULKINGTON Urban District Council is about to enter into a ten years' agreement with the Leicestershire and Warwickshire Electric Power Co. for a supply of electricity.

All opposition to the scheme of the Western Electric Distributing Corporation for the supply of electricity to WEST WILTS, Devizes and Chippenham has been withdrawn.

Pending the completion of the inter-connecting line between Blackburn and Preston, the application of LIVESEY and PLEASINGTON Parish Councils for the supply of electricity by Blackburn Corporation has been adjourned.

Alterations in Charges, Proposed and Actual.

WALTON Urban Council is considering the reduction of charges for electricity.

FULHAM Electricity Committee is considering the allowance of 10 per cent. discount to large power consumers.

TORQUAY Town Council has decided to supply electricity for shop window illumination after closing hours at 2d. per kWh free of meter rent.

The charge for electricity for lighting at SURBITON has been reduced from 9d. to 8d. per kWh as from the meter readings at the end of August.

A suggestion to reduce the price of electricity for lighting at EASTBOURNE by 1d. per kWh has been referred back to the Electricity Committee.

Substantial tariff reductions, giving rates ranging from 4½d. per kWh for lighting, to 1.1d. for industrial power and heating, have been effected at WILLESDEN.

HIGH WYCOMBE Electric Light and Power Co. has reduced the charge for electricity for lighting to 9½d. per kWh for the first 100 kWh per quarter, and to 9d. beyond.

STRATFORD-ON-AVON Town Council has decided to object to the application of the Electricity Co. for an order to continue the present price of 1s. per kWh with minimum charges of 13s. 4d. each winter quarter, and 10s. each summer quarter.

Inquiries and Orders.

The Minister of Transport has revoked the WORMIT AND WOODHAVEN Electric Lighting Order, 1900, as from June 30th.

The Minister of Transport proposes to confirm a Special Order authorising Mr. T. H. Thompson to supply electricity in BUDLEIGH SALTERTON urban district. Objections by July 18th to the Secretary, Ministry of Transport, Whitehall, London.

HORWICH District Council has received notice from the Electricity Commissioners granting an order authorising the Council to generate and supply electricity, and refusing the application of Lancashire Electric Power Co. Many local authorities are affected by this decision.

The Minister of Transport proposes to confirm a Special Order amending the BANSTEAD, WALTON-ON-THE-HILL and KINGSWOOD and the CHIPSTEAD AND DISTRICT Electric Lighting Orders. Objections to the Secretary, Ministry of Transport, Whitehall, London, by July 21st.

The Minister of Transport proposes to confirm a Special Order authorising the Egham and Staines Electricity Co. to supply electricity in FELTHAM and SUNBURY-ON-THAMES urban districts. Objections to the Secretary, Ministry of Transport, Whitehall, London, by July 21st.

The Minister of Transport proposes to confirm the COOKHAM AND DISTRICT Electricity Special Order authorising the Bourne End and District Electricity Corporation to supply electricity in certain parishes of the Wycombe and Cookham rural and the Marlow urban districts. Objections to the Secretary, Ministry of Transport, Whitehall, London, by July 21st.

A Special Order authorising the DERBYSHIRE AND NOTTINGHAMSHIRE ELECTRIC POWER Co. to supply electricity in Matlock, Matlock Bath and Scarthin Nick urban districts, and certain parishes in Ashbourne, Bakewell and Belper rural districts, is about to be confirmed by the Minister of Transport. Objections to the Secretary, Ministry of Transport, Whitehall, London, by July 21st.

On July 5th, the House of Commons approved the ELECTRICITY SUPPLY SPECIAL ORDERS made by the Electricity Commissioners in respect of (1) the urban district of Mold, Flintshire; (2) the urban district of Lees, Lancashire; (3) the urban district of Brentwood and parts of the rural district of Billericay, Essex; (4) the urban district of Exmouth, Devon; (5) the city and royal burgh of Elgin, Morayshire; (6) the borough of Yeovil, Somersetshire; (7) the urban district of Crompton, Lancashire; (8) the urban district of Royton, Lancashire; (9) the borough of Lyme Regis, Dorsetshire; (10) certain parishes in the rural district of Wellingborough and the parish of Overstone, in the rural district of Brixworth, Northamptonshire.

Miscellaneous Supply Items.

HULL electricity undertaking made a profit of nearly £100 000 in the last financial year.

For conveying electricity to the suburbs SHEFFIELD Corporation is adopting the overhead cable system in preference to laying mains underground.

BARNSTAPLE Town Council has been asked by the National Joint Industrial Council for the Electricity Supply Industry to reconsider its decision to resign membership of the council, but is reported to have taken no action.

Personal Items.

Watford Town Council has increased the salary of the borough electrical engineer, Mr. A. W. BARHAM, from £850 to £1 000 per annum.

Sir WILLIAM H. ELLIS, managing director of John Brown and Co., has been nominated by the Council of the Iron and Steel Institute for election as President for 1924.

Hastings Electricity Committee is considering a proposal to grant a sum of £500 to Mr. FERGUSON, the borough electrical engineer, in recognition of his services to the electricity undertaking.

Mr. JAMES S. D. MOFFET, general manager of the Belfast City Tramways, was on Tuesday recommended for appointment as general manager of the Salford Tramways at a salary of £1 000, plus bonus on the Civil Service scale.

Mr. VICTOR DELEBECQUE announces that the agreement between the Electrical Apparatus Co. and himself has been mutually terminated, and that correspondence should be addressed to him at No. 1 Cedar Court, 18, Cedars Road, Clapham, London, S.W.4.

On Monday, Sir TOM CALLENDER, head of Callender's Cable and Construction Co., was entertained to dinner and presented with a souvenir of Glasgow by the members of the Glasgow Welfare Association, to whom last year he presented a trophy for the annual football competition. A happy evening was spent, and Sir Tom gave some interesting reminiscences of his early days in Glasgow. Dr. DEWAR and Councillor MCINNES SHAW, representing the Electricity Committee, and who are greatly interested in the Welfare movement, were present.

OBITUARY.—Mr. C. S. MEIK, whose death is announced in his 70th year, had prepared a summary of a series of reports on the question of utilising the tides for the production of power at docks. He was joint author of a paper read at the International Congress on Navigation on the production of power from the Severn estuary. "The Times" reports the death, at Zurich, of Mr. A. TOBLER, aged 70, professor of electricity and telegraphy at the Federal Polytechnic High School. We also regret to announce the death of Mr. HENRY WATKIN, of Woodleigh, Wolstanton, managing director of Macintyre and Co., Ltd., electrical porcelain manufacturers, Burslem, which took place on Saturday last. Mr. Watkin, who was in his 71st year, was one of the pioneers of the electrical porcelain industry in this country.

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Tenders Invited and Accepted.

GREAT BRITAIN.

PLYMOUTH EDUCATION AUTHORITY, July 14th.—Electric light wiring and fitting in certain schools. Specifications, etc., from the Secretary, Education Offices, Plymouth.

MANCHESTER CORPORATION, July 16th.—Heating plant and hot water service apparatus for the Electricity Department's Offices in Dickinson Street. Specification (No. 49) from Mr. F. E. Hughes, Town Hall, Manchester.

MANCHESTER CORPORATION, July 17th.—Electric light wiring and fitting at Oxford Street, Clarendon Road, Manley Park, Beaver Road, Crimworth, Whalley Range and Swinton House municipal schools. Specifications from the Education Offices, Deansgate, Manchester.

BIRMINGHAM CORPORATION, July 20th.—Electric lamps, paints, cotton waste, etc., for the Tramways Department. Forms of tender from the General Manager, Tramways Department, Council House, Congreve Street, Birmingham.

EDINBURGH CORPORATION, July 23rd.—Eight top-covered tramcar bodies. Specifications from the Tramways Manager, 2, St. James Square, Edinburgh.

RHONDDA URBAN DISTRICT COUNCIL, July 23rd.—Two 150 kVA three-phase static transformers 11 000/412 V, and one 150 kVA three-phase static transformer, 3 500/414 V. Specification from the Engineer, Electricity Works, Porth, Glam.

WARRINGTON CORPORATION, July 23rd.—Five electrically driven vehicles for the sanitary works department. Specification from the Cleansing Superintendent, Central Sanitary Depot, Howley, Warrington.

ILFORD URBAN DISTRICT COUNCIL, July 24th.—E.h.t. and l.t. switchgear (Section H), and l.t. lead-covered and armoured cable (Section I). Specifications, conditions and forms of tender from Mr. A. H. Shaw, Electricity Works, Ilford.

WIGAN GUARDIANS, August 9th.—Electrically driven vertical pumping plant, hot water supply apparatus, etc., for the Infirmary, Billinge, near Wigan. Specification from the Clerk to the Guardians, Victoria Buildings, King Street, Wigan.

LONDON COUNTY COUNCIL, August 13th.—Pipework and deaerating plant for Greenwich power station. Specification, form of tender, etc., from the General Manager, London County Council Tramways, Victoria Embankment, W.C.2.

CANADA.

TORONTO MUNICIPALITY, August 21st*.—Two 2 880 000 gallon centifugal sewage pumps, directly connected to three-phase induction motors.

URUGUAY.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO, August 22nd*.—Lubricating oils.

The tender of Mr. James Southey, for electrical fittings, has been accepted by the PORTSMOUTH GUARDIANS.

ARMAGH URBAN DISTRICT COUNCIL has accepted the tender of Vosper and Vosper for fire alarms, at £198.

WEST HAM CORPORATION is recommended to accept the tender of the Titan Trackwork Co., for tramway junction, points, crossings, etc.

GLASGOW CORPORATION is recommended to accept the tender of Herbert Morris, Ltd., for a 20-ton crane for Langside sub-station at £884.

The tender of F. Price and Co. for wiring and fitting BETHANIA CHAPEL, SCHOOLROOM AND MANSE, MOUNTAIN ASH, at £133, has been accepted.

The AUSTRALIAN POSTMASTER-GENERAL'S DEPARTMENT, Melbourne, has accepted the tender of Elliott's Metal Co. for 600 tons of copper wire, £64 340.

The tender of J. Chapman and Sons for the extension of the electricity generating station, at £23 087, has been accepted by LEICESTER CORPORATION.

The tender of Hunter and English for repairs to engine at the electricity works, at £145, is recommended for acceptance by BARKING URBAN DISTRICT COUNCIL.

The tender of Powis and Pyle has been accepted by CANNOCK EDUCATION COMMITTEE for electric wiring and fitting at the Hednesford Technical Institute, at £209 10s.

The tender of J. Wolstenholme and Sons for a 15 000 gal. per hour centrifugal pump, motors, switchgear, etc., has been accepted by BARROWFORD URBAN DISTRICT COUNCIL.

For the construction of a station at Edgware the tender of J. Parkinson and Son, £16 690, has been accepted by the UNDERGROUND ELECTRIC RAILWAYS Co. of London.

The tender of Callender's Cable and Construction Co. for transmission lines to Great Sanghall and Mollington, at £3 521 18s. 3d., is recommended for acceptance by CHESTER CORPORATION.

For an electrically operated jib crane for PORTSMOUTH CORPORATION the tender of Stothert and Pitt, £3 000, has been accepted. Thirteen tenders were received, varying from £2 545 to £6 687.

EPSOM URBAN COUNCIL has accepted the following tenders: Union Cable Co., feeder cable, £1 690, and pilot cable, £189; W. Lucy and Co., joint boxes, £24 13s. 3d., and feeder pillars, £75 15s.

* Particulars from the Department of Overseas Trade.

The tender of Callender's Cable and Construction Co. for main and overhead line to supply current to Killan, Dunvant and Western gas collieries, at £11 170 17s. 6d., has been accepted by SWANSEA CORPORATION.

The tender of the British L. M. Ericsson Mfg. Co. for an intercommunication telephone system for the departments at the electricity works at £46 8s. 3d., has been accepted by MAIDSTONE CORPORATION.

LANCASTER CORPORATION has accepted the tenders of the Metropolitan-Vickers Electrical Co. for auxiliary plant for the Caton Road works, £1 380, and rotary converter, £1 080, and Ferguson, Pailin Ltd., for feeder switchgear.

DUBLIN CORPORATION is recommended to accept the tenders of the Sloan Electrical Co. for 80 000 pairs of open type carbons, £1 148, and 30 000 7·5 m.m. carbons, £202, and E. A. Langrith and Co. for 100 000 pairs of flame carbons, £792.

The following tenders are recommended for acceptance by BIRKENHEAD CORPORATION: Callender's Cable and Construction Co., six miles 0·0225 sq. in. cable, £840; W. T. Henley's Telegraph Works Co., two miles 0·1 sq. in. cable, £1 463.

BARROW-IN-FURNESS CORPORATION has accepted the following tenders: Johnson and Phillips, transmission line, £1 824, Enfield Edison Cable Works, underground cables; Ferguson, Pailin Ltd., switchgear, £482; Metropolitan-Vickers Electrical Co., switchgear, £312.

The following tenders have been accepted by MANCHESTER CORPORATION: B. Thomas, l.t., d.c. switchgear for Dickenson Street sub-station; British Insulated and Helsby Cables, Ltd., cable and tramway rail-bands; Metropolitan-Vickers Electrical Co., two tramcar motors.

The following tenders are recommended for acceptance by WALFORD CORPORATION: Bolckow, Vaughan and Co., 200 tons of tramway rails, £10 7s. 6d. per ton, and 200 pairs of fishplates, £13 7s. 6d. per ton; McHardy and Elliott, 12 tramcar roof covers and 24 staircases, £3 720.

The following tenders have been accepted by BERMONDSEY (LONDON) BOROUGH COUNCIL: Bells United Asbestos Co., covering exhaust pipes, £20 18s. 4d.; Babcock and Wilcox, pneumatic tube cleaner, £19 10s.; Ferranti, Ltd., 60 slot meters, £217 10s.; Venner Time Switches, Ltd., 12 B type time switches, £64 12s.; Chamberlain and Hookham, Ltd., 12 d.c. meters, 240V, six 10 amp., £29 8s., six 20 amp., £33 4s. 6d.; J. Howden and Co., Ltd., piston rings and springs, £9 10s., governor springs, £4; Keith, Blackman and Co., electric fan, £13 2s. 6d.; Lucy and Co., eight-way feeder pillar, £46 10s.; Harris and Pearson, fireclay material—3 in. bricks 18os. per 1 000, 2½ in. bricks 152s. 6d. per 1 000; Albion Clay Co., fireclay 27s. ton; Siemens Bros., four-link disconnecting boxes, £5; Sykes and Sugden, four ditto, £8; Lucy and Co., three feeder pillar units £11 15s., set of four £12 10s.

An Encyclopædia of Wire.

In the course of the discussion at the recent I.M.E.A. Convention, Mr. F. S. Grogan suggested that wire manufacturers would do well to undertake research into the quality of their production. To judge by a recent publication HENRY WIGGIN AND CO. are already doing this and, at any rate, are in a position to supply an extraordinary complete range of electrical wires and tapes. These resistance alloys, which are branded with a snake, include the "bright ray" for furnace work and cooking and heating apparatus. The "red ray," "glow ray," "mangonic" and nickel for cooking and heating apparatus, and many other materials with similarly attractive names for scientific and commercial instruments, wireless sets, motor starters, lamp making and sparking plugs. The properties—chemical, electrical mechanical and thermal—are described in full in the booklet in question, and useful tables of diameter, resistance, weight and current carrying capacity at various temperatures are given. Altogether a little work which no buyer or user of wire should be without.

The Cable Makers' Industrial Council.

Reviewing the work of the two years ended May 31st, the JOINT INDUSTRIAL COUNCIL for the Electrical Cable Making Industry mentions that the modification of the existing wages agreement in the latter part of 1922 was of undoubted assistance in helping British manufacturers to meet foreign competition for contracts which were being lost owing to the high price of British cables.

The Council adds that in the last report it was pointed out that because the cable industry had carried on with goodwill and without disturbances whilst almost every other industry had been dislocated by disputes and strikes, there was a tendency in some quarters to minimise the usefulness of the Joint Industrial Council, and even to suggest that it was of no use. Its functions during the further period under review had removed any possible suggestion that it was of no use, but the attitude now appeared to be that it was so useful that it might well be left to settle all questions arising without very active support or critical control.

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Electric Traction.

Tramway Extensions and Developments.

EDINBURGH has finally abandoned the use of cable cars.

SOUTHPORT Town Council has decided to lay about two miles of new track.

Ten new covered-top tramcars are to be purchased for LYTHAM ST. ANNE'S at a cost of £17,135.

BIRKENHEAD Corporation contemplates relaying its tramway track at an estimated cost of £101 500.

SOUTH SHIELDS Tramways Committee is prepared to continue negotiations for linking up with the Sunderland tramways at Fulwell.

The practice of providing letter boxes on incoming night trams has been extended to MANCHESTER, while its introduction at BRADFORD is receiving consideration.

The question of the desirability of substituting motor 'buses for trams in the congested streets in the centre of the city was to be discussed by the MANCHESTER City Council on Wednesday.

WEST BROMWICH Town Council has formally adopted an agreement with the Birmingham Corporation under which the latter authority will operate the local tramways for fifteen years from April next on the basis of West Bromwich receiving any profit or bearing any loss.

A proposal that eight new tramcars should be built in the Corporation's own workshops having been defeated, EDINBURGH Town Council has decided to invite tenders for a similar number of cars. At a meeting of the Town Council on July 5th several tramway extensions were agreed to.

A new type of light tramcar invented by Mr. E. S. Rayner, manager of the HULL tramway undertaking, has a system of transmission similar to that used in motor cars. A double worm drive enables light motors to be used, and the weight of the car is only 8 tons, with accommodation for 64 passengers.

Fares, Receipts and Passengers.

LIVERPOOL Tramways Committee has extended the cheap fares to children 15 years of age.

Cheaper fares for children came into operation on LONDON County Council Tramways this week.

DUNDEE Town Council has made several small alterations in fares and stages with a maximum charge of 2½d. instead of 3d.

The receipts of the Reading Corporation tramways undertaking from April 1st to June 7th were £14 315, compared with £15 319 for the corresponding period of last year.

Receipts on LONDON tramways controlled by the "Underground" group totalled £43 682 during the week ended June 30th, compared with £44 906 for the corresponding week last year.

KIRKCALDY Tramways Department, which announces a net profit of £227 on the past year's working, recommends the experimental adoption of short penny stages throughout the system.

During May the WALLASEY Corporation Tramways carried 1 650 445 passengers, as compared with 1 486 307 in May last year, but the receipts, at £10 247, show a decrease of £1 498.

The BRADFORD transferable weekly tram pass system continues to give gratifying results, the number of passes issued during the week June 25th to July 1st being 950, an increase of 61 on the first week.

Electric Railway Items.

For the week ended June 30th, receipts on the MERSEY RAILWAY amounted to £4 543, bringing the total for the first half-year to £118 109.

Accelerated and augmented summer services of electric trains commenced on Monday on the Brighton section of the SOUTHERN RAILWAY.

Tramway News in Brief.

A lightning strike of men employed by the LONDON SOUTH METROPOLITAN ELECTRIC TRAMWAYS last Saturday caused a suspension of the service for several hours.

A request that a recent increase of wages to motor drivers in the employ of Blackpool Corporation should be retrospective from February 1st has been declined. The increase places the men on the standard district rate.

Discussing the STARTING AND ACCELERATING PECULIARITIES OF ELECTRIC ROLLING STOCK in the "Engineer," Mr. J. Austin Baker states that very satisfactory results have been obtained from the experimental re-wiring of a car so that whichever way it runs the current flow is arranged so that the first of any two motors in series is at the rear of the car.

With regard to the recommendation of the BRADFORD Tramways Committee that drivers of one-man railless vehicles should be paid at the rate of 10 per cent. in excess of the ordinary rate for tramway drivers, it has been decided that the Industrial Council for the tramways industry be asked to give a decision; and that as there is no standard rate for this work, the recommendation of the Tramways Committee be acted upon in the meanwhile.

Wireless News.

The Broadcasting Committee's Report.

The Broadcasting Committee, after holding 23 meetings, and hearing a large amount of evidence, hopes to present its report at an early date. It will be remembered that the immediate question which led to the committee's appointment was the difficulty of licensing home-made wireless sets, and suggestions were made that the committee should confine itself to this question. The committee has, however, taken evidence from all the interests concerned and considered the broadcasting question as a whole.

Wireless to the Falklands.

The Board of Trade is informed by the British Vice-Consul at Punta Arenas that direct wireless telegraphic communication between Punta Arenas and Stanley, Falkland Islands was re-established on April 15th last. The hours for communicating are from 10.30–11 a.m. and from 6.30–7 p.m. The tariff is 0.63 centimes gold per word (roughly 1s.) from Punta Arenas to Stanley. The Falkland Islands authorities are charging 1s. per word. At present messages are only received at Punta Arenas for Stanley, but it is hoped eventually to make arrangements for messages to be sent via Stanley to all parts of the world.

Japanese Market for Broadcasting Sets.

For the guidance of British firms interested in the market for wireless broadcasting sets in Japan the Acting British Consul, Tokio, has forwarded a translation of Articles 1, 2 and 4 of the Wireless Telegraphy Law, giving a statement of the purposes for which private wireless installations may be erected and used. A copy of the translation can be inspected at the Department of Overseas Trade.

The Wireless Retailers' Association.

The Wireless Retailers' Association, particulars of the formation of which were given in our issue of June 29th, in a statement of its objects, states that the wireless industry is, at the present time, more or less in its infancy, but that its future possibilities are enormous, and its progress will be rapid. It is therefore essential, the Association states, that the interests of all retailers should be strongly protected by an association consisting of themselves, which can represent them in dealing with the many and complicated problems which confront, and will continue to confront, the retail trade, and which can be met only by collective action.

Charges fo Highway Aerials.

In connection with the proposal of the Sheffield Corporation to levy an initial fee of 21s. with an annual fee of 5s. for wireless aerials crossing highways, a meeting of wireless users on Monday protested against the proposals and resolved that only a purely nominal amount should be charged.

Wireless News in Brief.

Only one case is reported of a house bearing an aerial being STRUCK BY LIGHTNING during Monday's storm.

LEEDS Corporation proposes to seek Parliamentary powers to enable it to exercise proper control over wireless aerials.

A SHILLING WIRELESS RECEIVING SET, claimed to have a radius of 15 miles, attracted considerable attention at the London Fair and Market.

The studio of the BIRMINGHAM Broadcasting Station will be removed to premises in New Street on August 7th. During the same week the MANCHESTER Station will be removed to Dickinson Street.

The Telegraph Board in SWEDEN is to invite offers for the right of carrying on of the wireless broadcasting service. The Government "The Times" states, will establish broadcasting stations and control the development of the service.

A wireless direction-finding station will shortly be established by the Federal Government on the West Coast of VANCOUVER ISLAND for the benefit of shipping. The latest type of apparatus, on the aperiodic aerial system, will be installed.

Business Items.

LE TRANSFORMATEUR SOCIETE ANONYME has moved its London offices to Abbey House, 2–8, Victoria Street, S.W.1.

The MULLARD RADIO VALVE Co., of Nightingale Lane, Balham, London, S.W.12, announces that the Mullard "K" valve is now selling at 15s. instead of at 17s. 6d.

The works of the ARTIC FUSE AND ELECTRICAL MANUFACTURING Co., LTD., Higher Tranmere, Birkenhead, will be closed for holidays from August 6th to 11th inclusive.

The NEW SWITCHGEAR CONSTRUCTION COMPANY, LTD., of Sutton, Surrey, has purchased the assets and goodwill of the Kartret Engineering Co., of Southall and Westminster. The purchasers will continue to manufacture the type of gear hitherto made by the Kartret Co.

Books Received.

"Electrical Insulation." By W. S. Flight, Assoc.M.Inst.E.E. (London: Sir Isaac Pitman and Sons.) Pp. 107. 2s. 6d. net.

"Calculations in Heating and Ventilation." By G. S. Coleman. (London: Longmans, Green and Co.) Pp. xvi.+255. 15s. net.

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Companies' Reports, Dividends, etc.

London Electric Wire Co. and Smiths.—An interim dividend of 1½ per cent., less tax, has been declared on the ordinary shares.

William Griffiths and Co.—Similar to that paid a year ago, a dividend of 9d. per share, or 7½ per cent., less tax, is announced.

West India Electric Co.—Notice is given of the redemption of the company's 5 per cent. 20-year first mortgage bonds on July 19th.

Greenwood and Batley.—The directors recommend a final dividend of 2½ per cent. on the ordinary shares, making 5 per cent. for the past year. The annual meeting is fixed for July 24th.

Consolidated Electrical Co.—The directors regret that the result of operations for the year to March 31st last, coupled with depreciation in the company's investments, renders it advisable to defer payment of the half-year's preference dividend due on July 1st.

Drake and Gorham.—In addition to the redemption of half the £50 000 note issue which took place in May, the directors announce that they have now given notice to redeem further notes to the value of about £10 000, and the remaining noteholders have agreed to a reduction of interest from 10 to 7 per cent.

Shanghai Electric Construction Co.—It is announced that the 40 000 shares of £10 each have now been split into 400 000 shares of £1 each, and holders of warrants to bearer for shares of £10 each may deposit their warrants at the offices of the company, Basildon House, Moorgate, London, E.C.2, to be marked (free of charge) as representing the corresponding number of shares of £1 each.

Crompton and Co.—The report summarised in our previous issue was adopted, and the dividend confirmed, at the annual meeting held on July 5th. Mr. A. A. Campbell Swinton (the chairman) said that although the second half of the year had been profitable the improvement was not sufficient to wipe out the loss sustained in the first six months. While he did not think they could look forward to a substantial and permanent improvement in trade until the political difficulties on the Continent were more or less straightened out, it was satisfactory to be able to state that the unexecuted orders at the end of the year were well in advance of the figure at the commencement of the year, and that notwithstanding a considerable fall in prices. Since the close of the accounts, and more particularly during the last few weeks, orders had come in in a much more satisfactory way.

British Empire Trust Co.—Speaking at the annual meeting last week, Mr. J. Davidson (deputy-chairman) said the most important financial business they had undertaken during the year had been the finance of the establishment of an electrical power generating station and distribution system in West Gloucestershire. The construction of the station itself was now practically complete, and the main distribution system was expected to be completed before the end of the present year. Dealing with associated companies, Mr. Davidson said the revenue of the British Columbia Electric Railway Co. had improved satisfactorily following an agreement with the Vancouver authorities stabilising the fares. When a settlement with the Government of the State of Nuevo Leon was effected the Monterey Railway, Light and Power Co. should again make satisfactory progress. With regard to the Winnipeg Electric Railway, the continuation of the general industrial depression during 1922, together with a small reduction in fares, affected to some extent the gross earnings of the company, but economies were made in working expenses, with the result that the net earnings for the year were well maintained.

Cable, Telegraph and Telephone Companies.

Telegraph Construction and Maintenance Co.—An interim dividend of 6s. per share, free of tax, is announced.

Anglo-American Telegraph Co.—An interim dividend has been declared for the quarter ended June 30th of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less tax, payable on August 1st.

Marconi International Marine Communication Co.—Advanced by £53 805, the net profit for 1922 was £171 848. The directors recommend a final dividend of 7½ per cent., making 12½ per cent., against 10 per cent. for 1921, carrying forward, subject to E.P.D. for the years 1916 to 1920 inclusive, less amounts paid on account, £41 580, compared with £18 822 brought in. The annual meeting is to be held to-day (Friday) at the Connaught Rooms, London, W.C.

Traction Companies' Results.

Lisbon Electric Tramways, Ltd.—After providing for debenture interest and other charges the profit for past year was £9 747. Deducting this sum from the loss of £48 455 brought forward, there is a debit balance to be carried forward of £38 708. The preference dividend is in arrear since June 1917 and the last dividend paid on the ordinary shares was for the year 1915.

Underground Electric Railways.—The directors of the Underground group of railways have declared their dividends for the past six months. Compared with the corresponding period a year ago, the District is unchanged at 1½ per cent., the London Electric and City and South London each show a gain of ¼ per cent. to 2 per cent., while the Central London pays 2 per cent., as before. The Underground Electric income bonds receive the full 3 per cent., as against 2 per cent.

Supply and Lighting.

Hendon Electric Supply Co.—It is proposed to divide each of the existing shares of £5 each, both ordinary and preference, into five shares of £1 each.

Midland Counties Electric Supply Co.—Notice is given that the 7½ per cent. mortgage debenture stock will be paid off at 102 per cent. on September 1st with all interest accrued to that date.

Trowbridge Electric Supply Co.—At the annual meeting last week there were proposals to pay a dividend of 10 per cent. on the ordinary shares and of 6 per cent. on the preference shares. It was stated that good progress had been made by the Western Electricity Distributing Corporation with the preliminaries for the reorganisation of electricity supply in West Wilts and that proposals would shortly be laid before the shareholders.

Kalgoorlie Electric Power and Lighting Corporation.—The profit for 1922 was £7 568. After providing £5 500 for depreciation there remains, including £378 brought forward, £2 446. This will allow of the payment of 2 per cent., less tax, on the income debenture stock to be issued to holders of preference shares. Payment will be on account of 1922 and will be made as soon as the scheme now before the Court has been confirmed. The annual meeting will be held at Winchester House, London, E.C., on July 19th.

Cordoba Light, Power and Traction Co.—The report for the year ended March 31st last states that the receipts of the electric lighting and power supply business, and of the tramways, showed an increase over the preceding year. After providing for administration expenses, debenture interest, loss on exchange, and taxes, the profit and loss account shows a profit of £73 291 (against £54 669), while £5 702 was brought forward. A sum of £8 213 is set aside for debenture stock redemption, and the 7 per cent. preference dividend absorbed £34 955. After reserving £5 000 for redemption of preference and ordinary share capital, and applying £25 000 in writing down the discount on and expenses of the 6 per cent. debenture issue, there remains a balance of £5 825 to be carried forward. In June last the company offered to acquire the entire capital stocks of the Argentine Tramways and Power Co. Holders of upwards of 97 per cent. of the debenture stock and of each class of the shares of that company have accepted the offer, and the agreement has become binding subject to the passing of the resolutions at the general meeting on July 16th, and to the sanction by the debenture holders of the creation of a further 200 000 debenture stock.

New Issue.

Seaton and District Electric Light Co.—It is announced in connection with the recent issue that letters of allotment will be issued shortly.

New Companies.

Foster and Foster, Ltd. Private. Cap., £1 000 in £1 shares. Electrical and mechanical engineers, electrical sign makers, etc. Reg. office: 65, New Street, Birmingham.

London Lead Oxide Co., Ltd.—Private. Cap., £25 000 in £1 shares. Electricians, manufacturers of electric batteries or accumulators, etc. Reg. office: 107, Bishopsgate, London, E.C.

Harrison and Searle, Ltd.—Private. Cap., £1 000 in £1 shares. To carry on the business of an electric light company in all its branches. Reg. office: 13, Gothic Arcade, Snow Hill, Birmingham.

M. E. L., Ltd.—Private. Cap., £35 000 in £1 shares. To acquire certain patents, plant, etc., from the liquidators of Phi-Kappa Syndicate, Ltd. Electrical engineers, etc. Reg. office: 2, Staple Inn, London, W.C.1.

Uni-Directional Apparatus Co., Ltd.—Private. Cap., £5 000 in 4 000 7 per cent. cumulative preference shares of £1 each and 20 000 ordinary shares of 1s. each. Electricians, etc. Reg. office: 14-16, Cockspur Street, London, S.W.1.

Tungstalite, Ltd.—Private. Cap., £2 000 in £1 shares. Manufacturers of and dealers in electric lamps, electrical machinery and other electrical apparatus, etc. Solicitors: Blyth, Dutton, Hartley and Blyth, 112, Gresham House, London, E.C.2.

G. Davenport (Wireless), Ltd. Private. Cap., £10 000 in 9 750 ordinary shares of £1, and 5 000 deferred shares of 1s. To take over the wireless part of the business of G. Davenport and Co., Ltd., etc. Reg. office: 101-3-5, Clerkenwell Road, London, E.C.

W. E. C., Ltd. Private. Cap., £200 in 1 000 ordinary shares of 1s. each and 150 10 per cent. cumulative preference shares of £1 each. Manufacturers of and dealers in all types of complete instruments and accessories connected with telephony, telegraphy, and wireless telephony and telegraphy, etc. Reg. office: Room 91, Gloucester House, Charing Cross Road, London, W.C.

Motor Standardisation—*Errata.*

We regret that two errors occurred in the Editorial Note headed "Motor Standardisation" which appeared in last week's Electrician. The sentence reading "Such motors are also to be capable of carrying sustained overloads not exceeding 5 per cent. with a 90 degree rise" should read "overloads not exceeding 50 per cent. with a 90 degree total temperature." The application of the 40 degree rise in the case of general purpose motors is British as well as American practice.

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Reference Index to Recent Wireless Publications.

R.300. APPARATUS AND EQUIPMENT.

L. F. Fogarty. Valve Current from A.C. Mains (*Wireless World and Radio Review*, 11, pp. 521-524, January 20th, 1923). R.360.

P. W. Harris. American Ideas in British Design. The Construction of a Four-valve Detector Amplifier (*Wireless World and Radio Review*, 11, pp. 817-822, March 24th, 1923). R.360.

Improving the Selectivity of a Wireless Receiver (*Modern Wireless*, 1, p. 103, March, 1923). R.360.

Refinements in Receiving Circuits (*Wireless World and Radio Review*, 11, pp. 601-602, February 3rd, 1923). R.360.

J. Scott-Taggart. A Universal Receiver for all Wavelengths (*Modern Wireless*, 1, pp. 134-137, March, 1923). R.360.

H. S. Walker. Amplifying without Valves (*The Broadcaster*, 1, pp. 41-42, April, 1923). R.363.

O. H. Land. A Glass-Enclosed Crystal Detector (*Modern Wireless*, 1, pp. 176-177, April, 1923). R.364.

G. Y. Allen. The Facts About the Loud Speaker (*Radio Broadcast*, 2, pp. 287-289, February, 1923). R.366.

New Developments in Loud Speaker Horns (*Radio News*, 4, p. 1 612, March, 1923). R.366.

F. O. Read. Loud Speakers (*The Broadcaster*, 1, p. 60, April, 1923). R.366.

P. D. Tyers. Loud Speaking Telephones (*Modern Wireless*, 1, pp. 112-113, March, 1923). R.366.

Marconi's Calling Device (*Scientific American*, 128, p. 136, February, 1923). R.367.

J. H. D. Ridley. Recording our Broadcasts in England (*Wireless Age*, 10, pp. 45-46, March, 1923). R.367/550.

Storage batteries that are out of the ordinary (*Scientific American*, 128, p. 120, February, 1923). R. 380.

S. O. Pearson. Electrostatic capacity in Radio circuits (*Wireless World and Radio Review*, 11, pp. 573-575, January 27th, 1923). R.381.

The Values of Condensers, Grid Leaks, etc. (*Modern Wireless*, 1, p. 100, March, 1923). R.381/383.

G. P. Kendall. Multi-layer Coils (*Modern Wireless*, 1, pp. 182-185, April, 1923). R.382.

Barretter Tubes (*Wireless World and Radio Review*, 11, p. 603, February 3rd, 1923). R.383.

L. E. Prosser. A High-Tension Safety Unit (*Modern Wireless*, 1, p. 175, April, 1923). R.383.

B. Steinmetz. Methods of Using Wavemeters, with Suggestions for Insuring Accuracy (*Wireless Age*, 10, p. 73, March, 1923). R.384.

The Barrel Switch. How to use it in Wireless Circuits (*Wireless World and Radio Review*, 11, pp. 617-619, February 10th, 1923). R.385.

The Glow Discharge Microphone (*Wireless World and Radio Review*, 11, p. 834, March 24th, 1923). R. 385.

G. P. Kendall. A Filter Circuit (*Modern Wireless*, 1, p. 90, March, 1923). R.386.

A New Aerial Insulator (*Modern Wireless*, 1, p. 99, March, 1923). R.387.

R. A. Watson-Watt and J. F. Herd. Note on Electro-magnetic Screening (*Wireless World and Radio Review*, 11, pp. 532-534, January 20th, 1922). R. 387.

How to measure the millionth of a second—Dufour's Cathode oscillograph (*La Nature*, 51, pp. 71-74, February 3rd, 1923). R. 388.

R.400. RADIO COMMUNICATION SYSTEMS.

G. W. Gother. How Radio may help the Theatre (*Wireless Age*, 10, p. 37, March 1923). R. 412.

Transatlantic Radiotelephony (*Wireless World and Radio Review*, 11, pp. 566-568, January 27th, 1923.) R. 412.

S. R. Cummings. Wave-length and Interference (*Popular Wireless*, 3, p. 111, March 17th, 1923). R.430.

S. O'Connor. Atmospherics, Strays and Statics (*Popular Wireless*, 1, p. 159, March 24th, 1923). R.431.

A. W. Sharman. The New Radio Danger (*Popular Wireless*, 3, p. 99, March 17th, 1923).

Describes experiments on the limits from which a receiving aerial draws its energy and on interference arising between adjacent receiving aerials. R.432.

J. R. Tannehill. Reducing Interference (*Radio News*, 4, p. 1620, March, 1923). R.432.

Broadcasting over Light Lines Prevents Interference (*Radio News*, 4, p. 1613, March, 1923).

Describes "wired wireless" tests made by the Bureau of Standards. R. 470/550.

R.500. APPLICATIONS OF RADIO.

Free Medical Radio Service for Ships at Sea (*Scientific American*, 128, p. 136, February, 1923). R.510.

G. R. Putnam. How our Lighthouses use Radio (*Radio Broadcast*, 2, pp. 369-374, March, 1923). R. 510.

The Applications of Wireless to Commercial Flying (*Wireless World and Radio Review*, 11, pp. 620-624, February 10th, 1923). R. 520.

Wireless on the "R.34" (*The Broadcaster*, 1, pp. 61-65, April, 1923). R. 520.

J. Robinson. Directional Wireless (*Modern Wireless*, 1, pp. 129-133, March, 1923). R.521.

R. S. Wood. Finding the Way in Cloudland (*Wireless Age*, 10, pp. 41-43, March, 1923). R.521.

New Polish Trans-Atlantic Station near Warsaw (*Wireless Age*, 10, pp. 39-40, March, 1923). R.530.

O. A. Reberger. The Future of Commercial Radio (*Radio News*, 4, p. 1634, March, 1923). R.530.

Radio House. The New City Premises of the Marconi Company (*Popular Wireless*, 3, p. 119, March 17th, 1923). R.531/620.

Wireless Telephony on Trains (*Wireless World and Radio Review*, 11, p. 669, February 17th, 1923). R.533.

Radio in Mines (*Radio News*, 4, p. 1631, March, 1923). R.536.

Underground Radio for Miners (*Scientific American*, 128, p. 136, February, 1923). R.536.

P. R. Coursey. Transatlantic Tests. Results of British and French Transmissions, 1922 (*Wireless World and Radio Review*, 11, pp. 689-692, February 24th, 1924). R.545.

P. Louis. What France Received during the Trans-Atlantic Tests (*Radio News*, 4, p. 1652, March, 1923). R.545.

5 MS. The Transmitting Station of the Manchester Wireless Society (*Wireless World*, 11, pp. 715-718, March 3rd, 1923).

Description of experimental station used during the Trans-Atlantic Tests (1922). R.545/612.

R. Slade and J. Lough. Reception of U.S. Amateur Radio Signals in New Zealand (*Radio News*, 4, p. 1650, March, 1923). R.545.

The Transatlantic Tests (*Wireless World and Radio Review*, 11, pp. 543-544, January 20th, 1923). R.545.

The American Broadcasting Station WGY (*Wireless World and Radio Review*, 11, pp. 649-651, February 17th, 1923). R.550/612.

The Birmingham Wireless Magicians (*The Broadcaster*, 1, pp. 86-87, April, 1923). R.550.

The Broadcasting Company and the Experimenter (*Modern Wireless*, 1, p. 219, April, 1923). R.550/545.

J. F. Bront. Broadcast Receiving and Receivers (*Radio News*, 4, p. 1627, March, 1923). R.550.

W. H. Easton. "Out of the Studio" Broadcasting (*Radio Broadcast*, 2, pp. 364-368, March, 1923). R. 550.

H. B. Jackson. A Broadcast Talk from a Wireless Pioneer (*Wireless World and Radio Review*, 11, pp. 634-636, February 10th, 1923). R.550.

O. O. Millar. The Glasgow Broadcasting Station (*Popular Wireless*, 3, pp. 163-164, March 24th, 1923). R.550/610.

Musical Broadcasting Experiments (*Scientific American*, 128, p. 95, February, 1923). R.550.

Opera Broadcast by Radio—Covent Garden heard in Paris (*La Nature*, 51, Supplement p. 33, February 3rd, 1923). R.550.

Radio Broadcasting in Cuba and Porto Rico (*Scientific American*, 128, p. 136, February, 1923). R.550.

Radio Telephony in the West Indies (*Scientific American*, 128, p. 136, February, 1923). R.550.

Schedule of Radiotelephonic Transmissions (*La Nature*, 51, p. 1, Supplement, January 6th, 1923). R.550.

Telephoning across the Atlantic (*Wireless Age*, 10, p. 36, March, 1923). R.550.

W. G. M. Mitchell. Some Practical Applications of Time Signals (*Wireless World and Radio Review*, 11, pp. 751-754, March 10th, 1923). R.551.

A. Perry. The Boy Scouts' Place in the Radio Game (*Radio Broadcast*, 2, pp. 275-281, February, 1923). R.560.

A. Gradenwitz. A Wireless Selective Call (*Radio News*, 4, p. 1613, March, 1923). R.570.

R. Phillips. Controlling Models by Wireless (*Popular Wireless*, 2, p. 322, September 23rd; p. 372, September 30th; p. 403, October 7th; pp. 429-430, October 14th; pp. 455-456, October 21st; p. 479, October 28th; p. 532, November 11th; p. 556, November 18th; p. 580, November 25th, 1922). R.570.

S. R. Winters. The Transmission of Photographs by Radio (*Radio News*, 4, pp. 1 772-1 773, April, 1923). R.582.

M. B. Sleeper. Radio in England (*Radio News*, 4, pp. 1 794-1 795, April, 1923). R.592.

E. G. Osborn. Radio in Japan (*Radio News*, 4, p. 1 264, January, 1923). R.599.

A. M. Low. Seeing by Wireless (*The Broadcaster*, 1, pp. 68-69, April, 1923). R.582.

O. G. O. Crawley. Imperial Wireless Communications (*Modern Wireless*, 1, pp. 85-86, March, 1923). R.592.

Wireless in the Post Office (*Modern Wireless*, 1, pp. 163-166, April, 1923). R. 592.

R.600. RADIO STATIONS (DESCRIPTIONS, ETC.)

D. Wilhelm. N A A (*Radio Broadcast*, 2, pp. 292-296, February, 1923). R.611.

E. Coursey. The Erection of 5WS—The Radio Society's Special Transatlantic Station at Wandsworth (*Wireless World and Radio Review*, 11, pp. 525-527, January 20th, 1923). R. 612.

P. R. Coursey. "5WS." The Successful Transatlantic Transmitting Station of the Radio Society of Great Britain (*Wireless World and Radio Review*, 11, pp. 785-789, March 17th; pp. 826-830, March 24th, 1923). R.612.

R.700. RADIO MANUFACTURING.

D. H. Moss. Radio Receivers in the Making (*Radio News*, 4, p. 1 774, April, 1923). R.700.

W. Seeley. Where radio receivers come from (*Wireless Age*, 10, pp. 37-38, April, 1923).

A description of some of the manufacturing facilities of the Radio Corporation of America. R. 710,

Wholesome Growth in Radio Industry (*Electrical World*, 81, p. 364, February 10th, 1923). R. 700.

H. Gernsback. Radio's Greatest Opportunity (*Radio News*, 4, p. 1611, March, 1923). R.740.

R.800. NON-RADIO BUT ALLIED SUBJECTS.

F. W. Aston. The Atoms of Matter: Their Size and Construction (*Modern Wireless*, 1, pp. 117-121, March, 1923). R.800.

J. H. T. Roberts. The Electrical Theory of Matter (*Wireless Weekly*, 1, pp. 170-172, April 25th, 1923). R.800.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"The Decoration of Furniture"; "Full Size Details of Furniture Mouldings"; "Pram Publicity in the Past."

THE CHEMICAL AGE.—"The Fauser Synthetic Ammonia Process"; "Government Inspector's Annual Report on British Alkali Works for 1922."

THE EUROPEAN COMMERCIAL.—"Business Conditions in Sweden"; "Monthly Chemical Trade Section: The Situation in Europe and America"; "Trade-winning Samples and Advertising Matter."

THE FRUIT GROWER.—"The Royal Show"; "A Serious Menace to Plum Growing"; "Compatible Spray Mixtures."

GARDENING ILLUSTRATED.—"Outdoor Vines"; "New Roses" (illustrated).

THE GAS WORLD. (Special Coal Number).—The Production and Handling of Coal"; "Coal and Iron Distribution"; "A Good Record from Gas Engines."

THE HARDWARE TRADE JOURNAL.—"Prices of Building Materials"; "Milling Cutter Hubs"; "Sale of a Hardware Stock: Merchant's Claim against Trade Valuer."

A G.E.C. Vade Mecum.

The General Electric Co. believes in propaganda not only amongst the world at large—in other words its consumers—but among its shareholders. In order that the latter class of humanity may have a proper appreciation of what the company is doing, a booklet has been issued in which are illustrated and described the vast range of products manufactured. This booklet is a history in little. It begins with some details about the offices and showrooms at Magnet House, and there is also a map indicating how they may be reached. There are photographs of all the factories (really we did not know there were so many) and it gives some succinct details of what is made and done in each. It tells us something about the branches of the company at home and overseas, while finally there is some well written information about the products that all these places deal with. It is a most useful and informative production, and we hope that each shareholder and everybody else who can get hold of a copy will make a point of studying it.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

BENNETT (J. L.) AND CO., LTD., 17A, South Castle Street, Liverpool, electricians. £19 19s. 7d. May 31st.

KITCHING, LTD., 4, Charles Street, Sheffield, electrical factors. £14 5s. 4d. May 24th.

MUNRO MOIR AND CO., 8, Endell Street, Long Acre, W.C., electricians. £16 8s. 4d. May 28th.

PEEL, H. AND C., AND CO., 123, Northumberland Street, Newcastle-on-Tyne, electricians. £11 5s. 2d. June 3rd.

SHAW, F. L., AND CO., 14, New Street Hill, E.C., electrical engineers. £21 10s. 9d. May 23rd.

WELCH AND HALEY, 31, Union Hall Buildings, Chester, electrical engineers. £21 10s. 2d. May 31st.

WESTON, Mr. E., 38, New Oxford Street, W.C., electrical engineer. £11 4s. 2d. May 1st.

Deed of Arrangement.

MANDER, George Ernest, and TOWNSEND, Garnet Leslie, trading at Park Road, Bingley, as BINGLEY ELECTRICAL CO., electrical engineers. Filed, July 3rd. Trustee, C. H. Baker, 1, Albion Street, Leeds, accountant. Liabilities unsecured, £1 387; assets, less secured claims, £719.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

BRITISH RADIO-WIRELESS MANUFACTURING CO., LTD., Electric House, Wardour Street, London, W. At the statutory meeting, on Tuesday, of the creditors in this voluntary winding-up, the liquidator, Mr. G. W. Burgess, C.A., 14, St. Mary Axe, E.C., submitted a statement of affairs which showed liabilities of £2 258, and net assets estimated to realise £1 330, a deficiency of £928. The issued capital of the company was £2 000, and as regarded the shareholders the deficiency was £2 928. Mr. Burgess reported that the company was registered on November 2nd of last year and shares to the extent of £1 400 had been issued for cash and were fully paid. He had not had time to make an exhaustive investigation into the company's affairs, but he understood that trouble had arisen with customers through the supply of faulty apparatus while in some instances unsuitable stock was purchased. Since its inception the company had only made a gross profit of £67, while the expenses of the business had been £1 573. No directors' fees had ever been paid, and two members of the Board had lent the company over £1 000, and an attempt was made to bolster it up, but without success and finally liquidation took place. The following are creditors:—Fullers United Electric Works, £135; Graham, A., and Co., £94; Low, F. W., and Adler, £95; Re-Echo Wireless Co., £81; Putney and Sons, £45; Batsons, J., and Sons, £40.

NUNEATON ELECTRICAL CONTRACTING CO., LTD., Queen's Road, Nuneaton. In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of the creditors of the above was held on June 29th; at the registered offices of the company, when it was reported that voluntary liquidation had taken place, and that Mr. P. Russell, of Newdegate Street, Nuneaton, had been appointed as liquidator. The statement of affairs presented showed liabilities of £1 222, of which £1 150 was due to the ordinary unsecured creditors, and in addition the bank were shown as fully secured creditors for £2 794. The assets were estimated to realise £2 319, and a surplus was thus disclosed so far as the creditors were concerned of £1 097. It was stated that the company's business was established in 1911 and showed successful results until 1920. In view, however, of repeated trading losses since that date the shareholders had decided that the concern should be wound up. The business was being advertised for sale as a going concern. In the event of a realisation the surplus would not be realised, but there should be a very substantial dividend even if the creditors were not paid in full. The issued share capital of the company was £6 750. During the last two years the directors had found something like £5 000 for the business. Latterly contracts had been lost. After discussing the position the creditors decided to confirm the voluntary liquidation of the company, subject to Mr. A. Cripwell, of Corfield and Cripwell, accountants and auditors, Birmingham, being appointed as joint liquidator, while a committee of inspection was also nominated.

SURREY SCIENTIFIC APPARATUS CO., LTD., Shrewsbury Works, Isleworth, electrical engineers and manufacturers of wireless apparatus. Creditors were called together recently, when it was reported that the liabilities to the trade totalled £960, the present position having been brought about through the company making a big bad debt in Radio Installations, Ltd., which had gone into liquidation. The company had been doing a fairly substantial business and had orders on hand at the moment for immediate delivery of goods to the value of over £300, but was crippled for want of ready cash. The meeting was adjourned in order to enable the directors to confer together with the object of making an immediate cash offer of at least 5s. in the £ to the trade creditors.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-Up Voluntarily.

ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD. R. Kettle, 5, London Wall Buildings, London, E.C., chartered accountant, appointed liquidator.

Bankruptcy Information.

BOSWELL, Percy, carrying on business as BOSWELL AND CO., 110, Ebury Street, Westminster, electrical engineer. Receiving order, July 2nd. Debtor's petition. First meeting, July 17th. 12.30 p.m.; and public examination, November 7th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

LACLAND ELECTRICAL MANUFACTURING AGENCY (THE), 68, Great Queen Street, London, W.C., electrical engineers. Receiving order, July 4th. Creditor's petition. First meeting, July 18th. 2.30 p.m., and public examination, November 9th. 11 a.m. Bankruptcy Buildings, Carey Street, London, W.C.2.

MEARNS, Edward Enoch, 14, St. Bede's Road, East Boldon, co. Durham, electrical contractor. First meeting, July 20th, 11 a.m., Official Receiver's Office, Pearl Buildings, 4, Northumberland Street, Newcastle-upon-Tyne. Public examination, July 26th, 11 a.m., County Court, Westgate Road, Newcastle-upon-Tyne.

WRIGHT, Charles, and WRIGHT, Herbert Thomas, both of 251, Fulham Road, Chelsea, electrical engineers. Receiving order, July 2nd. Creditor's petition. First meeting, July 18th, 11 a.m.; and public examination, September 11th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

Notices of Dividends.

CHADFIELD, Cecil Richard Almas, 12, Nottingham Street, Melton Mowbray, in the county of Leicester, electrical engineer. First and final dividend of 9d. per £, payable July 20th, Official Receiver's Office, 1, Berridge Street, Leicester.

PERRIN, Francis Leopold, 57, Wellingborough Road, also 5, College Street, Northampton, electrical engineer. First and final dividend of 1s. 1½d. per £, payable July 16th, Kingham Chambers, Northampton.

Prices of Metals, Chemicals, etc.

TUESDAY, July 10.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£69 0 0	—	—
Electro Wirebars ..	„	£72 15 0	15s.	—
H.C. Wire, basis ..	per lb.	10 1/8d.	⅛d.	—
Sheet	„	10½d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2⅛d.	⅛d.	—
Brass 60/40—				
Rod, basis	„	7½d.	—	—
Sheet, basis	„	10d.	—	—
Wire, basis	„	10½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 17 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 10 0	—	—
Lead Pig—				
English	„	£25 15 0	10s.	—
Foreign or Colonial	„	£24 2 6	5s.	—
Tin—				
Ingot	„	£181 10 0	£4 10 0	—
Wire, basis	per lb.	2s. 5d.	⅛d.	—
Aluminium Ingots ..	per ton	£120 0 0	—	—
Spelter	„	£28 7 6	2s. 6d.	—
Mercury	per bottle	£10 7 6	—	7s. 6d.

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2¼d.
„ (Roll-Brimstone)—„ £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. „ £26 per ton, £7 10s.
Boric Acid (Crystals). „ £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2½d.; plantation 1st latex, 1s. 2d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Company.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

195 895 E. C. R. MARKS (Soc. ANON. APPAREILLAGE THECO.) Protective mount for fixing electric meters. (8/6/22.)
181 723 QUARZLAMPEN-GES. Electric heat-radiator for therapeutic purposes. (15/6/21.)
195 900 WARD LEONARD ELECTRIC Co. and G. W. CAMP. Resistance switches. (7/7/22.)
195 903 IGRANIC ELECTRIC Co (CUTLER-HAMMER MFG. Co.). Filament resistance rheostats. (13/7/22.)
195 905 GENERAL ELECTRIC Co. LTD., and W. C. C. HAWTAYNE Electric signs. (20/7/22.)
195 906 T. TAYLOR and F. H. MORRIS. Adjusting electric lamp holders in lanterns. (20/7/22.) (Cognate Application, 23660/22.)
185 742 METROPOLITAN-VICKERS ELECTRICAL Co. Electrically-driven power shovels (12/9/21.)
196 010 S. L. BAILEY. Coupling electrical machines to internal-combustion engines. (11/11/21.)
196 018 COVENTRY AUTOMATIC TELEPHONES, LTD. (F. R. MCBERTY). Machine-switching telephone exchange systems (9/12/21.)
196 019 DUBILIER CONDENSER Co. (1921) and P. C. GILSON. Means for measuring indicating or recording efficiency of an electric generating station or component parts thereof. (10/12/21.) (Cognate Application, 7115/22.)
196 037 A. M TAYLOR. Joints for underground e.h.t. cables. (10/1/22.)
196 048 NEWTON BROS (DERBY) and F. NEWTON. Construction of d.c. machines. (10/1/22.)
196 055 A. W. SHARMAN. Apparatus for controlling and regulating electric currents. (11/1/22.)
196 062 BRITISH THOMSON-HOUSTON Co (GENERAL ELECTRIC Co., N.Y.). High-frequency signalling systems. (12/1/22.)
196 068 W. ANDREWS-TESTER and S. THOMPSON. Control of a.c. motors. (12/1/22.)
174 076 GES. FUR DRAHTLOSE TELEGRAPHIE. Wireless telephone transmitters. (2/11/21.) (Addition to 161 521.)
196 071 F. G. PARKS, JUN. Electric imitation candles. (13/1/22.)
196 076 C. BOURGEOIS. Electric warp stop-motions for looms. (13/1/22.) (Addition to 174 335.)
196 079 BRITISH ELECTRIC TRANSFORMER Co., J. ROOTHAAN, and A J. HUBER. Transformers. (13/1/22.)
175 961 AUTOMATIC TELEPHONE MANUFACTURING Co. Telephone systems. (23/2/21.)
196 087 A. H. HUNT. Combined electric lamp holder and switch for the lamps of motor vehicles. (16/1/22.)
196 094 METROPOLITAN-VICKERS ELECTRICAL Co. and W. A. COATES. Switch gear. (17/1/22.)
177 143 V. MARTINETTO. Automatic maximum and minimum current circuit breakers. (15/3/21.)
175 258 PHILIPS' GLOEILAMPENFABRIEKEN. Gas-filled glow discharge devices for amplifying electric current variations. (9/2/21.)
196 107 WALSALL HARDWARE MFG. Co., and A. E. READ. Bonding boxes for electric conductors. (21/1/22.)
196 111 A. H. RAILING and A. E. ANGOLD Magneto-electric lamps. (25/1/22.)
196 121 H. C. HODGES. Electrical resistances for use as generator filled regulators. (21/1/22.)
196 123 WESTERN ELECTRIC Co. (WESTERN ELECTRIC Co., INC.). Telephone systems. (2/2/22.) (Addition to 170 286.)
196 126 H. G. WAGNER. Construction of storage batteries. (6/2/22.)
196 127 H. G. WAGNER. Positive and negative elements for storage batteries. (6/2/22.)
196 137 E. SCHRODER. Electrically welding high-speed steel to tool-shanks of foundations of iron or steel. (16/2/22.)
196 141 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Incandescent lamps. (21/2/22.)
196 147 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Thermostatic electric circuit controllers. (28/2/22.)
196 152 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Electromagnets. (3/3/22.)
196 156 A. L. DAVIS. Switches. (7/3/22.)
178 099 SIEMENS AND HALSKE AKT.-GES. Telephone systems. (7/4/21.)
196 188 A. W KNIGHT. Inductance coil holders for wireless telegraphy. (3/5/22.)
196 189 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Electric measuring instruments. (3/5/22.)
196 192 CALLENDER'S CABLE AND CONSTRUCTION Co., S. E. R. BEECROFT and A. H. HORSFIELD. Electric cables. (10/5/22.)
196 199 BRECKNELL, MUNRO AND ROGERS, and A. M. WILLIS. Insulators. (18/5/22.)
181 695 AKT.-GES. BROWN, BOVERI ET CIE. Metal-vapour rectifiers. (11/6/21.)
192 997 R. BOSCH AKT.-GES. Electric contact-breakers. (11 2/22.)
196 225 C. BRANDES, INC. Telephone head-sets. (12/5/22.)
186 327 METROPOLITAN-VICKERS ELECTRICAL Co. Electrically-operated vehicles. (23/9/21.)
189 095 GES. FUR DRAHTLOSE TELEGRAPHIE. Thermionic generators. (14/11/21.)
187 613 GENERAL ELECTRIC Co., LTD. Electric discharge lamps. (19/10/21.)
196 231 PHILIPS' GLOEILAMPENFABRIEKEN. Hollow bodies in which electric conductors are hermetically introduced through a glass wall. (28/7/22.)
189 777 METROPOLITAN-VICKERS ELECTRICAL Co. Motor control systems. (29/11/21.)
196 233 A. L. A. PETTY. Reception of wireless signals. (12/12/22.)
196 304 C. J. GORDON. Electric motor controllers. (30/6/22.)
196 305 BRITISH THOMSON-HOUSTON Co. and A. S. FITZGERALD. Electric relays. (11/10/21.)
196 355 VERITYS, LTD., and F. W. THORPE. Bulb reflector and globe fittings of electric lanterns. (19/1/22.)
196 369 METROPOLITAN-VICKERS ELECTRICAL Co., W. A. COATES and D. R. DAVIES. Potential transformers and fuses. (20/1/22.)
196 375 GENERAL ELECTRIC Co., LTD., A. E. ANGOLD and F. L. CASTLE. Electromotive apparatus for track circuit relays or electricity meters. (21/1/22.)
196 391 METROPOLITAN-VICKERS ELECTRICAL Co. and L. H. A. CARR. A.C. motors. (25/1/22.)
175 611 AUTOMATIC TELEPHONE MANUFACTURING Co. Telephone systems. (19/2/21.)
196 430 BRITISH THOMSON-HOUSTON Co. and C. T. HANNA. Current controllers. (14/2/22.)
196 453 A. P. WELCH. Transformers for wireless circuits. (16/3/22.)
179 147 SCINTILLA. Magneto-electric ignition apparatus. (29/4/21.) (Addition to 120 901.)
181 328 WESTERN ELECTRIC Co. Loaded transmission lines for telephone systems. (4/6/21.)
196 461 G. C. REED. Electric signalling for railways. (28/3/22.)
196 473 C. ROCKLEY. Selecting devices for telephone systems. (18/4/22.)
196 480 R. F. BAERLOCHER. Resistance grids. (1/5/22.)
196 510 G. P. TUSSAUD. Electrolytic manufacture of metal replicas of natural or manufactured articles. (7/6/22.)
196 511 JOHNSON AND PHILLIPS and C. J. H. STEVENS. Means for gripping electric cables to junction boxes, etc. (8/6/22.)
184 164 A. A. SAMUEL. Electrical and thermal insulators. (1/8/21.)
196 523 B. F. S. BADEN-POWELL. Primary batteries. (15/7/22.)
196 525 METROPOLITAN-VICKERS ELECTRICAL Co. (WESTINGHOUSE ELECTRIC AND MFG. Co.) Electrical measuring instruments. (22/7/22.)
196 528 SIR P. DAWSON and F. W. FAWDRY. Suspension of overhead conductor wires on electric railways, etc. (26/7/22.)
196 543 M. J. RAILING and J. H. COLLINGS. Fittings for electric candle lamps. (16/10/22.)

APPLICATIONS FOR PATENTS.

June 25th.

16 382 W. R. CLARK and J. H. HUTCHEON. Wireless apparatus.
16 388 F. R. HICKSON. Thermionic valves.
16 396 A. F. LOUIS. Tramway rails.
16 403 E. BOSELLI. Electro-magnetic wave signalling systems.
16 406 C. R. METCALFE and N. SEFTON. Protecting live rails.
16 408 J. H. HEPPENSTALL. Self-oiling wheel for tramcar trollies
16 409 J. L. CARTWRIGHT. Variable grid leak.
16 410 W. LAWRANCE. Trollies for electric tramways.
16 420 L. BENSON. Contact wire crystal detector arm.
16 421 R. H. ABREY. Plastic insulating materials.
16 430 J. C. DAVIES. Attachment for eletric fans to exterminate flies, etc.
16 442 G. W. HALE and R. LYLE. Distributing telephone or telegraph signals.
16 450 W. E. H. HUMPHRYS. Valve holder adapter.
16 452 C. H. HOPWOOD. Switches.
16 466 F. P. BERGMANN. Telephones.
16 475 BRITISH THOMSON-HOUSTON Co. Amplification of currents. (26/6/22, U.S.).
16 476 BRITISH THOMSON-HOUSTON Co. Amplifiers. (26/6/22, U.S.)
16 480 A. FRISCH. Conversion of pressure effects into equivalent electrical effects (29/6/22, Germany.)
16 483 AUTOMATIC TELEPHONE MFG. Co. Telephone systems. (15/7/22, U.S.)
16 489 AUTOMATIC TELEPHONE MFG. Co. Telephone systems. (17/8/22, U.S.)
16 490 A. WEST AND Co. and G. PAGE. Electric contactor devices.

June 26th.

16 568 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Electrical machines.
16 574 H. G. DETHERIDGE. Illuminated electric signs.
16 575 L. L. R. DEAN. Crystal receiver.
16 583 L. DE FOREST. Controlling electric current by sounds. (28/10/22, U.S.)
16 592 RELAY AUTOMATIC TELEPHONE Co., G. H. BRYANT, R. G. VANNECK, and B. B. JOHNSON. Party line telephones.
16 597 C. E. OGDEN. Rectifiers. (26/12/22, U.S.)
16 598 C. E. OGDEN. Vibrators for a.c. rectifiers. (2/10/22, U.S.)
16 610 N. JAPOLSKY and M. KOSTENKO. A.C. commutator machine.
16 615 A. B. COLE, INC. Variable condensers. (1/8/22, U.S.)
16 621-2-3-4 J. H. ROWLANDS and G. THOMAS. Conversion of electricity into heat.

June 27th.

16 656 F. E. SINCLAIR and E. T. BATEMAN. Dual amplification in wireless reception.
16 674 E. SCHRODER. Electric tube-welding machines.
16 675 W. MCCLURE. Wireless receiving apparatus.
16 677 METROPOLITAN-VICKERS ELECTRICAL Co. and E. Y. ROBINSON. Seals for leading-in conductors.
16 678 METROPOLITAN-VICKERS ELECTRICAL Co., R. BROOKS and W. T. GRAY. Controllers for electric traction, etc.
16 679 E. WYTHE-SMITH. Hand or mechanically driven electric generators.
16 680 FULLER'S UNITED ELECTRIC WORKS and L. FULLER. Galvanic batteries.
16 683 H. W. PARKER. Loud speaker for wireless apparatus.
16 689 A. W. SHARMAN. Apparatus for simultaneous reception and transmission of radio-telegraph signals.
16 692 THOMAS INVENTIONS DEVELOPMENT Co. and J. G. P. THOMAS. Ignition control switches.
16 702 H. G. CLARK and H. T. CULLIFORD. Insulating material.
16 703 C. F. ELWELL, LTD., and B. E. G. MITTELL. Condensers and inductance coils for tuned circuits.
16 708 G. MARR. Switches.
16 716 SIEMENS UND HALSKE AKT. GES. Electric conductors. (3/7/22, Germany.)
16 732 and 16 733 METROPOLITAN-VICKERS ELECTRICAL Co. and N. P. HINTON. Wireless receiving circuits.
16 737 T. L. ECKERSLEY. Radio transmitting systems.
16 739 A. T. COLLIER. Diaphragms for telephones, etc.
16 743 L. J. C. TOLMER. Electric lighting for vehicles. (28/6/22, France.)
16 744 P. W. BAKER. Rheostats.
16 750 K. M. RAYMOND. Electric irons.
16 756 RADIO-COMMUNICATION Co. and J. SCOTT-TAGGART. Wireless telegraphy, etc.
16 757 A. E. BOWYER-LOWE. Mounting and insulating valve legs of wireless sets.
16 758 A. E. BOWYER-LOWE. Variable resistances for valves of wireless sets.

June 28th.

16 762 A. M. TAYLOR. Electric power transmission.
16 765 J. C. TRICKEY. Wireless receiving sets.
16 772 J. R. C. AUGUST and E. K. HUNTER. Electric control arrangements.
16 775 MESSENGER AND SONS, A. C. JONES and A. KIRBY. Vapour lamps, etc.
16 814 L. S. LANGLEY. Reception of wireless telegraphy.
16 820 A. H. S. MACCALLUM. Resistances.
16 821 WESTERN ELECTRIC Co. Wire-drawing apparatus.
16 842 H. J. HARVEY. Wireless communication.
16 844 C. MAYER. Electric power systems.
16 846 W. SIMPKIN. Switch covers.
16 851 T. HUTCHINGS. Crystal detector.
16 852 METROPOLITAN-VICKERS ELECTRICAL Co. and H. G. BELL and W. J. BROWN. Wireless receiving set.
16 853 N. E. NORTH. Control of tramcar motors.
16 854 METROPOLITAN-VICKERS ELECTRICAL Co. and N. P. HINTON. Inductance coils for high-frequency circuits.
16 860 H. L. R. LUNDEN, D. GARDNER and C. G. T. SALENIUS. Arc electrodes.
16 863 J. L. CAPELLE. Resistances.
16 869 BRITISH THOMSON-HOUSTON Co. (CIE. FRANCAISE THOMSON-HOUSTON). Motor control systems.
16 874 A. F. SYKES. Electro-magnetic transmission and reproduction of sound.

June 29th.

16 876 A. M. HOOPER. Detector for wireless receiving sets.
16 877 J. MCCREATH. Earthing running rails, etc.
16 880 F. THODY. Wireless loud-speaker attachment to gramophones.
16 905 C. DELL. Pneumatically controlled condenser.
16 916 T. E. and T. A. E. HAYWOOD. Insulators for aerial or line wires.
16 932 ANC. ETAB. E. PICARD, SOC. ANON. Telephone receiver. (6/7/22, France.)
16 936 S. S. PETTICORD. Telephone instruments.
16 940 GENERAL ELECTRIC Co., LTD., and A. C. BARTLETT. Loaded telephone circuits.
16 944 W. A. CHAMBERS and R. M. ELLIS. Variable electric condenser.
16 945 FERRANTI, LTD., and S. Z. DE FERRANTI. A.C. meters.
16 948 V. PLANER. Electric distant control of signals. (28/12/22, Germany.)
16 950 P. SCHIFF AND Co. and A. BORCHERS. Arc lamp carbons and electrodes. (27/7/22, Austria.)
16 964 C. FRENCH. Automatic switch.

June 30th.

16 969 A. M. TAYLOR. Electric power transmission.
16 977 A. E. HARBORD. Vapour lamps or stoves.
16 988 E. LEWIS AND SONS and G. A. T. LEGG. Mounting tubular pole-arms on telephone poles, etc.
16 989 G. W. SHORD and C. W. WOODS. Means for locking electric lamp bulbs.
17 005 H. M. MACNAUGTON-JONES. Telephones.
17 009 E. Y. ROBINSON. System of generation of alternating current.

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THE ELECTRICIAN

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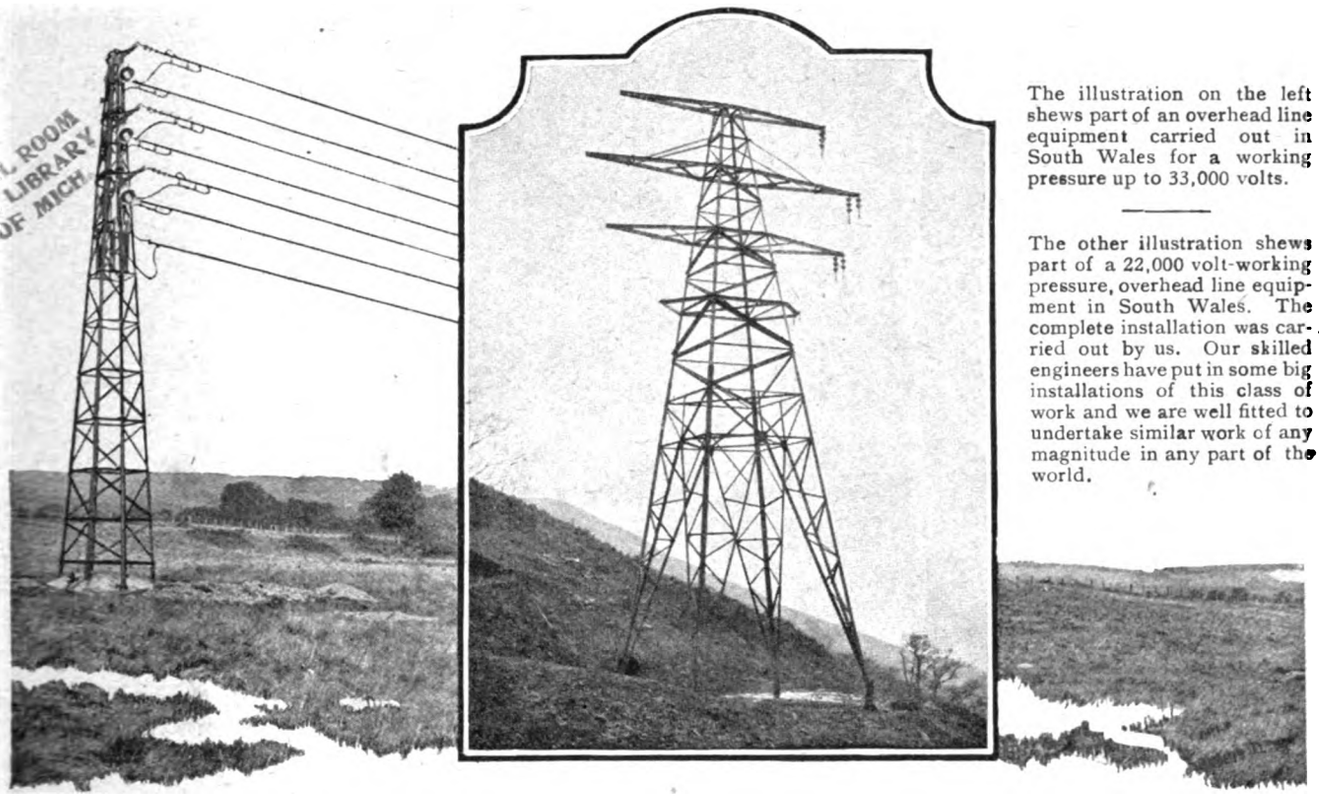

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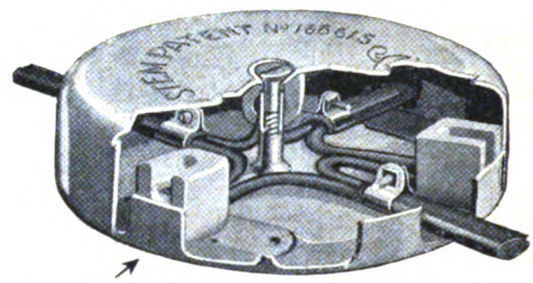

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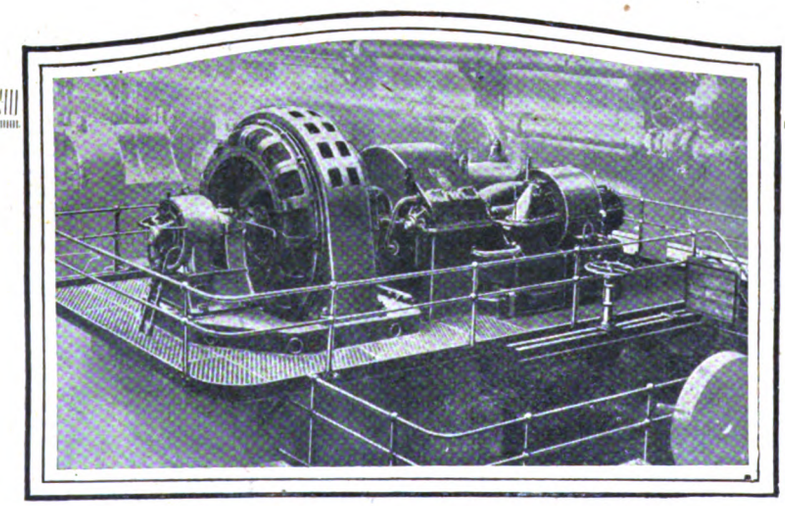

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Notes of the Week.

The New I.E.E. Council.

The result of the election for members of the Council of the Institution of Electrical Engineers for 1923–24 indicates two things: That the existing Council knew which nominees would be most acceptable to the general body of members, and that the general body of members have woken up. It may not be universally known, but there exists among the 10 000 odd members two coteries which, though singly and in the aggregate small in numbers, have all the power in elections which comes from concerted action. Each of these coteries have agreed to support members nominated by, or acceptable to, the other on the well-known ancient principle that if you scratch my back I will scratch yours. And this makes what, even when added together, is a minority vote all the stronger. Last year there was a little rift in the lute, and though the ballot is secret, we imagine this rift has had some effect on this year's results. For all the official nominees have been successful, and all the unofficial nominees have failed to secure election. In other words, Messrs. J. M. Donaldson, G. W. Partridge, P. Rosling, S. W. Melsom, Col. T. F. Purves and Dr. W. M. Thornton become members of Council next October, and Messrs. W. M. Selvey, F. W. Purse, J. N. Waite and J. H. Parker will have to live to fight again another day. We could wish the result had been a little different, but the new Council, as now constituted, should do useful work.

Electricity Supply in Edinburgh.

At the lunch which followed the formal opening by H.M. the King of the Portobello station of the Edinburgh Corporation last week, some interesting figures of the development of the undertaking were given. In 1913–14 the kilowatt hours generated were 23 000 000, in 1922–23 they amounted to 85 000 000. This was, of course, without Portobello, the prospective thermal efficiency of which is 21 per cent. In 1913–14 there were 16 000 consumers, now there are 41 000, and the revenue has increased from £142 000 to £418 000. We may add some figures that were not given. In 1913 the coal costs were 0·35d. per kWh sold; in 1922 they were 0·86d., the total costs being 0·91d., and 1·68d. respectively. The average price obtained for total supply was 2·75d. in 1922. We are glad to learn that the prices now being charged are to be reduced, and we hope that when Portobello really gets going a similar downward tendency in the costs will also be noted. Edinburgh is close to a coalfield. Its new station is excellently provided with railway facilities and cooling water. Yet its coal costs at present compare unfavourably with many undertakings not so well situated and with a lower output.

Electric Traction Economics.

America is supposed to lead in things electrical, and whether it does so or not it has certainly made a notable advance in a recent discussion on electric traction. No speaker fell into the temptation of comparing alternating with direct current, and no speaker felt called upon to give the well-known and well-worn list of the relative advantages of electric and steam working. Instead, after an interesting Paper by Mr. A. H. Babcock, detailing the fuel consumption of an average mountain-type locomotive burning oil, the various speakers confined themselves strictly to the economic question which is, after all, going to determine the matter one way or the other. If some figures given by Dr. C. T. Hutchinson are any criterion, electric traction has nothing to fear from such an examination. Its use would, he pointed out, reduce the fuel required by 75 per cent. Mr. W. J. Davis argued that this saving would be largely offset by greater fixed charges, but that electric traction meant increased track capacity, red ced

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overtime, less repairs and fewer locomotives. In fact, in practice one electric might actually replace four or five steam locomotives. Thus, even with fuel-saving counterbalanced by fixed charges, the savings on maintenance of locomotives, tracks, structures and by wages, would give a total economy of from 25 to 50 per cent. Even so, the real advantage of electric traction in this country, at least, is not that it saves but that it makes money.

Reparations and Industry.

On Thursday in last week the Prime Minister outlined proposals which the Government hope will at last bring to a solution the reparations problem, while on the same day Mr. Hugo Hirst called attention to the way in which this difficulty had checked the recovery of British trade, as exemplified in the activities of the General Electric Co. Though, Mr. Hirst said, we felt with France that our joint will must be imposed on our enemies, the occupation of the Ruhr had nearly destroyed the purchasing power of Germany and of Central Europe. The collapse of the mark was the cause of growing unemployment in Lancashire and Yorkshire, and of the loss to India, China, Australia, the Argentine and other countries of an outlet for their products. Again, reparations exacted in kind would only acerbate these sores and further depress the one thing necessary for industrial development, namely, credit. In speaking thus, Mr. Hirst expressed what is in every business mind; a patriotic desire that Germany should not escape; a recognition of the fact that some remedies are worse than the disease; and an intense longing for settlement of some kind. Such a pronouncement is badly wanted, for this matter of reparations is an industrial rather than a political question, and in settling it—for it can be settled—the advice of those who are connected with business and industry should be taken.

Cold Comfort.

We are afraid, however, that cold comfort is to be derived from the Government's statement. Mr. Baldwin is a business man and it is not surprising to learn that the draft announcement was much more definite on the subject of ways and means than that which was actually read. Foreign Office tradition and a fear of hurting French feelings caused a watering down of the original statement, and in the process we fear most of the vitamines have been extracted. If it is assumed that Germany can pay a certain sum by way of reparations, there are certain alternative methods of forcing her to do so. France has tried one; it has failed, and in failing has given a stunning blow to world trade. The British Government propose to appoint yet another Commission, which will mean yet more delay, to discover what sum Germany can pay. As to what is to be done then there is discreet silence. Yet it is the ways and means that are all important, and upon which all difference of opinion has arisen. Amidst disagreement with our Allies and faced by a grave obstacle to trade, our business men may well be apprehensive of the future and may well begin to argue that it would be better to drop reparations altogether in order that world finance and industry might be stabilised.

Dr. Deutsch on the German Electrical Industry.

Some apology is perhaps due to our readers for thus intruding into the field of politics, but the matter is so all-important both to this country and to the electrical industry, that they would do well to make themselves familiar with the daily course of the negotiations and the implications and the results of the various Governments' actions. In this problem Germany is a factor—perhaps the most important factor—and we have, therefore, much pleasure in publishing on another page of this issue an account of an interview with Geheimrat Felix Deutsch, chairman and managing director of the Allgemeine Elektrizitäts Gesellschaft, who is at present in this country. The picture he painted to our representative of the condition of the German electrical industry is black enough. It can hardly be reckoned as a competitor with our own industry. The prices of raw materials, especially coal, were high, labour costs have risen, and restrictive tariffs are a grave obstacle. The German worker is less efficient than he used to be, and developments have been checked by a scarcity of money. The cynical will say that this is mere window-dressing, but it is corroborated in more detail by the reports of the Department of Overseas Trade. And its truth is confirmed in a yet more certain way. Before the war Germany, besides being one of our strongest competitors, was one of our best customers. Now it is neither competitor nor customer. That is bad both for us and for Germany. The remedy for this lies in stabilisation, and stabilisation will never be achieved until the reparations question is settled.

The North Wales Scheme.

The most important point in the order which the Electricity Commissioners have just issued constituting the North Wales and South Cheshire Electricity District, is the compulsory transfer of certain responsibilities of the Joint Authority to the North Wales Power Co. These powers include those under Sections 12, 15 and 22 of the Electricity (Supply) Act of 1919 relating to the supply of electricity, subsidiary powers and wayleaves, the duties imposed in the order with regard to the carrying out of the technical scheme, securing supply in areas where there is at present no supply, giving bulk supply, making contracts, building stations and transmission lines, and developing the water power resources of the district. As the Power Co. is given five members out of a total of twenty-six on the Joint Authority, and as Chester has been omitted from the district, it is in every sense of the word a predominating partner. It has often been argued that one of the best ways of running a modern electricity supply scheme would be to hand the whole business over to private enterprise. The Commissioners' action in North Wales will give a chance for the soundness of this policy to be demonstrated. Incidentally the deed of transfer raises much the same point as is now being considered by the Court of Appeal in connection with the London scheme. It would seem that the Commissioners are pretty sure of their ground.

Dependence on Hydro-Electric Power.

The technical scheme is mainly interesting from the insistence it places on the development of water power in the district. By an agreement which is appended to the order the Aluminium Corporation agree to supply all the electricity generated at Dolgarrog (a station recently visited by the Institution of Electrical Engineers) to the North Wales Power Co. at a price of 0·75d. per kWh, to maintain their hydro-electric plant in good condition and to meet the maximum demands of which twelve months notice has been given provided certain figures are not exceeded, and provided not more than certain quantities have to be supplied in particular years. Dolgarrog station is not to be extended to the prejudice of the rights of the Company. By the main order the Power Co. is limited to a maximum return of £6 per kW per annum plus 0·75d. per kWh for energy supplied in bulk, and the standard price under Section 43 of the 1904 Act is to be 1·5d. per kWh. The existing generating stations in the district other than those of the Power Co. are only to be utilised until other supplies become available, and the first stage of development is to include the station at Maentwrog, with a capacity of not less than 15 000 kW. The other stations of the company are to be extended by not less than 12 000 kW, as the demand justifies. This is perhaps the most interesting, technically, of all the schemes, seeing the large area covered and the almost complete reliance on water power.

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Electro Culture.

In a leading article which appeared in THE ELECTRICIAN almost exactly three years ago we reviewed our then existing knowledge of the effect of electrical discharges on plant growth and called attention to the difficulty of drawing any definite conclusions from the results of the work, much of it very useful, that had been done by numerous detached experimenters. A few months later in his Presidential Address to the Institution of Electrical Engineers, Mr. LLEWELYN B. ATKINSON discussed the problem from much the same point of view. He said the results obtained up to then had been confused and contradictory and had not reached any degree of scientific certainty. The best that had been done up to that date was the discovery that above a certain value the effect of electrical discharge on plants was harmful rather than beneficial, and a realisation of the very numerous non-electrical factors which might confuse the results. This confusion was illustrated by the different effects that had been noticed on the same crops and the same land in succeeding years and even on the same crops on the same land in the same year.

Discouragement a Reason for Experiment.

Discouraging as all this was, however, it is no real argument against further experiments being made, and we are glad to notice from the fifth interim report of the Ministry of Agriculture's Electro-culture Committee, of which Sir JOHN SNELL is chairman, that not only is the work of research being continued but that the results are becoming stabilised. Nevertheless the investigation is far from complete, and the Committee's somewhat pessimistic statement that a period of twenty years was required to complete the investigation into a systematic application of fertilisers and that the electrical problem is even more complex is far from being unjustified. On the other hand we hope that the optimism which lies in the further remark, that the results already obtained lead the Committee to believe that positive and economic conclusions will be reached within a much shorter period than the problem of fertilisers required, if investigations are carried on continuously, will be verified by the event. That subject is in fact one which should yield to thorough examination, and, complicated as it is, it is no more difficult than many which electrical engineers have successfully tackled and solved in the past.

Work in 1922.

Turning to the report itself we learn that during 1922 experiments were carried out for the Committee by Prof. V. H. BLACKMAN at Rothamsted, the Harper Adams Agricultural College, Lincluden, and the Imperial College of Science. At the first of these places winter wheat and barley were dealt with, at the second cabbages, swedes, mangolds and potatoes, while potatoes were also experimented with at Lincluden. Seven field experiments were carried out during the year, two with cereals, two with potatoes, two with root crops and one with cabbages. Two of these gave a positive and five a negative result. This partial failure (for positive results are what are required), was to some extent due to the season and to the low yield of the cereals, the wheat crop being only about half the normal. In the case of the root and cabbage crops, owing to the doubt which exists as to the satisfactory nature of the cultural conditions, the Committee are of opinion that no safe conclusions can be drawn from these experiments, and that the results should not be included in future records. In these experiments the same apparatus was used as in previous years, the voltage varying from 55 000 to 25 000 V (crest value), and the current from 1 mA to 0·3 mA per acre.

Pot Culture Experiments.

Ten experiments with the pot culture of barley were carried out, and were more successful. The main aim of these experiments was to obtain further knowledge as to the stage of plant growth at which the discharge can most beneficially be given, and the most suitable daily duration. The discharge was applied in the first month, second month, and third month of the growing season, and also throughout the whole three months for six hours and four hours daily in each case. A separate set of plants was used for each experiment. Definite increases in yield were obtained in all cases but one, where mildew affected the results. In one case the increase in dry weight was as much as 39 per cent., though in the other it was quite small. But very marked increases in grain yield were noticed reaching as high a figure as 118 per cent. It should be specially noticed as a new effect that these increases in grain yield were usually associated with very small increases in total yield. This shows that the effect of the discharge is differential, that is, it accelerates reproductive growth apart from vegetable growth.

Marked Effect on Grain Yields.

Another interesting effect was the marked effect on grain yields of comparatively short periods of discharge. Electrification during the first, second, and third month respectively of the growing season gave in all cases large increases of grain, the second monthly period being the highest of the series with a yield more than double that of plants not subjected to the discharge. Another experiment showed that currents only about 100 times the value of the normal atmospheric current are equally as effective as the stronger current, except for plants electrified for the second month. The removal of the plants from the influence of the normal atmospheric current was accompanied by a slight reduction in yield.

A Field Installation Started.

In order to determine the result of electrification under actual farming conditions, a field installation was erected at Rothamsted during 1922 with the poles spaced widely and with high wires so that no undue interference was caused to farming, the object being to determine the kind of installation suitable for the purpose, the current required and the cost. The area thus treated is about 5 acres, and the cost of the installation was about £10 per acre. Actual estimates for larger areas show that this cost could be reduced to about £2 per acre, where the area treated was of the order of 100 acres. It is to be hoped therefore that farmers themselves will go into this question with a view to supplementing and confirming the results obtained at Rothamsted. It will be to their benefit to do so.

Future Work.

During the present year the committee are continuing their work on pot culture and on small plots to obtain results under actual field conditions, while as it has been found that the effect of the current is greater a short time after the discharge has ceased than while it is in progress, experiments are being made to ascertain the minimum period of electrical stimulation giving the greatest after effect as exhibited by an increase in the rate of growth.

It will therefore be agreed that the committee are to be heartily congratulated on their work which, as they truly say, is fraught with the most important consequences to agriculture. And we hope that the agriculturists themselves will realise this. The results so far obtained show definitely that a 20 per cent. increase with cereals can be expected and this definiteness is in itself most valuable. But the pot culture results show that the gain may be very much higher, and if an increase of 40 or 50 per cent. can be obtained in a field, electrification will be of the very greatest benefit to the farmer and to the general population. For the moment, then, while most attention will be paid to pot culture, by 1925 it is hoped that field experiments will be undertaken and that a definite advance towards the practical application of electro-culture will have been made.

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Autosynchronous Motors.

By PROF. A. LINDSTROM.

(*Continued from page* 5.)

Working Diagram and Characteristic Curves.

Fig. 5 shows the working diagram of the motor where I indicates the magnitude and phase of the leading primary current; Ep (OF) the magnitude and phase of the supply voltage, which is of course equal to the voltage at the motor terminals; E (OG) the voltage which according to Fig. 6 corresponds to the magnetising current I_l in the rotor, and XI (FG) the synchronous reactance voltage. If in Fig. 6 OAB is the no-load characteristic of the machine running as generator and I_{lo} and I_l are, respectively, the exciting current

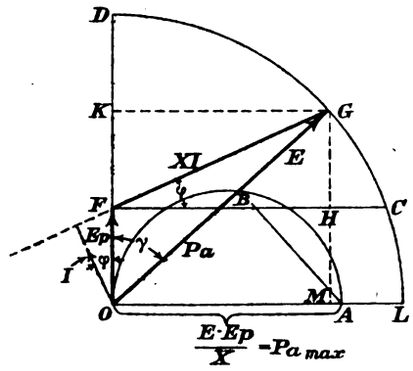

FIG. 5.

in amperes at no load as a generator and load as an autosynchronous motor indicated in Fig. 5, then the magnitude of E is shown in Fig. 6 by EO and

$$\frac{E}{Ep}=\frac{I_l}{I_{lo}}$$

The reluctance of the magnetic circuit is then assumed constant and equal to that existing at the voltage Ep and the magnetising current I_{lo}.

Further, if OD in Fig. 6 represents the short circuit characteristic of the machine as generator, I_{ko} (FD) is the current which on short circuit corresponds to the magnetising current I_{lo} and consequently the synchronous reactance

$$X=\frac{Ep}{I_{ko}}=\frac{AF}{DF}$$

The semi-circle OBA in Fig. 5 has a diameter $\frac{E\times Ep}{X}$ corresponding to the maximum active power of the motor (per phase if E and Ep are phase voltages) and the vector OB cut off E (OG) is the active power Pa developed by the motor at that moment. Pa is then equal to $\frac{E\times Ep}{X}\times\sin\gamma$ where γ is the angle between E and Ep. The angle φ indicates the phase displacement between the supply voltage Ep and the current I, which angle is negative and consequently will

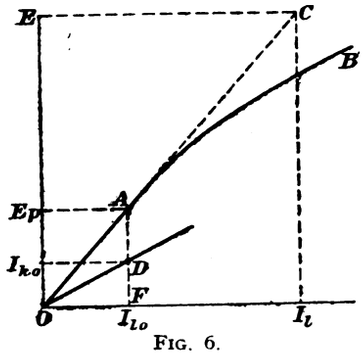

FIG. 6.

produce the required power factor correction so long as FG lies above FC. The active current component I_a is obviously proportional to FH and

$$I_a=\frac{FH}{X}$$

the reactive current component being

$$I_{re}=\frac{FK}{X}.$$

As FH is proportional to the active current the area represented by the rectangle $FHMO$ is obviously proportional to the active power and consequently at constant voltage is simply proportional to FH.

By studying this diagram the working of the motor can easily be followed. If the d.c. magnetising current is kept constant, and the motor load is varied between zero and maximum, E (OG) will also be constant, but turn round O describing a quarter circle $DGCL$. The vector FG will at the same time turn round F with its other end on the same quarter circle, while φ changes from -90 deg. at no load to a certain positive value at maximum load. It is of special interest to note how at the same time the reactive current component changes from its maximum value $\frac{FD}{X}$ at no load to $-\frac{FK}{X}$ at normal full load, then to zero when XI coincides with FC (when $\cos\varphi=1$) and finally to $\frac{FO}{X}$ at maximum load: in this latter case the reactive component is negative and consequently has an inductive influence, reducing the power factor of the plant as a whole.

In order to illustrate these conditions further. Fig. 7 gives curves drawn up to show the power factor and current (total

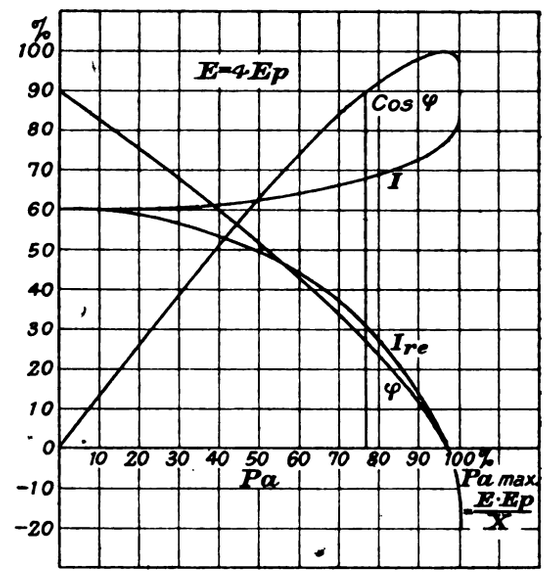

FIG. 7.

and reactive) in the motor as a function of the power Pa when this varies from nil to its maximum value—Pa max.$=\frac{E\cdot Ep}{X}$. Normal full load has here been assumed to be 77 per cent. of the maximum load and E is assumed to be equal to 4 Ep—i.e., the magnetising current at normal full load is four times as large as the magnetising current required at no load with unity power factor. Within this load variation the total primary current only varies in the ratio of 60 to 68, the reactive component, however, from 60 to 30, φ from 90 deg. to 26 deg. and finally the power factor of the motor from 0 to 0·9. The overload capacity is $\frac{23}{77}\times 100=30$ per cent.

Calculation of Mechanical Power.

The mechanical power produced by the motor is of course equal to the electrical power Pa, less the losses in the motor caused by resistance, hysteresis, eddy currents, windage and friction. As speed, magnetising current and terminal voltage are constant, and the primary current is nearly constant, the total losses will be practically constant. Consequently the difference between electric and mechanical power is also practically constant and broadly speaking equal to all the losses at no load—i.e., at $\cos\varphi=0$.

It has been stated above that the autosynchronous motor after running up to asynchronous speed automatically synchronises itself when the rotor is supplied with direct current. But as this is not achieved under all circumstances (without, for instance, increasing the magnetising current) it may be interesting to study this matter more closely.

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Synchronising Torque of the Autosynchronous Motor.

After the autosynchronous motor has been started up and whilst the throw over switch still remains in the "start" position—i.e., downwards (see Figs. 3 and 4)—the motor still runs as an asynchronous motor with a slip S depending on the characteristics of the motor, mainly the rotor resistance, and the amount of load. When the change-over switch is reversed to the "up" position—and it is assumed that the exciter has by that time reached normal voltage—no instantaneous change is made in the motor's asynchronous characteristics as the armature winding of the exciter does not add any appreciable resistance to the rotor circuit. Before any change in speed has therefore taken place the slip of the motor is still S and the torque of the motor as an asynchronous one still corresponds to the temporary load. Through this

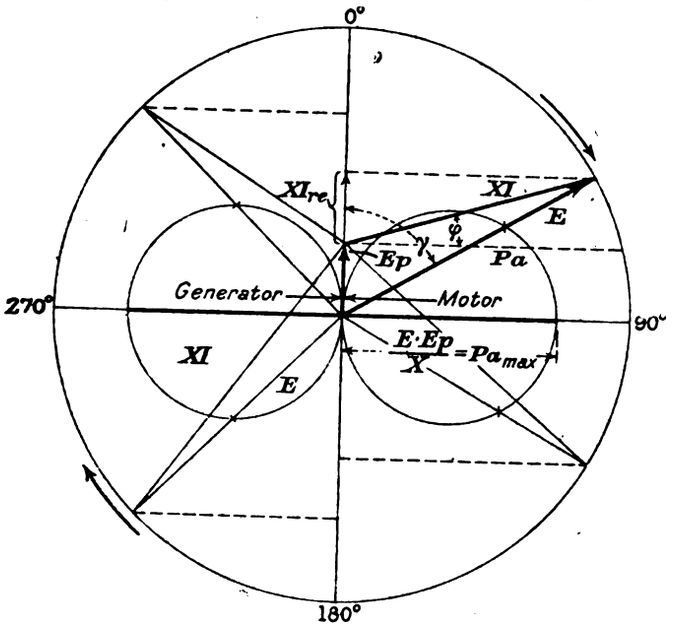

FIG. 8.

change over, however, a new torque condition has been added, a synchronous one, dependent upon the magnetisation of the rotor by direct current. This torque, however, is not constant but changes both in magnitude and direction according to the relative position of the fixed rotor poles and the poles in the stator created by the stator flux. It consequently varies according to the displacement indicated by the angle γ in Fig. 5.

In Fig. 8 the vector E is assumed to rotate at a speed which is $f \times S$ revs.* per sec. and consequently with a period of $\frac{1}{fS}$ secs. where f is the frequency of the primary current.

During this rotation I, I_{re}, φ and Pa will vary as shown in Fig. 8, which also shows that for instance I_{re} is positive above and negative below the top of Ep and that Pa is positive when the E vector cuts the lesser circle to the right and negative when cutting the corresponding circle to the left of the vertical axis of the large circle. Pa is in fact in this figure the synchronous torque M_s in question and consequently

$$M_s = M_{s\,\max.} \sin\gamma = \frac{E \times Ep}{X} \sin\gamma$$

Effect of Synchronous Torque on Speed.

It is evident that this synchronous torque, immediately after the throw over switch is moved "up," will affect the speed of the motor in one way or another. If this change over is effected when γ lies between 0 and 180 deg. acceleration occurs and between 180 deg. and 360 deg. retardation occurs. In both cases, the smaller γ is the more effective are the acceleration and retardation in question. The most opportune moment for the change over is when γ is 0 and the process of synchronising will be most easily achieved if the acceleration is strong enough to effect synchronism before the angle γ has passed 90 deg. If synchronism is only just achieved when γ lies between 90 deg. and 180 deg. the ability of the motor to remain in synchronism depends on whether γ is then so large as to make M_s larger or smaller than the load torque M_l.

* In accordance with English practice the letter f is used for frequency.

Referring to Fig. 9 and assuming that the load torque M_l = half maximum synchronous torque—i.e.,

$$M_l = \tfrac{1}{2} M_s \text{ max.} = M_s \text{ max. } \sin 30 \text{ deg.},$$

that the change over switch is in the "up" position when $\gamma = 0$ and that synchronism (which means that the rotor speed is equal to the speed of the stator field, in other words, the slip $S = 0$) is achieved under the first period, the following may occur:

Conditions of Synchronism.

1. Synchronism is achieved when γ is 30 deg.; M_s is then $= M_l$ and the rotor continues to run at synchronous speed and $\gamma = 30$ deg.
2. Synchronism is achieved when γ lies between 30 deg. and 150 deg., for instance at 90 deg.

The synchronous torque is then larger than the load torque and the acceleration should continue until γ is reduced to 30 deg. In such a case, however, the speed of the motor would be above synchronous speed—i.e., S negative, and the motor would then run as an asynchronous generator producing a retarding torque.

Actually, however, the acceleration finishes at a γ which is larger than 30 deg. but less than 90 deg. The speed is then still above synchronous speed and γ is further reduced and finally comes below 30 deg. but is then again increased and the whole results in a quickly dying oscillating movement of γ round about 30 deg. During this synchronising period the other factors, such as current, phase displacement, etc., are altered as shown in the diagram in Fig. 9 for different values of γ. In cases where the motor cannot reach synchronous speed or remain at synchronous speed, the speed is continually changing as well as the current and phase displacement. If the change over happens at $\gamma = 180$ deg. the slip is increased beyond normal during the first half period and the possibility of achieving synchronism during the following half period is then of course correspondingly less. It would be practically impossible to select a suitable moment for changeover, but if an attempt is repeated a few times success should be ensured if synchronising is at all possible. As it is of course of importance to predetermine the condition so that synchronism is possible, it is essential closely to examine the *facts governing the synchronising ability of the motor.*

The following four torques influence the rotor:—

1. The load torque, which is constant, M_l.
2. The synchronous torque, $M_s = M_{s\,\max.} \sin\gamma$.
3. The asynchronous torque, $M_a = k^1{}_1 S$.
4. The acceleration torque, $M_{acc} = k^1{}_2 m \frac{dv}{dt}$

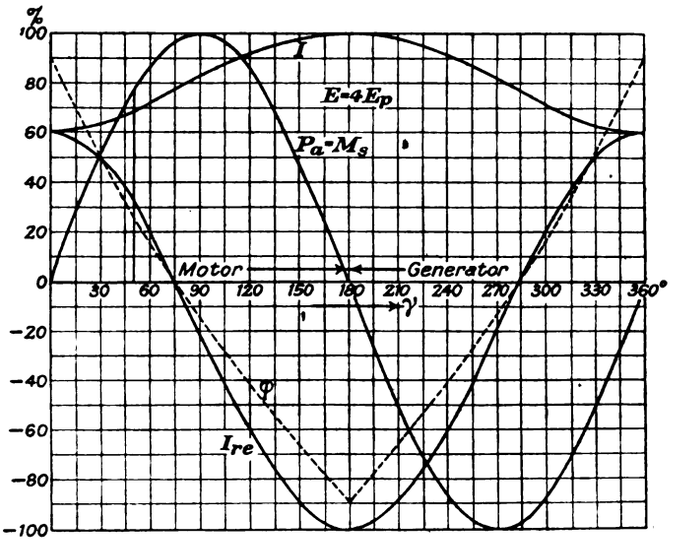

FIG. 9.

where m is the mass of the whole rotating part and v its linear peripheral speed, both reduced to, for instance, 1 m. radius. If the speed of the primary field is v_1 (1 m. radius), then:

$$v_1 - v = c \frac{d\gamma}{dt}$$

$$S = \frac{v_1 - v}{v_1} = \frac{c}{v_1} \frac{d\gamma}{dt}$$

$$M_a = k \frac{d\gamma}{dt}$$

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In addition—

$$\frac{dv}{dt} = -c\frac{d^2\gamma}{dt^2}$$

and

$$\overline{M_{acc}} = -k_2 m \frac{d^2\gamma}{dt^2}$$

In order to obtain balance it is necessary that

$$M_s + M_a = M_l + M_{acc}$$

and then

$$M_{s\,\max.} \sin\gamma + k \cdot \frac{d\gamma}{dt} = M_l - k_2 \cdot m \cdot \frac{d^2\gamma}{dt^2}$$

which equation gives, when solved, the synchronising occurrence.

As, however, this equation is difficult to solve, an approximate and more simple solution of the problem is given below.

It is assumed that the change over occurs when $\gamma = 0$ and that synchronism is reached during the first quarter period—i.e., before γ is 90 deg. The average value of the synchronous torque during this period would be

$$M_{s\,\text{av.}} = \frac{2}{\pi} M_{s\,\max.}$$

The asynchronous torque is M_a which, however, during the period is reduced from M_l to 0. The average value $M_{a\,\text{av.}} = \frac{M_l}{2}$

The torque available for acceleration is consequently

$$M_{acc} = M_{s\,\text{av.}} + M_{a\,\text{av.}} - M_l$$
$$= M_{s\,\text{av.}} - \frac{M_l}{2}$$

The torque can most suitably be calculated in kg. on 1 m. radius.

Slip Conditions.

When the synchronising operation is started the slip is S and when it finishes the slip is 0, consequently the average value during this period is $S/2$. The time of this period—i.e., the time during which the acceleration shall be achieved—is consequently

$$t = \frac{1}{4fS/2} = \frac{1}{2fS} \text{ secs.}$$

The speed must be increased from

$$v_1 (1 - S) \text{ to } v_1$$

and consequently

$$\Delta v = v_1 - v_1 (1 - S) = v_1 S$$

where v_1 is the speed at 1 m. radius in m. per sec. We consequently get

$$M_{acc} = m \cdot \frac{\Delta v}{t} = m \cdot 2f \cdot v_1 \cdot S^2$$

and therefore

$$M_{s\,\text{av.}} - \frac{M_l}{2} = 2\,m \cdot v_1 \cdot f \cdot S^2 \quad \ldots\ldots\ldots \quad (1)$$

If N_1 represents the number of H.P. corresponding to the load and n the synchronous speed in revolutions per minute

$$M_l = \frac{60 \cdot 75 \cdot N_1}{2\pi n} \; (kgm)$$

If E and Ep are voltage per phase and N_s max. is maximum output of the motor as a synchronous machine in H.P.—

$$N_{s\,\max.} = \frac{3E \cdot Ep}{736\,X}$$

and

$$M_{s\,\text{av.}} = \frac{2}{\pi} \cdot \frac{60 \cdot 75 \cdot N_{s\,\max.}}{2\pi n} \; (kgm)$$

If GD^2 is the flywheel effect of the rotating parts in kgm^2.

$$m = \frac{GD^2}{4 \times 9{\cdot}81}$$

The above formula (1) which, of course, due to the assumed conditions and simplifications made, must be regarded as only approximately correct, is, however, specially instructive as it clearly shows which characteristics and circumstances govern the synchronising and in what respect these facilitate or make synchronising more difficult.

From the above it is obvious, for instance, that a large $M_{s\,\max.}$ helps synchronising and a large M_l makes synchronising more difficult, as does a large m (GD^2), v_1, f and S.

If H.P. is introduced instead of torque and kinetic energy E $(= \frac{1}{2}mv^2)$, the following result is achieved:

$$\frac{2}{\pi} \cdot N_{\max.} - \frac{N_1}{2} = \frac{4}{75} \cdot E \cdot f \cdot S^2 \quad \ldots\ldots\ldots \quad (2)$$

Some Concluding Deductions.

The following deductions, amongst others, can now be made:

1. It is of very great importance to keep the rotor slip as low as possible (i.e., to put as much copper as possible in the rotor winding) if the motor is to start with a big load or if the rotating parts have a large flywheel effect or, still more, if both these conditions exist.

2. Under similar conditions a large overload capacity is of importance. As this is already decided by other circumstances it is important to arrange for the possibility of increasing the same during the synchronising period by increasing the magnetisation of the rotor.

3. If the motor is started without load there is no risk whatsoever of failure to obtain synchronism.

4. If the flywheel capacity in the driving machinery is very large it is preferable to use a flexible coupling, or a long belt, either method of which is preferable to direct coupling.

5. All other conditions being equal, a low periodicity supply is preferable to a high one.

Review.

Electric Cranes and Hauling Machines. By F. E. CHILTON. (London: Sir Isaac Pitman and Sons.) Pp. 114. 2s. 6d. net.

The enterprise of the publishers in getting out their now rapidly growing series of technical primers is to be commended, and the little volume "Electric Cranes and Hauling Machines" by Mr. F. E. Chilton is apparently the sixty-third on the list. The contents are divided into nine chapters; the first on development of electric driving, the second on control equipment on cranes, and the third, fourth and fifth chapters to descriptions of various types of electric cranes. The sixth chapter describes accessory appliances for cranes, the seventh and eighth describe capstans and winches respectively, whilst the ninth is devoted to haulages and winding gear. There is appended a useful bibliography which will be of assistance to the student who is making a systemised study of the subjects touched on by the primer under review, as although the descriptions of the various types of cranes, capstans, winches, and other electrically driven apparatus given are well backed by excellent and numerous illustrations, the booklet is obviously intended to be taken as first steps only on the subjects.

We notice, however, one or two erroneous items which do not seem to us to be strictly in line with practice and fact, and which should be amended in future editions.

Under electric haulages a curve is given (Fig. 46) for readily showing the H.P. of main haulages, and an explanation is given in the text as to the manner of using it and finding the total load to be hauled. The figures for the necessary H.P. of the motor are entirely misleading, as no account is taken of the effect on the rating of the motor due to the intervals for tub changing, and of the return journey with the motor declutched. Haulages should invariably be fitted with motors rated on the complete cycle of operations, that is, on the R.M.S. value, and on no account should short time rated motors as for cranes be installed. This can always be done by obtaining from the colliery engineer a complete specification of the duty the haulage under consideration has to undertake. The endless rope haulage curve is even more misleading, as the weight of trucks and rope outgoing are not balanced by the incoming trucks and rope. The friction on these on both full and empty sides has a plus sign and must be taken into account, otherwise a large error will be introduced. Fortunately the author gives an analytical method of arriving at the rope pull on haulages, and if this method is applied by the student to the calculation of the power for haulages of all types, much more accurate results will be attained. We regret to have to point out a serious misstatement regarding the use of Ward Leonard flywheel system controlled winders, which system is stated to have found most favour. The fact that is the a.c. winder has far outdistanced that system in popularity and numbers in this country; the reason being that, although Ward Leonard control is ideal for hoisting purposes, its installation is only economical under very special circumstances.

CHARLES RAEBURN.

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Electricity Supply in Edinburgh.

The King opens New Scottish Capital Station.

As briefly announced in our last issue, the King opened the new Portobello station of the Edinburgh Corporation during his visit to Scotland last week. On arrival at the station the King, who was accompanied by the Queen and the Duke and Duchess of York, was received by the Lord Provost of Edinburgh and the Magistrates and Council of the City. The Lord Provost made a short speech, reviewing the history of the undertaking, and in reply His Majesty said that he had heard with interest the history of the development of this scheme, and appreciated the enterprise shown by the City of Edinburgh in making available such abundant supplies of electricity for the many purposes for which it was required at the present time. It was an additional source of interest that this was the first electricity district to be constituted in Scotland; and he was gratified to hear of the co-operation of the County Councils of East Lothian and Mid Lothian in the undertaking. The successful completion of a scheme of this magnitude, costing as it did over one and a half million pounds, was a great tribute to the skill of the distinguished electrical engineer who had acted as the technical adviser of the Corporation, and of all those who had worked under his direction.

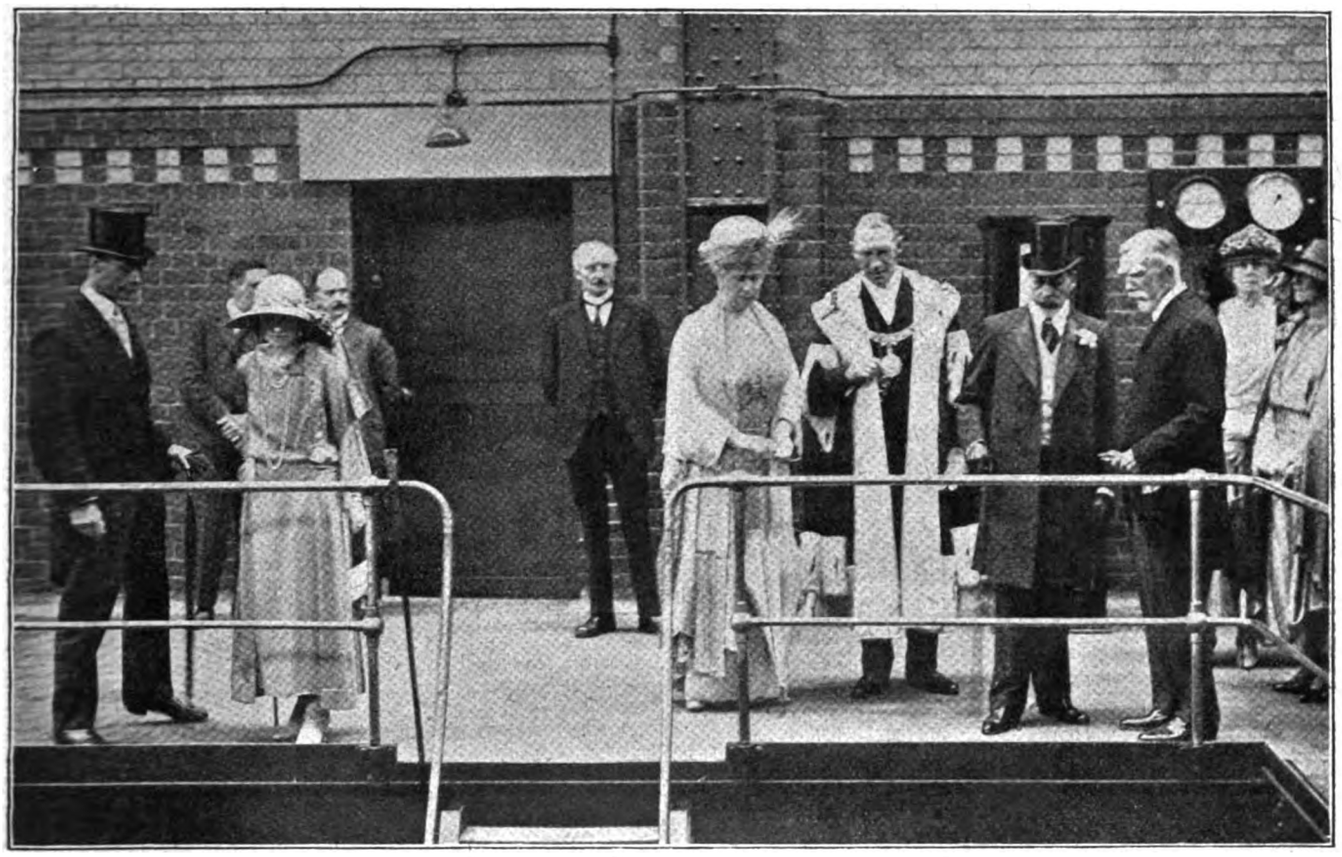

FIG. 1.—THE ROYAL PARTY AT PORTOBELLO: THE KING IS SEEN TALKING TO SIR ALEXANDER KENNEDY.

The Lord Provost then presented the King with a golden key, with which he opened the main door of the station. Afterwards the royal party made a thorough inspection of the plant, and were evidently much interested in what they saw. A view of the Royal Party in the station is given in Fig. 1.

The History of the Scheme.

Following the Lord Provost, and diving into history, we may remind our readers that the Corporation were advised by Sir Alexander Kennedy as long ago as 1913 to build a third station, which should relieve the load on the two existing stations at Dewar Place and Macdonald Road. In accordance with this advice a site was acquired at Portobello, on the sea front. This is about three miles from the centre of the city and about eight miles from the Lothian coal district. It is also connected by railway with the Lothians branch of the London and North Eastern Railway. Contracts were entered into for the erection of the station, and the work was actually started, but was stopped by the Ministry of Munitions in 1916. When work could be resumed, in 1919, it was decided to discard the original plans and erect a station on a much larger scale. This idea was approved by the Board of Trade, and the present station, which was designed by Sir Alexander Kennedy, will have an ultimate capacity of 100 000 kW. The cost of the station as it stands is £1 580 000, of which £300 000 has been for buildings and £717 000 for machinery and plant. Some of this expenditure, however, has been on works which were necessary for the preparation of the entire site, and in calculating the cost per kilowatt installed this must therefore be allowed for.

Architectural Features.

The first section of the station, a plan of which is given in Fig. 2, is capable of housing 45 000 kW of plant, 30 000 kW being at present installed. Architecturally, the building, which was designed by the city architect, Mr. J. A. Williamson, is rather more ornate than is usual with modern power stations, and presents a handsome frontage to Portobello High Street. The principal elevation consists of three storeys, broken up by a series of pilasters, which support an entablature of stone and are carved with Ionic capitals. The west elevation is pierced by the turbine room window, which is 38 ft. high and 37 ft. wide, and is flanked at the north and south side by lofty pylons. The lower storey has been built of adamantine bricks of a purple tone, while the upper parts are of red terra-cotta facing brick. A view of the exterior of the station is given in Fig. 5.

The station is divided into four parts, consisting of the southern annexe, which contains the offices, laboratory, battery and switchgear rooms and switch control rooms, the turbine room, the central annexe, which contains pipes, feed pumps, tanks, and mess rooms, and the boiler house. The building is a steel frame, with enclosing walls of brick, and ferro-concrete has been used for the floors, roofs, coal bunkers, and hoppers. The building is carried on a reinforced concrete raft, varying from 2 ft. 6 in. to 11 ft. in thickness. The circulating water pumps and the step-up transformers for the Lothians supply are in a separate building.

Coal Supply.

The main coal supply is obtained by rail and there is siding provision for sixty full trucks and forty empties. The trucks are

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emptied by a rotary tippler into a hopper below ground level. From this hopper coal falls on to a belt conveyor with a capacity of 100 tons per hour. This runs through a tunnel to the boiler house site, whence it discharges on to another belt conveyor,

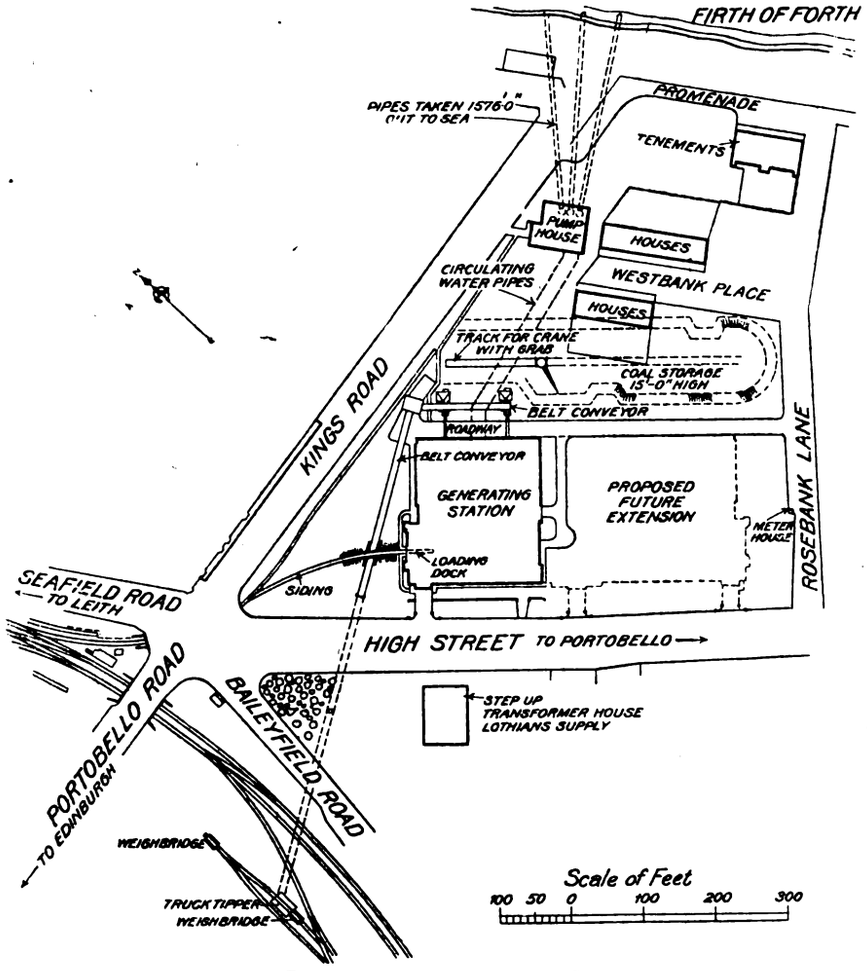

FIG. 2. SITE PLAN OF PORTOBELLO STATION.

which in turn discharges it into hoppers feeding gravity bucket conveyors which carry the coal up into the bunkers provided over each boiler house. The first belt conveyor can also discharge into a bunker near the boiler house, from which coal can be transferred by means of a travelling grab crane to the storage dumps, which have a capacity of about 15 000 tons. The greater part of the coal handling plant is electrically driven. For marshalling the trucks and bringing them on to the truck tippler electric capstans are provided, and there are weighbridges for weighing the trucks before and after they are emptied.

Ashes are discharged from hoppers below the boilers into skips These skips are run by hand to the north side of the boiler house, where they are lifted by a telpher hoist, and tipped into a reinforced concrete ash bunker, from which they are discharged into motor lorries which take the ashes away to a tip. A vacuum plant extracts the flue dust from the boilers, economisers, uptakes and chimney bases. This conveys the fine flue dust through pipes to a receiver outside the north wall of the boiler house, from which the dust can be discharged into motor lorries.

Steam Raising Plant.

The steam raising plant consists of six Sterling Tridrum boilers with superimposed economisers, each of a normal evaporative capacity of 65 000 lb. per hour. Two of the boilers are fitted with Babcock and Wilcox chain grate stokers, two with Erith Riley stokers, and two with the Underfeed Stoker Co.'s self-contained type of travelling chain grate, so that some interesting comparative tests should be possible. Each boiler is provided with forced and induced draught, and any two (they are arranged in pairs) are able to supply sufficient steam for running one of the main sets on full load.

The ultra-modern steam pressure of 300 lb. per sq. in. has been adopted, with a superheat of 700 deg. F. Each boiler has a heating surface of 11 160 sq. ft., a superheater heating surface of 2 500 sq. ft., an economiser heating surface of 5 800 sq. ft., and a grate area of about 400 sq. ft. The boilers are steel cased, lined with fire bricks. The economisers are carried on an extension of the framing which supports the boilers, and are also steel cased. The induced draught fans are above the economisers, each boiler having its own induced draught fan, but there is only one chimney for each pair of boilers. The top of each chimney is about 100 ft. above the firing floor. The base of each chimney is fitted with a special dust-catching chamber to prevent the emission of fine ash. A very complete set of instruments, including steam and feed-water meters, coal weighers, steam pressure and temperature indicators, draught indicators, and flue gas analysers, has been provided. There are three turbine-driven feed-water pumps, each with a capacity of 18 000 galls. per hr.

Turbo-Alternators.

The turbo-alternators are of Brown Boveri's design and manufacture. They have a continuous maximum rating of 12 500 kW at a power factor of 0·85. They generate at 6 600 V and a frequency of 50 when running at 1 500 revs. per min. Each turbine exhausts into a condenser with an area of 15 500 sq. ft., the vacuum maintained being 29 in. at a temperature of 55 deg. F. About 840 000 galls. of circulating water are required per hour when the station is on full load, and these are provided by three vertical spindle centrifugal pumps driven by 220 H.P. motors. Each pump is capable of providing the full supply.

The condenser extraction pumps are driven by small steam turbines running at 2 000 revs. per min. Each condenser has duplicate water and air extraction plants, one of the steam jet and one of the kinetic type. The extraction pump turbines exhaust into feed water heaters through which the condensate is passed on its way to the feed pumps and boilers. A "Degasser" is provided between the feed heaters and the feed pumps. Additional feed heaters are provided on each set to raise the temperature of the feed water entering the economiser to at least 150 deg. F., these heaters being fed by steam taken from the main turbines. A view of one of the condensers is shown in Fig. 4.

The station also contains a 900 kW turbo-alternator, which is used to provide a stand-by supply for the station auxiliary plant.

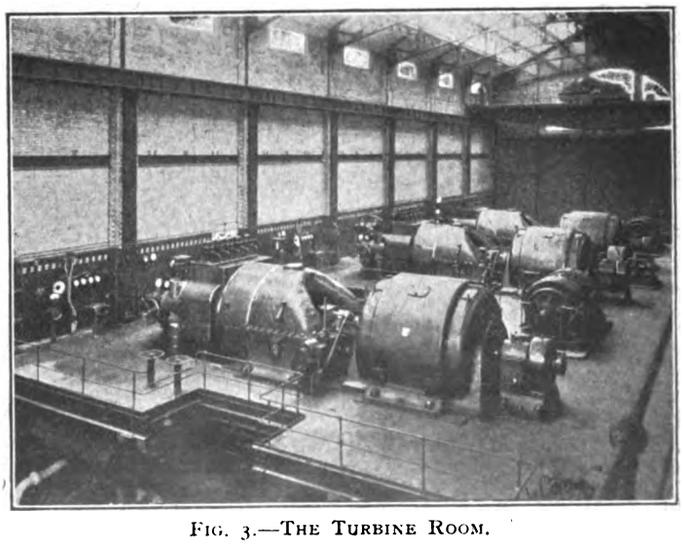

FIG. 3.—THE TURBINE ROOM.

The switchgear has been supplied by the British Thomson-Houston Co., and consists of stone cellular gear with motor-controlled spring-operated oil switches of the H type. The switchgear cells occupy three floors of the switch house, which

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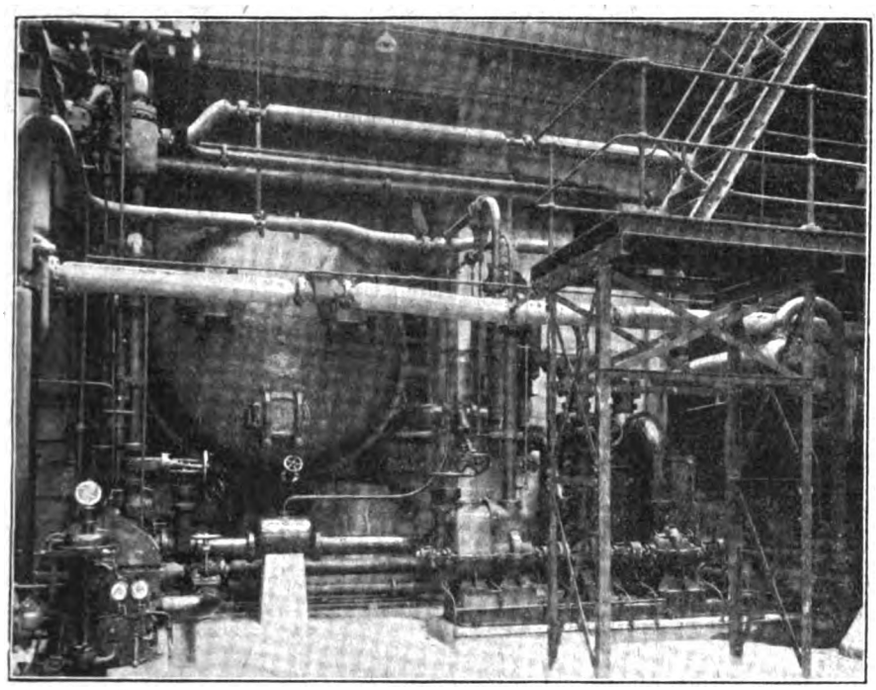

FIG. 4.—THE CONDENSING PLANT SHOWING TURBINE-DRIVEN EXTRACTION PUMP.

is adjacent to the turbine room, whilst remote control boards and also the panels controlling low tension a.c. and d.c. supplies for station auxiliaries and local traction feeders occupy the topmost floor. This operating room gives access to a gallery commanding a view of the whole of the turbine room.

The high tension busbars are in duplicate, as also are the oil switches for the generators and the principal trunk feeders. Each set of main bars is further subdivided into four sections, three being used for supply to the Dewar Place, Cowgate, and McDonald Road sub-stations respectively, the fourth to the Westgate local distributing centre in the basement.

Feeder Arrangements.

Three trunk feeders, each of 5 000 kVA, are provided to each sub-station, one of these feeders being equipped with duplicate switches and isolators permitting service to be obtained from either set of busbars, and the local centre is supplied through two 5 000 kVA equipments. The distribution from this centre is effected through 3-pole solenoid-operated oil switches of the O.F. pattern.

Protection is afforded the generators by the usual arrangement of circulating current transformers and relay and inverse time limit overloads, whilst over-voltages are guarded against by a special cut-out operating in connection with the B.B. voltage regulator and automatic field switch.

The feeders are protected by inverse time limit overload relays, and in addition a new form of protection, to give selective switching on parallel feeders and inter-connectors, is being developed to the requirements of the consultants.

The station auxiliaries are supplied by three-phase current at 400 V 50 cycles through four 1 000 kVA step-down transformers, the low tension current being controlled through a 16-panel flat back board equipped with duplicate busbars. As already mentioned, this board is located in the main control room, where it faces the high tension remote control panels. Other panels in the control room control the d.c. side of various synchronous motor generator sets for lighting and traction.

A battery for supplying the necessary power to operate the oil switches and protective devices is installed.

At one end of the control room there is a switchboard for the Portobello tramway section, which is supplied from machines installed at Westbank. The whole of the power generated by the plant at the new station is at present distributed from the power station by means of nine cables, three leading to each of the principal converting stations at Cowgate, Dewar Place, and McDonald Road. Each of these cables is capable of transmitting 4 500 kW, and is about three inches in diameter over all. Further switchgear, transformers, transmission cables and ovehead lines are now being prepared for a pressure of 33 000 V for providing supply to the Lothians, and further switchgear is to be installed by the British Thomson-Houston Co., to control the 10 000 kVA feeders.

Civil Engineering Work.

In conclusion, we may mention that a considerable amount of civil engineering work was necessary in conjunction with the provision of the condensing water. As the foreshore at Portobello shelves very gradually it has been necessary, in order to secure an ample supply of water at low tide, to place the intake water shafts about 500 yd. from high-water mark. The work has been carried out by sinking shafts near the promenade at the sea front and tunnelling out from there a distance of 1 570 ft. to meet other shafts sunk into the sea bed. Three sets of shafts and tunnels have been provided, each of which can be used for either flow or return, and it is intended that normally two of these will be used for drawing the water from the sea and the third for returning it. On emergency only two tunnels need be used, one for suction and one for return, allowing the third to be cleaned or repaired. The velocity in the return tunnel will normally be double that in the intaking tunnels, thus tending to scour out the tunnel. The positions of the sea shafts are marked by beacons equipped with a winch. The tops of the sea shafts are fitted with machined gun-metal faces about 18 in. above the sea bed. On this face a sealing cap can be lowered from the beacon when necessary for sealing the opening and allowing the tunnel and shaft to be emptied and cleaned out. When in use, each sea shaft top is protected by a grid. At the lowest tide observed there is always about four feet of water covering the top of the sea shafts. The insides of the tunnels and sea shafts are made smooth by lining with cement concrete.

As mentioned above, the design of the station was due to Sir Alexander Kennedy, his partner, Mr. S. B. Donkin, being responsible for the details, and Mr. D. T. Powell, resident engineer. The work in connection with the transforming plant and the transmission lines to the Lothians was carried out by Mr. F. A. Newington, city electrical engineer.

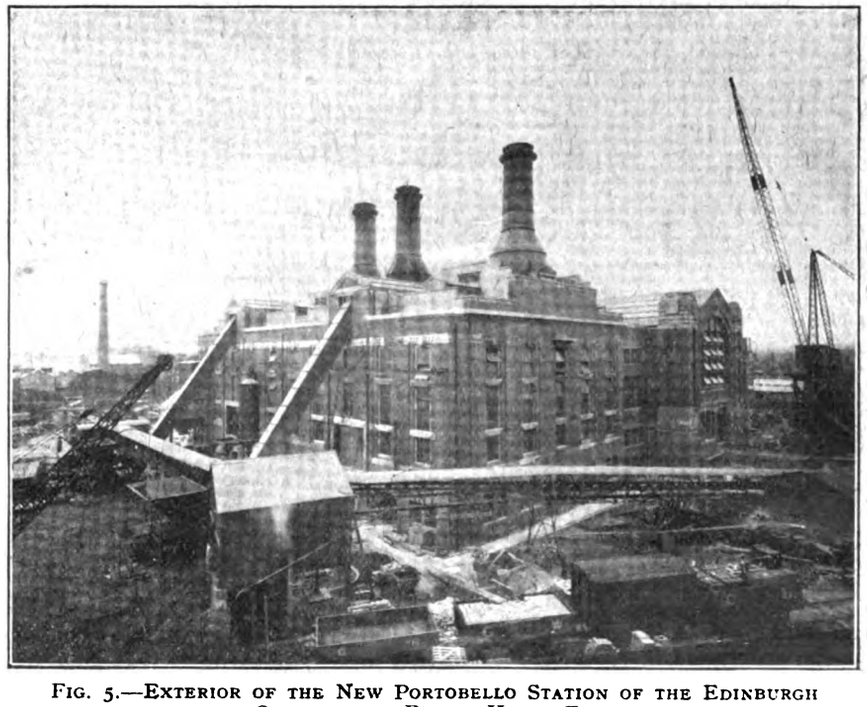

FIG. 5.—EXTERIOR OF THE NEW PORTOBELLO STATION OF THE EDINBURGH CORPORATION, BOILER HOUSE END.

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Atomic Projectiles and Their Properties.

(*Continued from Vol. xc., p. 367*).

Owing to an indisposition, which coincided with the fatal illness of Sir James Dewar, Superintendent of the Royal Institution, who died on March 27th, Sir Ernest Rutherford had indefinitely to postpone his sixth lecture. In order to be able to notice the last three lectures together, we interrupted publication of our abstract, which we now resume, the concluding lecture having been delivered at the end of the Royal Institution's season on June 17th.

In the fourth lecture, Sir Ernest Rutherford discussed the peculiarities of C. T. R. Wilson's ionisation trails. When radioactive particles are fired into air supersaturated with aqueous vapour, each particle leaves ions behind which, serving as condensation nuclei for the moisture, mark the path of the particle. In Fig. 16 the upper straight curve is the trail of an α particle, the lower crooked curve that of a β particle; the fainter straight track between the two others is also due to a β particle. How was it, he argued, that the slower α particle gave so many more condensation nuclei than the far swifter β? And why did, in the case of the α, the ionisation increase as the speed of the particle decreased?

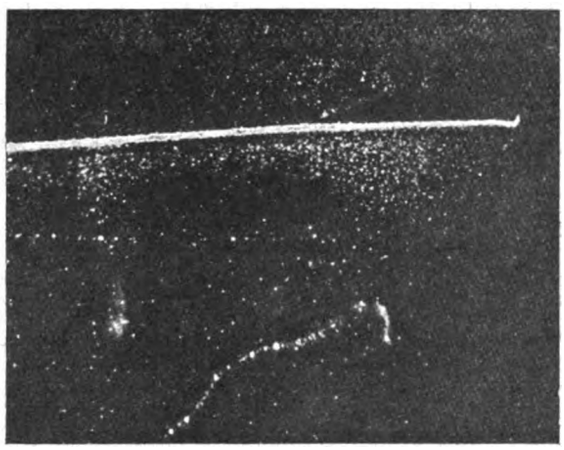

FIG. 16.

The opposite might be expected. The reasons were these: In its range of about 7 cm. the α would pass through many atoms or molecules, all complex structures of nuclei and electrons; it would expel an electron when it came sufficiently near it to give it momentum. The impulse the electron would receive depended upon the time during which the α

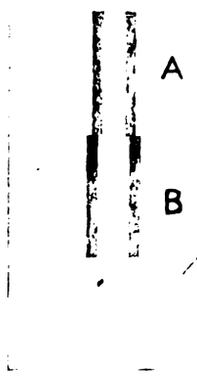

FIG. 18.

was within the range of the mutual forces. Now the swifter the particle, the shorter would be that period of probable activity. For that reason the α particles were more effective ionisers when slow, i.e., when near the ends of their paths, and more effective also than the twenty times swifter β particles. Moreover, the α particle carried two charges, the β only one charge. To exemplify these cases, Sir Ernest made use of his pendulum magnet; when passing a stationary magnet very swiftly the pendulum was not deflected; when it came on slowly it was diverted.

The Electron as Ioniser.

Sometimes an α particle would expel an electron with sufficient energy to make this electron itself act as ioniser. The α particle then proceeded on its straight track; the secondary electrons went off in short side tracks, as Bumstead had observed, by firing α particles into moist hydrogen (Fig. 17). It might, however, be thought that the facts were not so simple as represented, and that an α particle might knock out more than one electron from the same atom. In exact experiments Millikan had, however, not found evidence of more than one electron being removed from one atom in ordinary gases, except in helium. There 20 per cent. of the ions liberated had carried double charges; these charges

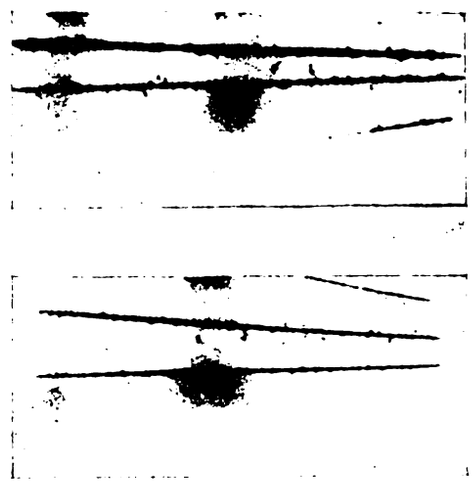

FIG. 17.

might be due to the two K electrons which the helium atom contained inside its nucleus of four positive charges. The case was probably not quite so rare; it would be difficult, however, to prove the two charges. But in shooting through thousands of atoms, the α particle would lose energy and speed, and we could determine that loss by measuring the deflection which the particles suffered in a field of known intensity before and after passing through a screen of mica or aluminium. In Fig. 18 the bands A marked the original deflection and B the subsequent greater deflection of the slower particles. By this method, which the lecturer first

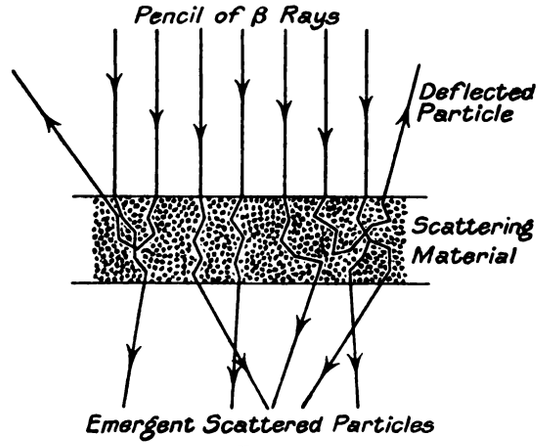

FIG. 19.

applied in 1903, Marsden had shown that the stopping power of a gold foil, weighing 4·3 mg. per sq. cm., was equal to that of 1 cm. of air; the curve of the stopping power was regular, as long as the thickness of the gold foil did not correspond to more than 6 cm. of air; for foils of greater thickness the curve became irregular, but the speed of α rays could be reduced to any desired degree by the aid of screens.

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Scattering Effects.

When passing through such screens the α particles would themselves be deflected, especially if they approached a nucleus, and a homogenous pencil of rays would hence appear scattered on emerging. That scattering was far more pronounced with the much lighter β particles, which, after repeated tortuous deflections, might come out on the near side of the screen as if they had directly been "reflected" (Fig. 19). The α particles, of greater mass and energy, were less liable to this cumulative deflection, and were hence mostly scattered through a few degrees only; moreover, their "reflection" was more real, and not merely due to repeated deflections. Under certain conditions, however, there would

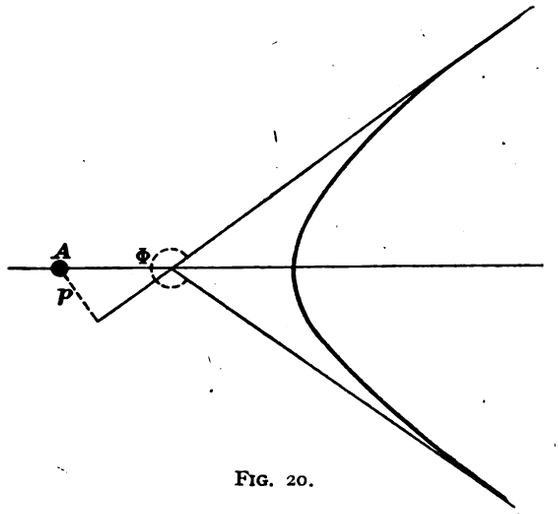

FIG. 20.

also be considerable scattering of α rays, and it was the exploration of the degree of scattering which had led to the modern views on atomic structure. When an α particle, carrying two positive charges, actually approached a nucleus (a relatively very rare case), which was also positively charged, the repulsion would be very strong, and the α would be deflected in a path which, assuming the inverse square law to hold, should be a hyperbola, as in Fig. 20, when φ marked the angle of deflection. In Fig. 21 further paths were traced; one particle hitting the nucleus straight, was deflected or reflected through 170 deg., others of more glancing approach were diverted through smaller angles.

To get so near the nucleus the particle must be very swift; but if so, a reflection after "collision" and various deflections would occur, as Sir Ernest demonstrated with the aid of his magnet-pendulums. There were no actual collisions in these cases, the pendulum, like the α particles, being merely deflected

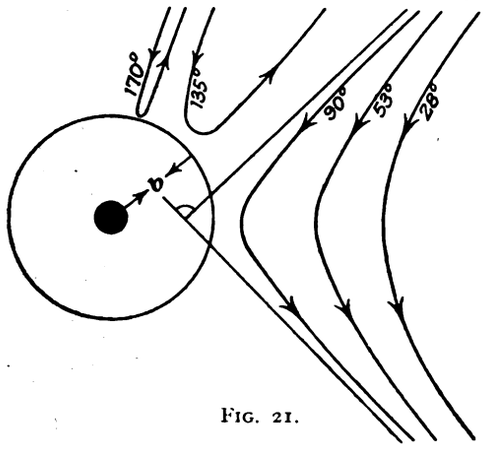

FIG. 21.

by the electric forces. But the ordinary laws governing mechanical collisions held also for atomic collisions, so far as momentum and energy were concerned. The frequency of the collisions and hence the scattering, would, however, depend upon the particular forces. Theoretically the number of particles deflected through a large angle φ varied with $\mathrm{cosec}^4(\varphi/2)$ and with the product $(Ne)^2$, where N was the atomic number indicating the number of residual charges e on the nucleus. That law had been tested by letting α particles from the radium *C* fall through a long fine slit upon the material to be examined and beyond that upon a screen of zinc sulphide which the scattered α particles would hit; the numbers of scintillations observed per sq. cm. of screen per minute were counted with the aid of a microscope behind the screen, and by moving the microscope up and down the screen, the rate of scattering could be studied.

A Novel Experiment.

Before proceeding further, Sir Ernest interposed a novel experiment not previously tried. In front of the small hole of a Geiger counter (Fig. 22) charged to 1 200 V, was placed a button of carbon *C* and beyond this, obliquely to the hole and button, some polonium. (Polonium is used because it does not give any β rays which would complicate the phenomena.) Carbon being an element of low atomic weight should scatter the α particles very little, and indeed no α entered the counter, though the polonium was emitting abundantly. But when a small piece of the finest gold foil *Au* was so held between the

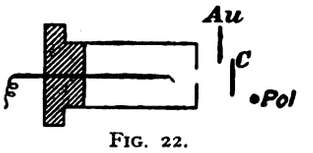

FIG. 22.

carbon and the counter that the scattered α particles could hit the gold, the heavier gold scattered these particles so much (through nearly 90 deg.) that some of them entered the counter and made the string electrometer connected with it kick rapidly; the kicking stopped again, as soon as the gold foil was taken away. A similar experiment was then shown for β rays. They were so diverted (downward in Fig. 22) that they passed the window unable to enter: a plate of aluminium or better still, lead, so held as to reflect the rays into the hole, made the electrometer kick.

Effects of α Particles on Light Atoms.

Passing on to the effects of α particles on light atoms—e.g., of oxygen and nitrogen, Sir Ernest showed some of the remarkable photographs which P. M. S. Blackett had obtained in the Cavendish Laboratory within the last few weeks. In these experiments of the Wilson type a sheaf of divergent rays is emitted by a radioactive source, and two photographs are taken in planes at right angles to one another on the same plate; by comparing the left and right photographs (as in

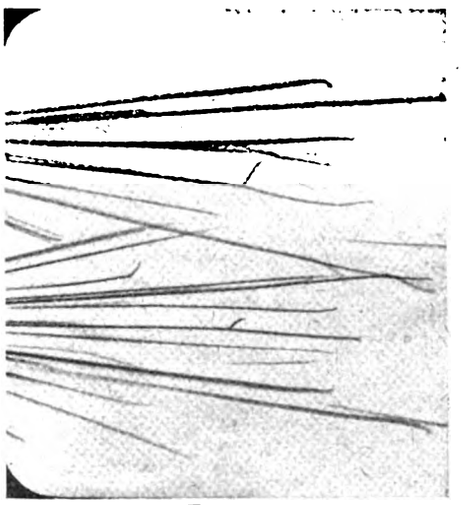

FIG. 23.

Fig. 23) prospective effects can be eliminated, and the angles be measured at which the projectile and target proceed in their rotation after a collision. When two equal billiard balls, the lecturer demonstrated, hit one another in exact alignment, the projectile stops and the target moves on. When the impact is not straight, but oblique, the balls rebound from one another, at right angles if the two balls be of the same mass, at other angles if the masses differ. By measuring the angles and the paths traversed after collision the masses can be deduced. When, now, α particles hit the oxygen atoms the α went off to the right, the more sluggish oxgyen atom moved a shorter way to the left; from the measurements the mass of the oxygen atom was estimated at 16·7 or 16·3 (instead of 16). In Fig. 23 the projectile was an α particle, the target a helium atom; the masses were therefore nearly equal, and the angle should be 90 deg.; the angle found was 89 deg. 40 min., which would yield for the helium atom 4·03 (instead of 4).

(To be continued.)

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Advertising in the Engineering Press.

Headlines and Nameplates.

By HUGH M. GOODY.

However good the "copy" of an advertisement may be, it is useless unless it is read, and to be read it must depend largely upon the forcefulness of the headline. The function of a headline, however, is not merely to awaken interest, but to awaken interest in *the product*, and, more even than that, it must awaken *favourable* interest.

Some Bad Examples.

Let us examine one or two suppositious headlines which do not comply with the above rules. We will assume that a manufacturer of electric motors finds it possible to make some semi-humorous connection (either in prose or verse) between the word "revolution" and his motors. (The kind of thing I have in mind will quickly occur to the reader.) In a strained effort to be topical, he inserts such an advertisement at a time of labour unrest. The effect on 90 per cent. of the readers is probably somewhat as follows: The headline is sufficiently unusual to ensure its being read; thus it fulfils the first of our conditions by awakening interest. But does it awaken interest in the product? Is there, that is to say, any obvious association of ideas between the word "revolution" and an electric motor. Is there even any *desirable* association (as between the word "reliability" and any product) which it is worth while by reiteration to engrave on the reader's mind. The answer to these questions is hardly in doubt. Finally, is the attention which such a headline evokes favourable, or, at least, not unfavourable? Even that cannot be said, for the average reader will feel, first, that such a headline is in the nature of a "trap," and, secondly, that both it and the copy are rather foolish and undignified as applied to an engineering commodity. Such a headline, therefore, while it may strike the advertiser at first glance as being rather "clever," fulfils none of its proper functions.

The Blunderbus Headline.

Then there is the blunderbus headline, which seeks to bully its readers into attention, the sort of thing which says "YOU!" in large letters. This is not, perhaps, very common in engineering advertisements, but it is still occasionally met with. The condemnation of this type of headline lies in the fact that the attention which it attracts is so exceedingly unfavourable as almost to stultify the whole of the advertisement. A third type of headline possesses in an exaggerated form one of the faults ascribed to our first example. This is the headline which has no connection at all with the advertisement proper (headlines and even illustrations of this type are by no means so uncommon as might be thought).

Attraction and Suggestion.

The headline, then, should attract the reader's eye in an open and fair way, should suggest the merits of the product and the interesting nature of the "copy," and should form a natural introduction to the advertisement proper. The requirements sound simple, but headlines of this kind do not hang on every bush; and it is worth the advertiser's while to devote serious consideration to his choice of headlines.

The Slogan.

Before leaving this subject, I propose to deal briefly with the advertising "slogan" which bears certain resemblances to a headline. The slogan may be described as a form of words which crystallises the policy of a firm, the goods which it makes, or the merits which these goods possess, into a short, pithy, easily-remembered phrase. Examples which will occur to all electrical men (and which need no acknowledgement) are:—

"The perfect path from power to production."
"Switch on Ediswan."
"The sun's only rival."
"A little bill with a Tantalum Lamp."

The value of a slogan to the engineer when advising to engineers is not quite the same as to the "national advertiser." Nevertheless, its uses should not be underestimated, since a clever phrase of this kind, used systematically, has undoubtedly a cumulative effect of a very valuable nature. The features of a successful slogan are largely these: It must compress within a maximum of, say, ten words some definite aspect of the advertiser's sales message. It must fall easily from the tongue. (In this connection it will be noticed that the accented syllables in the first phrase above are almost perfectly rythmical.) "Alliteration's artful aid" cannot be despised. And there is one "must not." A slogan may be described as the epigram of commerce; do not allow it to provide material for repartee. The well-remembered slogan (not, of course, electrical), "Get it at ——" provoked the reply, "or ——"! Once a good slogan has been found, it should be used systematically but not too prominently. It is a mistake to use a slogan in such a position in an advertisement that it seriously interrupts the progress of the reader's eye from the headline to the copy and illustration and then to the nameplate.

One Constant Feature.

While the headline of the advertisement should vary as frequently as possible, the form in which the firm's name is presented should be the one feature of the announcements which is absolutely inflexible. Other points, such as the border or type of illustration, may be kept constant for greater or less periods (during, say, the life of a series of consecutive advertisements), but the "nameplate" always. The expression nameplate does not necessarily mean that the firm's name must be embodied in a complicated design (indeed, that is undesirable), but merely that several features shall be presented in a distinctive fashion and as integral parts of a whole. These features (in the case of an engineering firm advertising to engineers) are: The name of the firm, the postal address, and, if desired, a trade mark or monogram.

"Distinction"—the first essential of a nameplate—can be obtained either by originality of lettering or of design. Originality must, however, be kept within bounds, particularly as regards lettering. Freakish lettering should be given a wide berth, and legibility must be kept well in mind. (There are not many Government publications of use to the business man, but the advertiser who is interested in legibility cannot do better than read "A Note on the Legibility of Printed Matter," by L. A. Legros). But the design of lettering is a job for the expert (not merely an artist) in *lettering*.

Individuality in Trade Marks.

The form of the trade mark, whether it takes the shape of a monogram or otherwise, is possibly already fixed. If not, however, here again there is space for individuality and distinctive effects, but with due regard to legibility. A monogram, for example, which while of pleasing general appearance takes some minutes to decipher is absolutely useless from an advertising point of view. For example, in the well-known "B.T-H." monogram the combination of letters jumps to the eye in the correct sequence, and thus serves its purpose admirably.

There remains to weld the name, address and trade mark into one unmistakable whole. This should be done with the greatest possible economy of lines. All that is necessary is that the several parts of the nameplate shall be held together. Do not be tempted to indulge in unnecessary and disfiguring scrollwork. If, as advised above, an artist is employed to design the lettering, he would, of course, carry the job right through, but the warning in the previous sentence is still worth while, since the artist's work is often marred by the incorporation of suggestions made by the advertiser. Or the artist himself may have a leaning towards the fanciful, in which case the engineer's sense of what is appropriate to the advertising of his product should provide the corrective.

The Value of a Nameplate.

The value of a nameplate lies in the fact that if its general shape and form is sufficiently distinctive, it will, by a process of reiteration, convey its message eventually without requiring to be *read*. Therefore, having obtained a successful nameplate use it wherever and whenever possible. Ideally, the firm's name should never be employed except by means of the nameplate. It should be the one feature which, throughout a continually varying stream of advertisements, remains constant, linking each up with the other and conveying in a flash to the reader that that announcement is *yours*, and, consequently, worth reading. In this latter direction, it reinforces the headline and may often secure the reading of an advertisement where the latter has failed to do its work.

If it should be thought that in this dissertation on headlines and nameplates over-much attention has been devoted to subsidiary portions of the advertisement, it must be remembered that they are not so subsidiary as would at first appear. As previously stated, your advertisement serves no useful purpose unless it is read, and these are the features which you rely upon to ensure that it *is* read.

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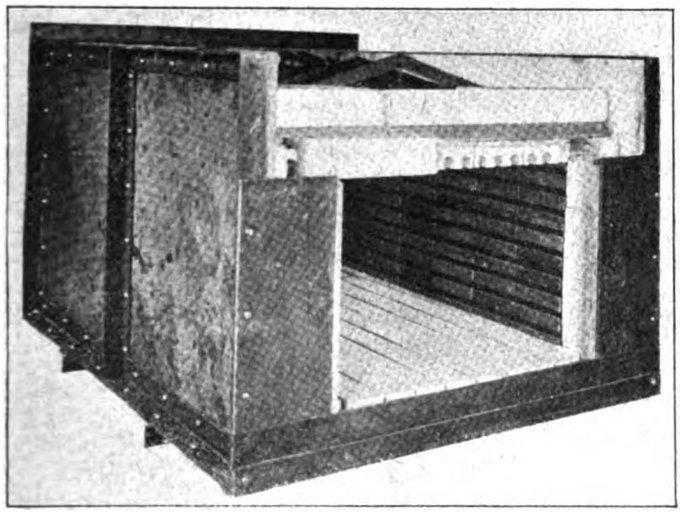
A New Internally Heated Electric Furnace.

The field for electricity in industrial electric heating has certainly been tapped, but it is one worth greater cultivation for many reasons altruistic and otherwise. For one thing it forms an all-the-year-round load whose quantity should be comparable with the power load, to which it forms a useful addition. For this reason it is worth offering to supply this load at an attractive price and thus to give a wide range of manufacturers the benefits of flexibility, ease of control, constancy of temperature, certainty of repetition, and, last but not least, better hygienic conditions. The manufacturer who adopts electric heating will find that his costs are reduced and his products are improved.

These advantages, we are glad to learn, are now beginning to be realised and have resulted in the demand for furnaces, to take one electrical application only, of considerably larger dimensions than previously constructed. AUTOMATIC AND ELECTRIC FURNACES have therefore turned their attention to the design of these larger types some time back, but have found numerous technical difficulties to overcome. But according to the latest information they are now in a position when they can state that these obstacles have all been successfully surmounted, and the new type of WILD-BARFIELD internally heated furnace which we illustrate is the result.

Details of New Furnace.

These furnaces are built on the unit principle with inside or exposed heating coils, which are designed to permit the construction of electric furnaces of unlimited size. Each unit consists of a brick, measuring 4 in. by 4 in., specially shaped so as to dovetail into its neighbours. In the face of each unit or brick are three annular channels. When the bricks forming the heating chamber



THE LATEST WILD-BARFIELD FURNACE.

are assembled, the annular channels present continuous grooves in the walls, floor and roof, and the heating units in the form of spirals or rods are drawn through from end to end of the heating chamber or tunnel.

A reference to the illustration will show the construction more plainly. It will be noticed that the grooves in which the exposed heating elements lay are shaped so that the spirals whilst free to expand in all directions, cannot come into contact with the work in the furnace. Special attention has been paid to the roof of these furnaces. The fire-brick units are each recessed to hang from trussed girders of specially treated iron or nickel chrome, and supporting pieces of nickel chrome with " pick-ups " of similar material. The furnaces are complete with the firm's patent automatic cut-out and a thermo-couple, both entering through tubes at the rear.

The heat-resisting lagging is of a special nature, and reduces heat losses to a minimum. The outside casing is constructed of boiler plate, strengthened by angle iron to which it is bolted. The door consists of fire-bricks and is usually counter-balanced to facilitate opening and closing. A temperature of 800 deg. C. can be reached in one hour and 1 000 deg. C. in about 1½ hours from cold.

Low Energy Consumption.

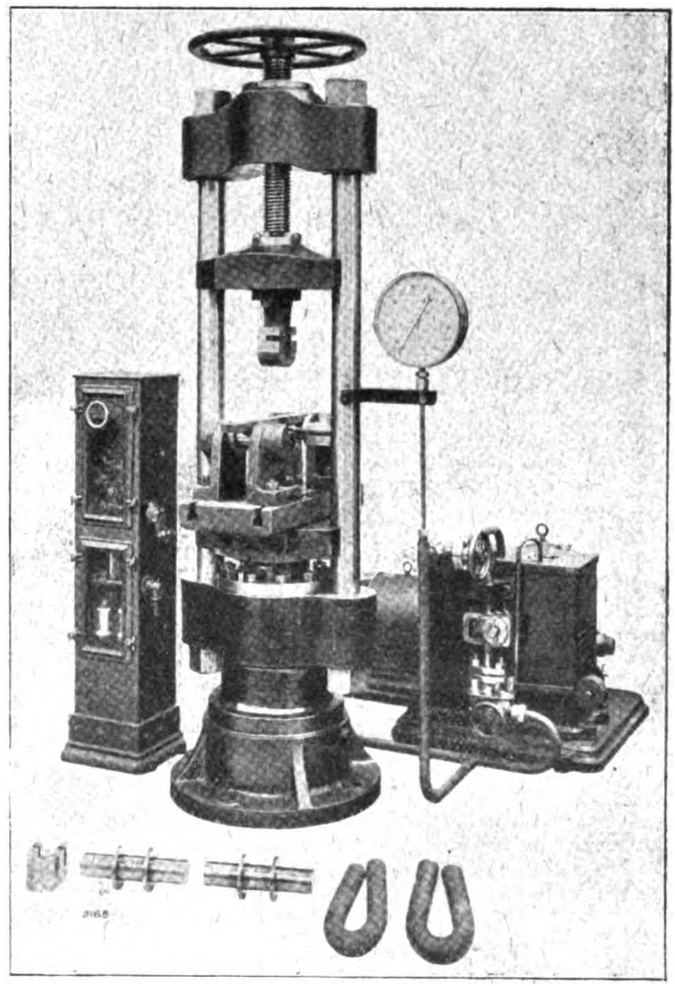
As an indication of energy consumption, it may be stated that to heat a furnace up to 1 000 deg. C. measuring 20 ft. by 12 ft. by 12 ft. requires approximately 1 400 kWh. A carburising furnace of the same construction measuring 24 in. by 12 in. by 12 in. is heated in one hour to 900 deg. C. with a consumption of 11 kWh, and the furnace after the first hour, together with work being carburised, is maintained at 900 deg. C. with a consumption of 5·6 kWh. The output of these furnaces is practically the same as those of similar sizes heated by gas and solid fuel. These furnaces will be of considerable use for the heat treatment of locomotive cranks, connecting and coupling rods, billets, plates, carburising, etc., and in annealing both ferrous and non-ferrous sheet, wire, etc., also for making and kilning pottery ware. In fact, it may be stated that they are designed to replace existing gas and solid fuel furnaces of all sizes.

For supply authorities who desire night loads, these furnaces are admirably suited, for carburising steel parts in large or small engineering works. In conjunction with a time switch the work and furnace could be left to itself from closing time until the works re-open next day.

Bending Test for Iron and Steel Bars.

A convenient and useful form of testing machine has just been completed by W. AND T. AVERY for carrying out cold bend tests upon iron and steel bar specimens, in accordance with the British Engineering Standards Association specification.

The test is well known amongst manufacturers and usually consists of bending the bar, when cold, through an angle of 90 deg. round a mandril having a radius equal to the diameter or thickness of the bar. The two ends of the bar are then closed together in the machine, after which the bar must exhibit no signs of fracture.



A TESTING MACHINE FOR IRON AND STEEL BARS.

As will be seen from the illustration, the machine is of the hydraulic type, being supplied with pressure from a motor-driven pump. The hydraulic ram is raised by the pressure, carrying with it the bar specimen, which is spanned across the two upturned presser feet fitted with rollers. A middle presser foot is attached to a central adjusting screw, and the bar specimen is brought to bear against the former by the action of the ram, thus bending it through a right angle. The bent bar is then removed and placed again in the machine, to complete the test by bringing the two ends together, making a total bend of 180 deg. The load necessary to carry out the test is shown upon a pressure gauge. The machine itself is capable of applying a pressure of 60 tons to the specimen.

Prizes for "Points"

An Interesting American Competition.

At the recent convention of the NATIONAL ELECTRIC LIGHT ASSOCIATION in New York prizes were awarded to those whose houses were most fully electrified. Mr. W. D. A. Ryan, of the General Electric Co. (U.S.A.), was adjudged winner with 343 points, three other competitors having over 300 points. The prizes were given by " Electrical Merchandising." We wonder what the result of a similar competition in this country would be !

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Institution of Civil Engineers.

Exhibits at Annual Conversazione.

The Annual Conversazione of the INSTITUTION OF CIVIL ENGINEERS was held at the Institution on Thursday, July 12th, the guests being received in the Great Hall by the President and Mrs. Maw and the Council of the Institution.

Besides the ordinary musical programme three lectures were given on roads, sea salvage and irrigation, while Mr. Walter Heap demonstrated the possibilities of rapid cinematography.

The exhibition of engineering models and scientific apparatus in the Library attracted a great deal of attention, but not a very large proportion was of direct electrical interest.

A Traffic Control Apparatus.

We may, however, note that the WESTERN ELECTRIC Co. showed a traffic control apparatus consisting of a controller's signalling and telephone apparatus at one end of a model railway telephone line, and three typical sets of apparatus for use in signal cabins bridged at intervals across the line, all the sets being in simple multiple. This represented on a small scale the equipments which are now in use on many railways both at home and abroad for the regulation by telephone of railway traffic.

The calling is done by means of coded reverse current impulses, and only one station is rung at a time. By this means as many as 78 stations in bridge across a common line can be rung selectively. A particular feature of the system is that the bell at any particular station produces a tone on the line so that the Controller can be certain that everything is working satisfactorily. A loud speaker which obviates the necessity of the controller having to wear a head receiver for long periods was also demonstrated. This operates in conjunction with a special valve and can be cut in or out as required.

The same Company also showed some applications of the piezo-electric effect by means of Rochelle salt crystals and of the kathode ray oscillograph which we have noticed on former occasions. Other purely electrical exhibits were Mr. S. G. BROWN'S frenophone, and Mr. F. H. GLEW'S levitating magnet, of both of which we have given details at various times.

Mr. A. C. EBORALL showed a model of a new type of locomotive drive which we described a short time ago. Each driving axle has its own motor mounted above the axle, both motor and gear being rigidly fixed to the framework. A flexible coupling between the gear and the axle allows, it is claimed, absolute regularity in transmission to be obtained, while side play and radial adjustment of the driving axle are possible owing to the flexibility of the coupling. There is no effect on the axle load when locomotive displacement occurs between the driving wheel and the frame. Reduced tyre wear and easy disconnection of the motor are claimed as further advantages, while another point is that the whole space between the locomotive frame is available for the disposal of the electrical equipment.

Included with the NATIONAL PHYSICAL LABORATORY'S exhibit was a demonstration of a standard end bar gauge hardening by electrical heating, while Major G. W. C. KAYE was showing in conjunction with Dr. Griffith a specific heating apparatus for materials of high temperatures, and some early types of electrical discharge tubes.

An Electrically Operated Steam Flow Meter.

A remarkable electrically operated steam or water flow meter was shown by Mr. J. L. HODGSON. The object of this apparatus is to provide a very large number of definite positions of measurement (as many as a thousand) between zero and full flow, so that an almost continuous record can be obtained.

In principle the apparatus consists of a central arm which is actuated by a float. The latter moves in accordance with the difference of pressure in the steam main, and in moving closes the circuit of a small motor, which operates a cam which revolves until it reaches a position corresponding with this difference of pressure. The circuit is then broken and the motor stops.

The indication of pressure difference thus given is transmitted electrically to a repeater motor through a series of contactors, and thus a continuous record can be obtained on an ordinary indicating instrument.

The Telechron.

The Telechron transmitter was exhibited by the TELECHRON ELECTRIC TRANSMITTER CO. This equipment consists of an electrically operated step-by-step transmitter and receiver in which the usual difficulty of lack of synchronism between the transmitted and received signals, especially when the impulses follow each other in rapid succession, is overcome. This is effected by "storing up" the movement of the float wheel or other transmitting mechanism in an epicyclic gear. The first movement of this gear operates an electric relay which moves a ratchet wheel round tooth by tooth, and this indication is transmitted to the receiving end, where a similar gear is installed. A sudden rise of the float pushes a swinging armature and link motor over an appropriate number of teeth on a tooth wheel. When the circuit is broken the armature falls back tooth by tooth and at each-tooth movement an impulse is sent to the receiving instrument. In this way every indication given is stored and transmitted as time allows.

The INSTITUTION OF MECHANICAL ENGINEERS showed a model of Penn's trunk engine, also a model of a workshop which we noticed with some interest was driven by a low pressure reciprocating engine.

An interesting exhibit of historical apparatus, pictures and books was visible in the upper Committee Room. In this room the principal things we noticed of direct electrical interest were specimens of the first telegraph cable laid between England and Ireland, the first Atlantic cable, and of the first cable to India. These cables were all laid by the late Sir Charles Bright, and were exhibited by Sir CHARLES BRIGHT.

Some Bradshaw Guides exhibited by Mr. W. B. WORTHINGTON and the early records of the INSTITUTION of CIVIL ENGINEERS also attracted a good deal of attention.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

TRANSMISSION AND DISTRIBUTION OF ELECTRICITY BY OVERHEAD LINES.

To the Editor of THE ELECTRICIAN.

SIR,—In Mr. Storr's valuable paper on the above subject before the I.M.E.A. at the Scarborough Convention, and also in the discussion that followed, there are several points which were not emphasised, and which should, I think, be very important in all interested engineers' minds. They are as follows :—(1) The current density at which conductors are run can be at least 25 per cent. greater with overhead wires than with underground cables. (2) For opening out new areas where loads are uncertain, and especially the diversity factors for cooking and heating loads, an overhead scheme is almost essential, as if ample strength is put into the supports and material, the conductors can, at a very low cost, be increased in size. (3) With regard to feeders and trunk transmission lines, the importance of being able to increase the size of the conductors at a low cost for subsequent increases of load is very great. In many cases it is worth starting in with an overhead line, even if ultimately when the full load data is available an underground cable might be used.—I am, etc.,

Newcastle-upon-Tyne. N. W. PRAGNELL.
July 10th.

British Engineering Standards Association.

Chairman's Plea for Financial Support.

The BRITISH ENGINEERING STANDARDS ASSOCIATION held its fifth annual meeting on Thursday, July 12th, at the Institution of Mechanical Engineers. The chairman, Sir ARCHIBALD DENNY, in reviewing the year's work, laid stress on the fact that the Association was faced with a deficit of some £1 700, and he hoped that the Government, which represented the purchasing public as well as industry as a whole, would assist in putting the finances of the Association on a more stable basis. The national character of the work of this organisation, devoted to simplification and the promotion of national economy in our engineering and allied industries, was too well known to require enlarging upon.

The continually increasing amount of work which the Association had to deal with as a result of outside pressure, as well as the natural progress shown in all sections, necessitated more generous financial support than was given at present. Neither the Government nor industry as a whole appeared fully to appreciate the value of the labours voluntarily given by the 2 000 engineers who formed this Association, which was doing so much both for the home as well as the export trade of this country.

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Electricity District Schemes.

North Wales Electricity Order.

The Electricity Commissioners have issued their Order constituting the North Wales and South Cheshire Electricity District and establishing the North Wales and South Cheshire Joint Electricity Authority. In November last a further local inquiry was held at Llandudno in respect of the draft order, and since that date the area of the city of Chester has been omitted from the draft Order, the Corporation of the city being authorised to extend their generation plant by taking over the steam plant at Queensferry.

Area and Constitution.

The area included in the North Wales and South Cheshire district as now defined by the order comprises the counties of Anglesey, Carnarvon, Denbigh, Flint, Merioneth, and Montgomery, the municipal borough of Aberystwyth, and the township of Scybor-y-Coed, Cardigan; the municipal borough of Crewe, the urban districts of Alsager, Nantwich, Sandbach, and Tarporley; the rural districts of Congleton, Malpas, and Nantwich; the detached portion of the rural district of Northwich situate in the rural district of Congleton; a number of parishes in the southern part of the county of Chester, including Beeston, Coddington, Crewe, Farndon, Huxley, Kelsall, Tattenhall, Tilston, and Tiverton; the municipal borough of Oswestry, the urban and rural districts of Ellesmere, Wem, and Whitchurch, and the detached portion of the rural district of Atcham (Salop) situate in the rural district of Oswestry.

The constitution of the Joint Electricity Authority provides for twenty-six members, including one each from Crewe and Wrexham Corporations, and the Colwyn Bay and Llandudno Urban Councils and four from other local authority undertakers in the district; five from the North Wales Power Co., and one from other company undertakers; one each from the nine County Councils interested: one each from the North Wales Quarry Owners' Association and the North Wales Slate Quarries Association, and one from the railway companies.

Transfer of Powers.

The Joint Authority will transfer to the North Wales Power Company the powers conferred upon them by the Electricity (Supply) Act, 1919, for the supply of electricity but without prejudice to any application that may be made for a Special Order to authorise the supply of electricity within an area of supply forming part of the district. There is a provision entitling a local authority to purchase from the Power Company any part of their undertaking that may be established for the distribution of electricity at low and medium pressure after the expiration of 42 years from the date on which the company commences distribution.

The Technical Scheme.

The Order incorporates in an annex the main outlines of the Power Company's technical scheme, which provides for the further development of the water-power resources of North Wales and for the transmission ultimately of power to Crewe, Holyhead, Pwllheli, and the other extremities of the district for the use of the community.

The scheme provides for a standard supply of 3-phase a.c. at 50 cycles per second; main transmission at 33 000 and 66 000 V, and secondary transmission at 22 000, 11 000 and 6 600 V. Provision is made for the existing hydro-electric works at Cwm Dyli and at D lgarrog to be utilised, and an extension of the D lgarrog hydro-electric works by not less than 10 000 kW of additional generating plant to be commenced forthwith. The existing generating stations in the district belonging to authorised undertakers other than the North Wales Power Co. are to be utilised without further extension unless otherwise determined later, until other supplies become available at rates justifying the shutting down of such stations. The water power resources of the district will be further developed to the fullest practicable extent, but without prejudice to the development of any local water power resources by the owners thereof for the supply of electricity where it is proved to the satisfaction of the Commissioners that such local development is desirable. The development to be undertaken during the first stage will comprise the establishment of a new hydro-electric station at Maentwrog having an installed capacity of not less than 15 000 kW. Provision is to be made, when the demand so justifies, for the extension of the power stations of the company by an installed capacity of not less than 12 000 kW.

Transmission Lines.

Main or secondary transmission lines to be established shall—(i) during the first stage of development, include lines connecting (*a*) Dolgarrog-Hawarden; (*b*) Colwyn Bay-Rhuddlan-Hawarden-Wrexham-Oswestry; (*c*) Wrexham-Crewe; (*d*) Conway-Penmaenm.wr-Bangor-Carnarvon-Marconi Station-Beddgelert; (*e*) Bangor-Holyhead; (*f*) Cwm Dyli-Beddgelert-Portmadoc-Criccieth Pwllheli-Nevin; (*g*) Portmadoc-Maentwrog-Blaenau Festiniog; (*h*) Llanrwst-Bettws-y-coed; and (ii) During the second stage of development, as and when the demand so justifies, include lines connecting—(*a*) Dolgarrog-Maentwrog-Hawarden; (*b*) Hawarden-Crewe; (*c*) Maentwrog-Harlech-Barmouth-Aberdovey-Aberystwyth; (*d*) Barmouth-Dolgelly-Bala-Corwen-Ruthin-Hawarden; (*e*) Aberdovey-Machynlleth-Llandiloes-Montgomery-Welshpool-Oswestry.

The second schedule of the Order contains the text of an agreement executed on June 21 last between the Power Company and the Aluminium Corporation, Dolgarrog, under which the latter, as producers of electricity, undertake to supply to the former, all the electricity generated by the Corporation at Dolgarrog.

Under an Order made by the Minister of Transport on June 18th last, the maximum price to be charged by the Power Company for electricity supplied in bulk to authorised undertakers within the North Wales and South Cheshire electricity district is £6 per kW per annum of maximum demand, and in addition the sum of ¾d. per kWh supplied. For the purposes of section 43 of the Act of 1904 the standard price should be 1½d. per kWh.

East Midlands Inquiry Concluded.

Order Postponed for a Month.

With a view to settling the details of the East Midlands electricity scheme, the preliminary inquiry into which was reported in THE ELECTRICIAN of January 26th last, page 100, the Electricity Commissioners held a further inquiry at Nottingham last week, Sir HARRY HAWARD presiding. The other Commissioner was Mr. A. Page (vice-chairman), Mr. J. C. J. Dalton sitting as legal adviser. The East Midlands Electricity Advisory Board, which represents the district concerned, and comprises the boroughs of Nottingham, Leicester, Derby, Burton-on-Trent, Ilkeston and large portions of the counties of Notts, Derby, Leicester, and part of Stafford, was represented by the Town Clerk of Nottingham (Mr. W. J. Board) and Ald. Huntsman, while Mr. W. Craig Henderson, K.C., appeared for the Notts and Derbyshire Electric Power Co.

Principal Generating Stations.

Mr. Board asked that the Derby and Burton stations should be included with Nottingham, Leicester, and the Power Company's station at Spondon to form the principal generating stations for the district, to be extended as might be hereafter determined. The Order, in its present form, provided that the Derby and Burton stations might be extended to "a limited amount."

The CHAIRMAN assured Mr. Board that the effect of the Order, as it stood, was not to dub Burton and Derby as "second class" stations, though they were not included with the other three.

Scheme of Transmission Lines.

On the question of the effective use of the generating stations, Mr. Henderson asked for powers to supplement the present scheme relative to Mansfield. The company had already laid cables from Spondon to Heanor and were going to Sutton-in-Ashfield. They now proposed to duplicate this, *via* Ambergate, with a view to supplying the Matlock Bath area.

The Town Clerk put forward as an alternative that the Electricity Board should be instructed to prepare a full scheme of transmission lines, and submit it to the Commissioners within six months.

After some discussion it was decided that the parties should confer in order to see how far they could come to an agreement on transmission lines, and that the order should be held up for a month. The Power Company, remarked the CHAIRMAN, was in a strong position, as they alone had the powers to lay these lines. It only remained for the municipalities to work harmoniously with them, so that the inter-connections between the towns should be profitable to both parties, and the electricity supply of the whole area developed to the greatest extent.

The inquiry was concluded.

South-West Midlands District.

The Order made by the Electricity Commissioners after two local inquiries constituting the South-West Midlands Electricity District has been confirmed by the Minister of Transport, and approved by both Houses of Parliament. The first meeting of the Advisory Joint Committee established under the Order was held in Birmingham on July 12th, when Councillor Beale was appointed chairman, and Mr. E. J. Jennings secretary. The South-West Midlands Electricity District comprises portions of the counties of Shropshire, Stafford, Warwick and Worcester.

The first meeting of the newly elected District Industrial Council for the Electricity Supply Industry, No. 5 (West Midlands) Area, was held at the Chamber of Commerce on July 13th. Mr. R. A. Chattock (Birmingham) was re-elected chairman for the fourth year in succession, Mr. Alderman J. Gregory was re-elected vice-chairman and Mr. E. J. Jennings (Birmingham) was re-appointed secretary and reasurer.

Broadcasting for Garden Parties.

Broadcasting is now becoming quite a feature at garden parties, tennis meetings and other outdoor gatherings. Those who are arranging for such gatherings need not fear the results that will be obtained, for demonstration vans fitted with a Gecophone two-valve set in conjunction with a single stage amplifier, two stage power amplifier, and two loud speakers are now available. A novel feature of these equipments is the aerial used. This has been supplied by the GENERAL ELECTRIC Co., and consists of a sectional bamboo mast 30 ft. high and a wire mesh aerial, the dimensions of which are 12 ft. by 4 ft. This type of aerial has been tested over distances of more than 100 miles from London.

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Merchandise to Sell and Profit By.

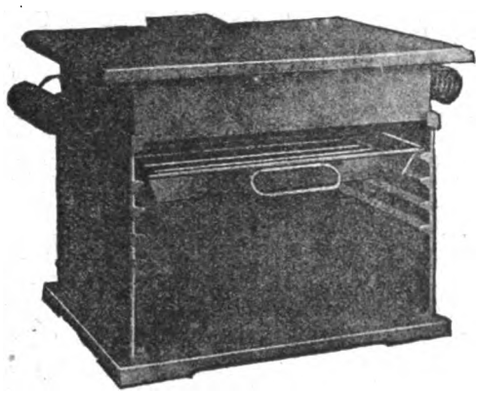
In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

A Stepping Stone to Turnover in Cooking Apparatus.

"In kitchen cool," says an E.D.A. folder. There are, however, many practical difficulties to be ironed out before big business in large kitchen cookers can come as a result of this intriguing propaganda, and it behoves the contractor to build up a turnover in cooking apparatus by selling the smaller apparatus such as grills

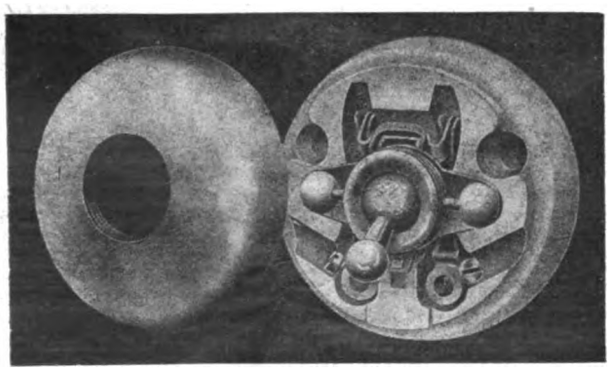


THE ARORA CO'S. RAPID GRILL.

and toasters. An authority in electric cooking chided contractors last winter on the faint-hearted methods of contractors with cookers (he was referring to the larger kitchen cookers), but the fact has to be faced that the time for them is not yet, in the majority of districts. We repeat, therefore, that the turnover must be built up with smaller apparatus. We illustrate a grill which is typical of the apparatus which we have in mind. This particular grill is manufactured by the ARORA CO., and is a well-made device which is marketed at 30s.

Why Not 3 A Tumbler Switches?

What is the *real* capacity of the average competitive priced 5 A (so called) tumbler switch? The question, when reduced to cold print, seems a little unnecessary. Some may judge it to be facetious. We all know, however, that the cheap tumbler switch does not come up to the 5 A rating. There are many situations where a 3 A



CRABTREE 3 A FLAT SWITCH.

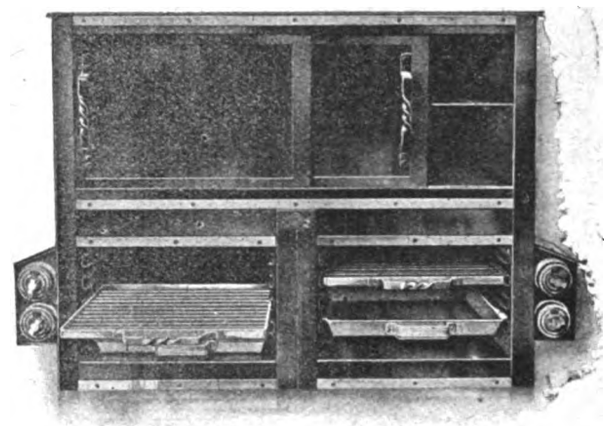
switch of good quality could be offered and probably the difference in price would secure the job. We illustrate a 3 A switch manufactured by J. A. CRABTREE AND CO., which is essentially a good-quality device, and the rating of 3 A is a real rating. All the other features of Crabtree switches are in this switch, notable amongst them the quick-make and the quick-break action.

G.E.C. Wireless Parts of Quality.

The present state of affairs in connection with "wireless" must end, and it may be that by the time these notes are in print events will have shown what is going to happen. If it should come about that events so shape themselves that a great number of "experimenters" will be licensed, obviously a large potential market will be created for "wireless parts." Possibly many retailers, dispirited at the slump in business in complete sets (because there *is* a slump not created solely by the summer season, and it would be absurd to deny it), are hoping that they will find relief from their present worries by making a good turnover in these parts. There is a perfectly legitimate line of thought, but to make it concrete the buying must be done with great discrimination. The fact that the parts are to be bought by amateur "domesticians" emphasises the truth of this dictum, and if the retailer hopes to be successful in this business he must follow it. The GENERAL ELECTRIC CO. have recently issued a booklet, B.C.2984, which we prophesy will become a *vade-mecum* to retailers. This booklet is one which no buyer can afford to overlook. It contains "wireless parts," parts of quality, and quality is the only basis on which a business worthy of the name can be built.

How Much Will the Job Bear?

At an E.D.A. Salesmanship conference last winter, the author of a paper pointed the way to secure business in cooking apparatus from restaurants, hotels, works canteens, etc. One obvious requirement for success is apparatus of quality and efficiency. We illustrate a toaster manufactured by ELECTRIC FIRES, LTD. It will be apparent at once that in offering this apparatus for any particular job, a step

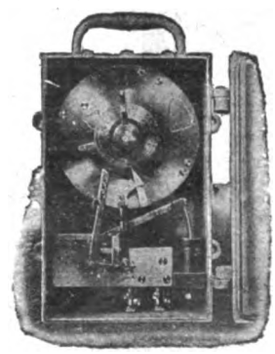


A TOASTER FOR HOTEL WORK.

towards success has been made. The toaster is constructed throughout in heavy gauge steel, finished in stove black enamel with facings ground and polished bright. The hot cupboards shown are a particularly interesting feature of the design, but we should mention that several variations and sizes can be supplied, including two sizes without hot cupboards. Apparatus with a number of simple variations is therefore available for just the amount of money the job will bear.

Business Going A-begging.

We have previously commented on the business which is going a-begging for time switches in connection with shop-window lighting. It should not be assumed that the business will be limited to the less expensive switch, which consists usually of a simple clock



A VENNER TIME SWITCH FOR SHOP WINDOW WORK.

with the switch action mounted on a glazed teak case or on a hardwood baseboard. In fact, there are many situations where such a switch would be useless, and in but a short while it would cease to be a time switch and have become a nuisance. VENNER TIME SWITCHES, LTD., however, have a thorough knowledge of time switch requirements and include in their range switches for practically

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every condition. It cannot, therefore, be pleaded that the right switch is not available for the job, because Venners have it. We illustrate a switch which will give sound value and enhance the reputation of the contractor who installs it. It has a capacity of 5 A at 250 V, and the clock movement has a 14-day winding. The action of the switch is " on and off automatically."

A Benjamin "Bencolite."

The trend of thought on lighting by means of enclosed units will be quickened by the advent of a new fitting just recently placed upon the market by the BENJAMIN ELECTRIC Co. We illustrate the device, which is being marketed under the name of

THE HANDSOME "BENCOLITE."

" Bencolite." The details of the fitting are obvious from the illustration. It is claimed by the Benjamin Co. that the " Marbella " glass used with these fittings ensures perfect diffusion with low absorption, and as no less than four sizes are available, many lighting requirements can be catered for. The Benjamin Co. express a truth in their publicity matter when they state: " The illumination of shops, showrooms, offices, public halls, etc., has in the past had little or no attention from the scientific aspect. So long as the general appearance of the fittings chosen are pleasing to the eye, it is felt that the ultimate end as regards efficiency has been obtained, with the result that in the majority of cases the illumination results are far from efficient."

From "The Home of a Hundred Comforts."

We feel we are rendering a service to the trade by making a further reference to " The Home of a Hundred Comforts." The HOTPOINT ELECTRIC APPLIANCE Co. have been successful in compiling a piece of publicity matter which will compel business. This booklet should really litter the showroom and counter of every retailer, because it contains a wealth of good things for the public to buy and the retailer to sell. We illustrate a boudoir utility set,

SOMETHING FOR THE BOUDOIR.

and the following brief description, taken from " The Home of a Hundred Comforts " is all we need put forward to show what an attractive line of merchandise the set is.

" Consisting of a 3 lb. bevelled edge electric iron with two holes at rear into which curling iron may be inserted for heating; metal stand to convert the electric iron into a small stove and a pair of folded curling irons. The set fits compactly into an attractive tapestry cloth covered substantial wooden box which, when unfolded, becomes a small ironing board. Takes up but a little space in a travelling bag, suit case or trunk. All metal parts finished with highly polished nickel. A very handsome and valuable accessory for Milady's use. May also be had with Franconia tapestry cloth bag instead of wooden box."

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

Readers of THE ELECTRICIAN whose walk in life is that of armature winding and the like, will read with interest the descriptive booklet published by the MIDLAND DYNAMO Co., on the Quickway coil forming machine.

MICHELL BEARINGS, LTD., announce the publication of two new descriptive lists. The first in order of number is list No. 5, describing Michell patent thrust bearings, and list No. 6 describing Michell patent oil deflectors.

We have to acknowledge the receipt of new publicity matter from THE SUN ELECTRICAL Co. This includes list No. 389 describing Venner time switches, and list No. 390 showing, with prices and technical data, the " Sunco " electric fans.

ECK AND BROOK have recently placed upon the market the " S.P." electrostatic potential indicator. Engineers interested in this apparatus are invited to apply for a copy of folder H.B. 401, which describes the device briefly but comprehensively.

The HOFFMANN MANUFACTURING Co. have published a new catalogue and price list of ball and roller bearings. To technical men the list will be of great interest. The feature of the catalogue is that it has been compiled to meet the needs of such men.

" FLEXIBLE SHAFT COUPLINGS " is the title of a new price list No. 2510B, just issued by the BRITISH THOMSON-HOUSTON Co. We also have to acknowledge from the same manufacturers price list 5111c, describing air break Y-delta starting switches.

" Concerning Exhibitions " is the arresting title of a folder just received from FREDERICK SAGE AND Co. Electrical men do not give much thought to " display " as it is understood in other trades, but the time is rapidly approaching when they will have to.

A very artistic folder, in a style quite original in the electrical field, was recently published by METROPOLITAN-VICKERS ELECTRICAL Co., describing the " Cosmos " Iron. We are advised that quantities will be supplied over-printed with retailer's name and address.

The HOTPOINT ELECTRICAL APPLIANCE Co. are determined to give every aid to the retailer to increase turnover in heating and cooking apparatus by publishing compelling literature. " The Home of a Hundred Comforts " is Mr. Hotpoint's very latest sales help.

Wiring Systems for Electric Light and Power Installations " is the title of a booklet recently published by SIMPLEX CONDUITS. It is a treatise describing the familiar Simplex conduit system, the Simplex " Terra-Grip " conduit system, and the Simplex " Durex " wiring system.

" Morris Overhead Railways Render Invaluable Services " is the claim by HERBERT MORRIS. The apparatus and its application is fully described in booklet No. 77, and is invaluable to executive men who wish to have up-to-date information on their files of the best and most efficient labour-saving apparatus.

" Reduced prices " are announced by the GENERAL ELECTRIC Co., for " Freezor " electric fans. The 11th edition of Section V., of their catalogue has just been published, and we would refer buyers to our " Merchandise to Sell and Profit By " column for detailed comments on the 1923 " Freezor " sales campaign.

The latest novelty of the trade is G.E.C. invisible bell wire. Progressive contractors will need no urging to look into the selling possibilities, but to old-fashioned contractors (alas! there are many still) we tender the advice to forget those conservative principles and see to it. The new bell wire is fully described in folder W2927 just published by the GENERAL ELECTRIC Co., LTD.

We have to acknowledge several publications from SIEMENS BROS. AND Co. Pamphlet 825a describes their thermo-couple potentiometer, and Pamphlet 810a deals briefly with their lamp signalling system for pyrometer installations. Siemens dry batteries for wireless work form the subject of leaflet 595 III, while in Leaflet 595 II Siemens briefly describes their loud speaking equipment.

STERLING TELEPHONE AND ELECTRIC Co., LTD., announce the issue of a new publication No. 360 describing the " Sterling " high tension smoother, designed for radio purposes. " Radio in Summertime " is the intriguing title of another new publication No. 361 by the same company, while List No. 350 describes, with prices, the " Sterling " combined valve and crystal receiving set, and list 357 new pattern multiple connector board for wireless telephones.

METROPOLITAN-VICKERS ELECTRICAL Co. continue to render service to the trade by placing new wireless apparatus on the market. A leaflet, No. 640/2, describes the " Cosmos " crystal set amplifier, and leaflet No. 669/1 describes the " Cosmos " protective device. We also have to acknowledge receipt from the same company of circular No. 1061/1, entitled " Drum Controllers," leaflet 61/1–1 and 3–1 on the same class of apparatus; and a leaflet bearing No. 51/1–3 illustrating D.C. motor starters. Retailers of merchandise will note with interest that " Met-Vick " have just published three booklets on " Cosmos " fans. We refer readers to our " Merchandise to Sell and Profit By " columns, where we comment in more detail on this apparatus.

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Parliamentary Intelligence.

Telephone Works in Scotland.

In reply to Mr. T. JOHNSTON on July 10th, Sir L. WORTHINGTON-EVANS said no telephone cable was being laid between Balfron, Buchlyvie, Kippen, Gargunnock and Stirling. The establishment of exchanges at Buchlyvie and Kippen by running overhead lines to Glasgow and Stirling, respectively, was authorised during the latter part of March. A considerable amount of work was involved and was being expedited. Gargunnock was canvassed for subscribers at the same time as Kippen, but the necessary support for an exchange could not be found there.

Wireless Telegraphy in the West Indies.

Mr. ORMSBY-GORE on July 10th informed Mr. HURD that there was no high power wireless station at present in operation in the West Indies. There were objections to a system of high power wireless telegraphy as the sole method of communication with the West Indies, and the Government took the view that the needs of the West Indies could best be met by supplementing and improving the present system of cable communication. There were certain low power wireless stations in the West Indies which were used for local communication, and it was possible that under the new scheme additional stations of this kind might be erected as auxiliaries to the cable system.

Electrical Power in Palestine.

Mr. BECKER on July 12th asked the Under-Secretary of State for the Colonies by what power the dynamos were being driven as used by the Rutenburg Co. in Palestine?

Mr. ORMSBY-GORE: I understand that the power is oil fuel. The use of water-power has not yet started.

Replying to Mr. BECKER on July 16th, Mr. ORMSBY-GORE said he was not aware that the Jaffa municipality had opposed the erection of electric light standards in Jaffa. Nor was he aware that their erection, which had the full consent of the Palestine Government, had been the cause of unrest.

Dalmarnock Power Station.

Mr. HARDIE on July 10th asked the President of the Board of Trade the consumption of coal per kW generated at the Dalmarnock Power Works, Glasgow; and what was the lowest consumption of coal per kW produced in the British Isles?

Colonel ASHLEY: I have been asked to reply. The average consumption of coal per kWh generated at the Dalmarnock Power Station during the past year was 1·99 lb. The lowest average consumption at any steam power station in Great Britain during the year was 1·73 lb. per kWh generated. The Commissioners have no particulars concerning generating stations in Ireland, which are no longer under their jurisdiction.

Work of the Electricity Commissioners.

Mr. HARRIS was informed by Colonel ASHLEY on July 10th that the Electricity (Supply) Acts did not provide for the submission of a report by the Electricity Commissioners to Parliament. The Minister of Transport was, however, required to present an annual report of the applications to and the proceedings before him under the Acts.

A suggestion by Mr. D. G. SOMERVILLE that the Commissioners were holding up a lot of work by refusing loans elicited no reply, Colonel ASHLEY later stating, in reply to Mr. HARDIE, that the Commissioners were doing very valuable work indeed.

Registration of Telephone Calls.

Answering Lieut.-Colonel STOTT on July 10th, Sir LAMING WORTHINGTON-EVANS said the present method of registering telephone calls, which was the same as that adopted in America, was the most satisfactory that had yet been devised. A certain machine had been tried but it was not proposed to adopt it, as, apart from other serious drawbacks, it would place a prohibitive drag on the telephonists' work, and the apparatus and method of working it at the subscribers' premises were too complex.

West Indian Wireless Stations.

Mr. HURD was informed by Mr. ORMSBY-GORE on July 16th that the Governments of British Honduras, the Bahamas, Barbados and Trinidad possessed their own wireless stations; the Governments of British Guiana and St. Lucia had taken over wireless stations from the Admiralty. There was no present intention of discontinuing the use of any of these stations: there was also an Admiralty station at Christiana in Jamaica, which was not now working. Arrangements were now in progress which would, he hoped, result in putting communications with the West Indies on a more satisfactory footing; in the meanwhile it was not practicable to make use of broadcasting for this purpose.

High-Power Wireless Stations.

Sir L. WORTHINGTON-EVANS on Tuesday informed Mr. BECKER that the company which had applied for a licence to build a high-power wireless station in this country in connection with the Empire wireless chain was the Eastern Telegraph Co. It would have the same chance of obtaining a licence as the Marconi Co., so far as H.M. Government was concerned. The question of corresponding stations in India or the Dominions would be one for the Government concerned.

Rugby Wireless Station.

Sir L. WORTHINGTON-EVANS informed Sir H. BRITTAIN on Tuesday that the Post Office had purchased eight hundred acres of land near Rugby for a high-power wireless station as a link in the Imperial Wireless Chain. The cost of the site, including compensation for disturbance, would be about £50,000. He was advised that a large site was required for the station immediately intended to be erected and for possible additions. Provision had been made by the Governments of Australia, South Africa and Canada for the erection of stations for communication with this country, but, so far as he was aware, no definite arrangements had been made in India and New Zealand. In some, at least, of these cases express provision had been, or would be, made for the stations to communicate with stations of the Imperial system generally. But the question with what distant stations the new Government station here should communicate was at present a subject of negotiation.

Wireless Telegraphy Act, 1904.

When the House of Commons went into Committee on the Expiring Laws Continuance Bill on Tuesday, Mr. PRINGLE moved the omission of the Wireless Telegraphy Act, 1904, from the schedule of the Acts proposed to be continued. He said he did so in order that information might be obtained from the Postmaster-General as to the present position of broadcasting.

Sir L. WORTHINGTON-EVANS said the point could be more properly raised on the Post Office Estimates on Tuesday next. He asked the Committee to reject the amendment. The Wireless Telegraphy Act was the Act under which the control of wireless telegraphy was maintained. If it were not in operation there would be nothing to prevent anyone from setting up wireless telegraphy in this country, nothing to regulate wave-lengths, and the confusion would be so great that no one would have the benefit of wireless telegraphy. It was absolutely essential for the orderly progress of wireless development that the Act should be continued another year. He proposed to make a short statement next Tuesday, and he would try and include broadcasting and the Imperial Wireless Chain.

The amendment was withdrawn.

Private Bills.

On July 16th the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board Bill came before the House of Commons, the Lords' amendments being considered and agreed to.

The Unopposed Bills Committee of the House of Lords last week considered a Bill to confer further powers on the Corporation of Greenock in relation to their electricity undertaking. The Bill sanctions the construction of a culvert and pumping station by which, with the consent by agreement of the Trustees of the Port and Harbour, it is proposed to take waters from the Victoria Harbour for the purposes of the generating station. The Bill also takes power to construct electrical sub-stations under streets, and to lay electric mains in private streets. Formal evidence was given, and the Bill passed third reading.

Legal Intelligence.

The London Electricity Scheme: Judgment Reserved.

The case of The King *v.* The Electricity Commissioners, *ex parte* the London Electricity Joint Committee and others, the hearing of which was begun in the Court of Appeal last week (see THE ELECTRICIAN, July 13th, p. 40), was under consideration on July 12th, when the ATTORNEY-GENERAL, in support of the judgment of the Divisional Court, said the Commissioners had not purported to put forward any scheme at all. All that they said in effect was: "Here is a scheme which we are advised is within our powers, and we are now going to consider whether it is advisable." Of course, it would be easy to pick holes in any scheme of such complexity. To do that was the business of the opposition in His Majesty's Government and of nobody else. If difficulties were made out, the Commissioners would no doubt modify the scheme or would scrap it if it turned out to be unworkable. The scheme did not purport to compel anybody to transfer their undertaking to the authority.

He submitted that the application for the rules was misconceived, that the decision of the Divisional Court was right in discharging them, and that the appeal failed and should be dismissed.

Mr. MacMorran followed on the same side.

Mr. Talbot having replied, the Court reserved judgment.

A Useful Tool for Electro-Motorists.

The "grinding in" of valves is an operation with which the electrical engineer often has to deal, either in his proper person or as his *alter ego* the motorist. His task should be lightened and the result be more satisfactory by the use of valve seating and tuning tools now being marketed by S. A. CUTTERS. These cutters are made from high quality steel, not merely case-hardened material, and it is therefore claimed that they remain sharp for a considerable time, besides having a capacity for re-sharpening when required. They are adjustable within limits, are multi-toothed, well backed off to suit each particular quality of valve metal, of solid construction and free from chatter, all points to which it is worth while giving consideration.

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Herr Deutsch of the A.E.G.

His Impressions of the German Electrical Industry.

That the German electrical industry could hardly be reckoned at the present time as an important competitor of the British industry was the contention of Geheimrat FELIX DEUTSCH, chairman and managing director of the Allgemeine Elektrizitäts Gesellschaft, Berlin, when interviewed in London last Friday by a representative of THE ELECTRICIAN. Herr Deutsch, who, with Dr. ADLER, head of the foreign branch of the business, is paying a short visit to this country, had some interesting things to say regarding the German electrical industry, and in support of the above statement he referred to the high cost of raw materials in Germany—coal in particular—the increased wages bills due to increased staffs required as the result of the institution of the eight-hour day, the lowered efficiency of the workers, and the incidence of high import tariffs placed on German goods in many countries. Although there was great activity in the German electrical industry between 1918 and 1920, business had since fallen off considerably, except in a very few directions. Russia, he said, was one of the countries in which a considerable amount of business was available at the present time, and they had found no insuperable difficulties in obtaining payment in one form or another for goods supplied. Herr Deutsch attributed the decreased efficiency of the German worker largely to the instability of the currency, which had the effect of eliminating thrift, and tended to make the conversion of paper money into something of a less evanescent nature the main object of existence. In the German electrical industry to-day the production amounted approximately to 50 per cent. of that of pre-war times, and to achieve that they had to employ more men than before.

"A Scarcity of Money."

Questioned regarding developments in the industry, Herr Deutsch said these were being held up by a scarcity of money which he maintained was an alarming factor. Not only in the electrical industry but in most other industries they were unable to make sufficient profit to maintain their reserves at an adequate figure. The large German dividends reported in the British press were, he contended, largely mythical, a 100 per cent. dividend represented a trivial amount to shareholders when reckoned on a gold basis. An English shareholder in the A.E.G. who received in the year before the war £14 000 on a 14 per cent. dividend, would now receive only £5 although the dividend was quoted at 25 per cent. Our representative failed to obtain any modification of this view. On the contrary, Herr Deutsch added that most of the German manufacturing concerns were, as he put it, "living on their substance," and even went so far as to prophesy that within the next two or three years many of them would be forced to close down as the result of having exhausted their financial resources.

A Wireless Slump.

With regard to wireless, Herr Deutsch said they were experiencing a slump somewhat similar to that which has been encountered here although the contributory cause was slightly different. It appears that owing to the reluctance of the Ministry of Posts and Telegraphs to encourage private enterprise, it has not as yet been possible to start broadcasting stations, so that a large number of potential users of cheap receiving sets is quite unapproachable. There was, he thought, some prospect of a revival, but, generally speaking, his opinion was that public interest in wireless would require stimulation from manufacturers and dealers if a large business was to be maintained.

Herr Deutsch had little to say regarding the electrical industry of this country, the general effect of his remarks giving one the impression that satisfactory progress was being made. In conclusion, he expressed surprise that we were not interesting ourselves more in the establishment of power stations and tramways abroad.

Electro-Farming in Germany.

Dr. ADLER said that electricity was used much more extensively for lighting purposes in Germany than in this country, but it was not at all generally employed for heating, gas being the favourite medium. One direction in which the use of electricity had been developed there was in farming, practically every farmer being dependent upon it for a large proportion of his work. He thought that Mr. Borlase Matthews's pioneer work would eventually lead to large development in this country.

Automatic telephony was making good progress in Germany, and a fair amount of export trade was being done in this direction. Dr. Adler mentioned incidentally that the much abused English telephone system was at the present time more efficient than the German, and he had found since he had been over here that the London services were superior to that obtaining in Berlin.

Dealing with German power stations, Dr. Adler said the greatest difficulty was experienced in adjusting prices in accordance with fluctuations in the value of currency, and the price of coal. Quite a number of the smaller companies, he said, were compelled to claim payment from consumers in advance in order to enable them to purchase coal for future requirements. Where energy was required for traction purposes the tendency in Germany was to have separate traction power stations or to have separate traction generators in mixed stations owing to the unsteady character of a traction load. Several railway electrification schemes in Austria were nearing completion.

Electrical Imports and Exports.

Half-year's Exports Greatly in Excess of Imports.

IMPORTS.—The following are official values of electrical machinery, apparatus and material imported into this country (*a*) during June, 1923, and (*b*) the aggregate figures from January 1st to June 30th, with increase or decrease compared with corresponding periods of 1922 :—

Electrical machinery, (*a*) £89 019 (decrease £23 678), (*b*) £553 543 (decrease £108 657); telegraph and telephone cables, submarine, other than submarine, (*a*) £9 281 (increase £8 023), (*b*) £53 865 (increase £37 776); telegraph and telephone apparatus, (*a*) £44 253 (increase £30 473), (*b*) £274 033 (increase £189 691); other electrical wires and cables, rubber insulated, (*a*) £6 771 (increase £736), (*b*) £59 312 (increase £5 328); with other insulations, (*a*) £10 585 (increase, £5 612) (*b*) £58 732 (increase £30 072); carbons, (*a*) £4 395 (increase £1 781), (*b*) £31 467 (increase £12 944); glow lamps, (*a*) £10 139 (decrease, £1 449), (*b*) £93 751 (increase £8 270); arc lamps and electric searchlights, (*a*) £721 (increase £689), (*b*) £1 603 (increase £1 499); parts of arc lamps and searchlights (other than carbons), (*a*) £1 453 (decrease £1 067), (*b*) £7 970 (increase £1 235); batteries, (*a*) £5 213 (decrease £1 584), (*b*) £62 545 (increase £27 858); electrical instruments (commercial and scientific), and electricity meters, (*a*) £8 277 (increase £3 277), (*b*) £51 591 (increase £18 729); switchboards, (*a*) nil (decrease £199), (*b*) £1 927 (increase £209); other electrical goods and apparatus, (*a*) £78 439 (increase £43 451), (*b*) £408 797 (increase £156 842). Total of electrical machinery, apparatus and material (other than uninsulated wire), (*a*) £268 548 (increase £66 065), (*b*) £1 659 136 (increase £381 796).

EXPORTS.—The exports of electrical machinery, apparatus and material, produced or manufactured in the United Kingdom, (*a*) during June, 1923, and (*b*) from January 1st to June 30th, with increase or decrease compared with corresponding period of 1922, were as follows :—

Electrical machinery, (*a*) £274 916 (increase £12 171), (*b*) £1 944 482 (decrease £501 433); including railway and tramway motors, (*a*) £27 177 (increase £9 870), (*b*) £146 970 (increase £61 924); other generators and motors, (*a*) £124 777 (decrease £20 003), (*b*) £1 005 571 (decrease £294 534); and other electrical machinery, (*a*) £122 962 (increase £22 304); (*b*) £791 941 (decrease £268 823); telegraph and telephone cables, submarine, (*a*) £51 230 (increase £6 409), (*b*) £278 838 (increase £102 981); other than submarine, (*a*) £72 856 (increase £45 881), (*b*) £478 740 (increase £201 044); telegraph and telephone apparatus, (*a*) £145 504 (increase £2 336), (*b*) £965 172 (decrease £47 538); other electrical wires and cables, rubber insulated, (*a*) £68 897 (increase £19 996), (*b*) £524 339 (increase £229 657); with other insulations, (*a*) £66 259 (increase £590), (*b*) £502 824 (decrease £47 655); carbons, (*a*) £4 442 (increase £1 996), (*b*) £29 937 (increase £7 144); glow lamps, (*a*) £30 999 (increase £2 353), (*b*) £163 119 (decrease £34 377); arc lamps and searchlights, (*a*) £2 069 (increase £1 908), (*b*) £4 866 (increase £862); parts of arc lamps and searchlights (other than carbons), (*a*) £201 (decrease £428), (*b*) £657 (decrease £4 254); batteries, (*a*) £42 329 (decrease £538), (*b*) £267 297 (increase £29 490); electrical instruments (commercial and scientific) and electricity meters, (*a*) £27 969 (increase £8 849), (*b*) £167 821 (decrease £6 370); switchboards, (*a*) £9 078 (decrease £3 889), (*b*) £62 011 (decrease £9 825); other electrical goods and apparatus, (*a*) £130 082 (increase £46 937), (*b*) £701 011 (increase £106 730). Total of electrical machinery, material and apparatus, other than uninsulated wire, (*a*) £926 831 (increase £44 175); (*b*) £6 091 114 (decrease £61 976).

Books Received.

"Crystal Receiving Sets and How to Make Them." By Bernard E. Jones. (London: Cassell and Co.) Pp. 123. 1s. 6d. net.

"The Post Office Electrical Engineers' Journal." Vol. 16, Part 2. (London: The Electrical Review.) Pp. 204. 2s. net.

"Simple Valve Receiving Sets and How to Make Them." By Bernard E. Jones. (London: Cassell and Co.) Pp. 123. 1s. 6d. net.

"Uber Schwingungserscheinungen in Entladungsröhren." By Dr. Walter Schallreuter. (Braunschweig: Driedr. Vieweg and Sohn.) Pp. 37. 1s. 2d. net.

The Model Engineer Series.—No. 48, "Gear Wheels Simply Explained." By Alfred W. Marshall. Pp. 63. No. 49, "Screw Cutting Simply Explained." By G. Gentry. Pp. 63. No. 50, "Clock Repairing and Adjusting." By W. L. Randall. Pp. 68. (London: Percival Marshall and Co.) 9d. each net.

Service Notes.

In the last few weeks a further batch of officers who served with electrical units during the war were posted to the Territorial Army Reserve for duty.

Lieutenant H. A. Voss has just relinquished his commission in the London Electrical Engineers, retaining his rank. He saw a good deal of service in the late war, and was mentioned in despatches in 1919.

Lieutenant W. J. Rawlings from the London Electrical Engineers, has been appointed to the 11th Anti-Aircraft Battalion, London, Captain R. L. Aiken, O.B.E., from the Territorial Army Reserve, has been posted to the Corps of Royal Engineers (Electrical) Reserve.

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Imperial Notes.

BRITISH COLUMBIA.

Hydro-Electric Power from the Stave River.

Plans have been drawn up by the BRITISH COLUMBIA ELECTRIC RAILWAY COMPANY for the development of 115 000 H.P. on the Stave River, in three plants. It is anticipated, the "Engineer" states, that the expenditure will be in the neighbourhood of $10 000 000. Adjacent to Stave Lake lies Alouette Lake, distant about half a mile at its upper end, and it is proposed to tunnel between the two lakes, build a dam at the lower end of Alouette Lake, and divert the water by means of Stave Lake and River.

INDIA.

Electricity Supply Developments in Mangalur.

Inhabitants of MANGALUR have decided to form a company to establish electricity supply works for the town. It is estimated that a capital of R500 000 will be required.

Telephone Charges in Calcutta.

A committee of CALCUTTA Corporation disapproves of the proposed introduction of the mea ured rate system of charging for telephone facilities, and suggests that the telephone company's concession be renewed for 21 years on a graduated "flat" rate system, with a rebate of 30 per cent. on telephones rented by the Corporation.

NEW ZEALAND.

Preference for British Electrical Goods.

Over and above the tariff, the NEW ZEALAND GOVERNMENT has decided to give a preference of 20 per cent. to British manufacturers over foreign firms for all its electrical requirements, according to the Wellington correspondent of "The Times." To manufacturers in New Zealand it has decided to give 10 per cent. preference. The Minister for Public Works, Mr. J. G. Coates, recently stated that in connection with the contract for the Mangahao (Wellington) hydro-electric scheme, British tenders for exciter sets, transformers and other goods were accepted in preference to lower-priced foreign goods, although in one instance the British offer was 20 per cent. above the foreign tender. In connection with a Government hydro-electric undertaking in the Waikato district a tender for transformers amounting to £3 310 was accepted in preference to a foreign tender of £2 882. The Minister expressed the hope that local Power Boards, which are concerned with the reticulation of districts using Government current, would show the same practical preference for British manufacturers.

Foreign Notes.

EUROPE.

Trans-Scandinavian Electric Railway.

Claimed to be the longest stretch of electric railway in the world, the line between Narvic, on the west coast of NORWAY, and Lulea, on the east coast of Sweden, has now been opened for traffic. Energy is supplied by the State power station at Porjus on the Lule River.

Electrical Orders for Soviet Russia.

According to an Exchange message from Stockholm the General Electric Co. of Sweden has received large orders from Soviet Russia for a power station to provide PETROGRAD with power and light. The company has also received orders for generators from Canada.

Wireless Development in Austria.

The Austrian Marconi Co., Ltd., with a capital of £133 000, has been formally constituted in VIENNA, Marconi's Wireless Telegraph Co., London, subscribing £93 000 and the Austrian Government the remaining £40 000. The company, Reuter states, has the exclusive right to conduct wireless traffic between Austria and all other countries for a minimum period of 30 years. Several new stations will be erected, and traffic will be opened before the end of the year.

Water Power in Sardinia.

Dealing with the development of Sardinian industries by the utilisation of water power, the "European Commercial" states that a scheme for utilising water from the TIRSO RIVER is nearing completion and that a reservoir, 50 sq. kilometres in area, is now in course of being filled. It is calculated that the storage will produce 50 000 000 kWh, besides irrigating nearly 75 000 acres of land. Our contemporary points out that a few central stations would, for a long time to come, supply the light and power necessary for the whole island of Sardinia, and that they would also aid in the development of the Sardinian mining industry. The milling of minerals produced in the island is at present carried on abroad, owing largely to lack of power to operate the necessary machinery.

LATIN AMERICA.

New Electrical Plant of Sao Paulo.

The annual report of the Brazilian Traction Light and Power Co. states that a fourth unit of 18 500 kW has been ordered for installation at the São Paulo Electric Co.'s power house at SOROCABA, and it is expected that this will be in operation early next year. It was originally planned to instal a unit of 10 000 kW, but having regard to future needs and the most economical development of power it was considered desirable to provide the unit of larger capacity.

Electrical Switch and Control Gear.

New British Standard Specifications Issued.

Following the issue of British Standard Specifications Nos. 109–1923 and 110–1923 for air-break switches and air-break circuit breakers, the BRITISH ENGINEERING STANDARDS ASSOCIATION has prepared thirteen additional specifications relating to switch and control gear, as follows:—No. 124, totally enclosed air-break switches; No. 130, totally enclosed air-break circuit breakers; No. 126, flame-proof air-break switches; No. 127, flame-proof air-break circuit breakers; No. 117, drum starters for electric motors; No. 140, liquid starters for electric motors; No. 141, switch starters for electric motors; No. 147, multiple switch starters for electric motors; No. 155, contactor starters for electric motors; No. 167, auto-transformer starters for electric motors; No. 118, drum controllers for electric motors; No. 123, face plate controllers for electric motors; No. 129, contactor controllers for electric motors.

Inclusion of New Tests.

The specifications for switch and circuit breakers are for voltages not exceeding 660, and follow the same general lines as Nos. 109–1923 and 110–1923, but there are a number of additional clauses special to enclosed switchgear, for example, containing case, interlocking, clearances, etc. In the case of the switch specifications a test of breaking capacity has been included, and the flame-proof switch and circuit breaker specifications, a test of flame-proofness.

Periodical Revision Policy.

In accordance with the usual procedure all these specifications have been submitted to the interested traders and users' associations, technical societies and Government Departments for comment and approval. Those for motor starters, whilst in draft, formed the subject of an open discussion at the Institution of Electrical Engineers. As a result many valuable suggestions, the adoption of which made for the improvement of the specifications, were received. Other comments were recorded for future revision, as it is intended that a revision of all of them shall take place after a year or two's use.

In the preparation of the six starter specifications full use was made of the experience gained in connection with the pioneer specification for face plate starters (No. 82–1919). This latter will now be revised and brought up to date in conformity with the new issues.

Every endeavour has been made to secure the uniformity of the starter and controller specifications as far as possible. Each specification is sectionalised as follows:—general definitions; definitions of enclosures; rating, sizes and marking; design and construction; and tests.

Copies of the specifications are obtainable from the B.E.S.A. Publications Dept., 28, Victoria Street, London, S.W.1, price 1s. each.

Honour for Mr. W. R. Cooper.

Elected Fellow of City and Guilds Institute.

Mr. W. R. COOPER, M.A., B.Sc., A.C.G.I., has been elected a fellow of the City and Guilds Institute on the ground that since he gained his Diploma of Associate in 1893 he has done much original work and made valuable contributions to the advancement of the industry of electrical engineering.

After gaining his Diploma at the City and Guilds Central Technical College in 1893, Mr. Cooper entered works, and subsequently practised as a consulting engineer, for some years in partnership with Mr. J. Swinburne, F.R.S., and Mr. G. H. Baillie, and later on his own account. For thirteen years he was Editor of THE ELECTRICIAN, and materially contributed to the advancement of the electrical industry in that capacity.

He made many original contributions to learned societies, and has written several books.

During the war, Mr. Cooper was a member of the Nitrogen Products Committee, Chairman of the Gas Firing Sub-Committee and member of four other sub-committees. He is Hon. Treasurer to the Physical Society of London.

Automatic Telephone Systems.

The first volume of "Automatic Telephone Systems," by William Aitken (London: Ernest Benn, Ltd., 25s. net), which was enthusiastically received on all hands, is already familiar to most of our readers, and the publishers now announce the issue of the second volume, which deals with auxiliary services on large systems and with private and branch exchanges in all kinds of situations. Moreover, the author adds an important appendix, which brings completely up to date the subject matter of Volume I, by discussing developments which have taken place since the publication of that volume. The price of the second volume, which consists of 230 pages of text, supplemented by 131 illustrations and nine folding plates, is 35s. net. Volume III, now in active preparation, will deal with the systems put forward for London, New York and other great cities; semi-automatic systems and other matters of interest. The complete work will form an essential work of reference, embracing all that it known of interest in automatic telephony to-day.

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City and South London Railway Bill.

New Negotiations with Opponents.

A Local Legislation Committee of the House of Lords, Earl Beauchamp presiding, on July 10th, rejected that part of the CITY AND SOUTH LONDON RAILWAY Bill which deals with the extension from Clapham Common to Morden, where it was to have joined a new Wimbledon to Sutton railway. The proceedings before a Committee of the House of Commons were reported in our issue of May 4th last, p. 488.

Sir LYNDEN MACASSEY, K.C., for the City and South London Co, said all the local authorities whose districts the new line would serve supported the scheme, and the promoters had had numerous offers of support from residents. The Southern Co., he continued, feared the new line would divert traffic from its existing lines in this area, and suggested that the scheme should be decapitated at Tooting, because they were electrifying their lines in that area.

Lord ASHFIELD (managing director of the Underground Railways) gave evidence in support of the Bill, and referred to the recent marked change in London traffic.

Economy of Surface Construction.

Referring to the fact that it was proposed to construct part of the new line underground, and then to come to the surface for the remainder, Lord Ashfield said that this enabled the railway to be constructed more cheaply. The average cost of constructing a surface railway was £133 000 per mile, but double-track tube construction cost, on the average, £550 000 per mile. By extending outwards a little in advance of the immediate needs of the public they would keep down capital cost. The proper distribution of London's traffic could only be done by the underground railways, it was not possible for the main-line railways to do it. Dealing with the financial side, Lord Ashfield gave a number of calculations to show that there would be a surplus of £13 925 between income and expenditure, after the payment of interest on capital. It was proposed to raise £4 250 000 by redeemable debentures, this method being adopted in order that the Company might get a guarantee from the Trade Facilities Committee.

On July 11th, Lord Ashfield said the Trades Facilities Committee had already guaranteed £6 000 000 and were reserving from their total credits the sum of £8 000 000 for this and other underground developments. The company would raise the money in the open market, but the Government guarantee would enable them to do so at a much cheaper price.

Southern Railway's Electrification Plans.

Sir HERBERT WALKER (general manager of the South-Western Section of the Southern Railway Co.) said that the companies which had been designated " main-line companies " had conducted a very large amount of suburban traffic, and, prior to the advent of the tube railways, the suburban services were provided entirely by those companies at very heavy cost. In consequence, very large capital demands had been made upon the Southern Railway Co. and other companies operating around London. The area with which the Committee was concerned was developed to a large extent by the Southern Railway Co., which was contemplating the expenditure of about £7 000 000 on electrification.

Examined by Mr. SHORTT, Sir Herbert Walker said that he did not think there would have been opposition had the new extension stopped at Tooting, and that, had the Southern Co. been approached, they would probably have given the underground railways running powers over their loop lines connecting Tooting and Wimbledon. Mr. Shortt said that, if the Southern Railway agreed to the underground railways doing in a roundabout way what they now proposed to do in a better way, the question of principle disappeared. Witness replied that the question of principle did not disappear, but was entirely altered. Mr. Shortt obtained the information that the loop line referred to was closed, and that when it was open it did not pay. He also pointed out that to connect the new extension to the Southern Railway loop line at Tooting would mean coming to the surface sooner than was contemplated; this was a matter of engineering importance.

When the proceedings were resumed on July 12th counsel for both parties addressed the committee. Mr. MACMILLAN, for the Southern Railway Co., said the measure was calculated to injure them materially. He described the proposed extension as a gambler's throw, and said that the new policy of the Underground was that, finding it difficult to carry on as underground tramways, they wished to come to the surface and compete with the surface railways.

Sir LYNDEN MACASSEY said that if the line were decapitated at Tooting Broadway it would mean that it could neither be constructed nor operated, for financial reasons.

The chairman announced that the Committee would not allow the Bill to proceed so far as the whole extension of the railway from Clapham Common was concerned, but if there were any other technical matters left in the Bill to be dealt with they would hear them.

Other Extensions Affected.

Mr. SHORTT, for the promoters, said that, in view of that decision, the London Electric Railway Bill, providing for an extension which would connect the Hampstead Railway at Charing Cross with the City and South London line at Kennington, and would also connect with the Bakerloo line near Waterloo would probably be withdrawn. Subsequently he said that the City and South London and the London Electric Railway Bills were, in their proposals, very much one scheme, and the promoters had to consider what proposals in the two Bills could be carried out advantageously, in view of the Committee's decision. It was therefore agreed to adjourn until July 17th to enable the promoters to consider their position in the light of the Committee's decision.

When the Committee met on Tuesday, a further adjournment was asked for, on the ground that discussions had commenced between the City and South London Railway Co. and the Southern Railway Co., and that it was desirable that the parties should be given the opportunity of continuing the discussions. The CHAIRMAN said the Committee was very anxious to meet the wishes of the parties, and did not wish to do anything which would close the door to negotiations. The next sitting of the Committee will be arranged between the parties and the Committee Clerk.

We are informed that opposition to the London Electric Railway Bill has now been withdrawn, and the Bill will be considered by the Unopposed Committee of the House of Lords in the ordinary way.

Tenders Invited and Accepted.

GREAT BRITAIN.

ST. STEPHEN'S CHURCH, AUDENSHAW, LANCS.—Electric light wiring and fitting. Specification from Mr. D. C. Rolls, 59, Audley Street, Cockbrook, Ashton-under-Lyne.

NEWTON ROAD CONGREGATIONAL CHURCH, FAVERSHAM, July 23rd.—Electric light wiring and fitting. Particulars from Mr. Frederick Austin, 5, East Street, Faversham.

RHONDDA INSTITUTION FOR THE BLIND, LLWYNPIA, July 23rd.—Electric light installation. Specifications can be seen at the office of Mr. W. D. Morgan, 199, Ystrad Road, Pentre.

LAMBETH (LONDON) GUARDIANS, July 24th.—Electric light wiring and fitting at the Relief Station, Renfrew Road, Lower Kennington Lane, S.E. Specification, etc., from the Clerk, Brook Street, Kennington, S.E.

GREENOCK CORPORATION, July 28th.—Overhead transmission lines (1) between the Dellingburn (Greenock) and Blackhall Street (Paisley) power stations, (2) between the Corporation's existing transmission lines near Beith and the Blackhall Street station. Specifications from the Burgh Electrical Engineer, Dellingburn power station, Greenock.

SALFORD CORPORATION, July 30th.—Ten tramcar top covers, Particulars from the general manager. Tramways Department, 32. Blackfriars Street, Salford.

SHEFFIELD CORPORATION, July 30th.—Socket and spigot pipes, valve, strainer, etc., for conveying water along Club Mill Lane, Neepsend, for the Electricity Department. Specifications from the General Manager and Engineer, Commercial Street, Sheffield.

AUSTRALASIA.

VICTORIAN RAILWAY COMMISSION, August 8th.*—Three-phase induction motors, starting apparatus and accessories.

IRELAND.

DUBLIN CORPORATION, July 30th.—Two oil coolers for use in connection with steam turbine plant at Pigeon House electricity works. Particulars from the City Electrical Engineer, Fleck Street, Dublin.

DUBLIN CORPORATION, July 30th.—Supply, or supply and erection of transformers for one year. Specification from the City Electrical Engineer, Fleet Street, Dublin.

NEW ZEALAND.

AUCKLAND CORPORATION, August 9th.—Two miles galvanised steel span wire, 1 mile copper wire, two miles triple braided aerial cable, 500 yards lead-sheathed cable, joint boxes, 12 000 ft. earthenware troughing, overhead line fittings, etc. Specifications can be seen with Downie Bros., 7, Fenchurch Avenue, London, E.C.3.

N.Z. PUBLIC WORKS DEPARTMENT, August 21st.*—Steel runway crane for Khandollah sub-station (section 84 of Mangahao power scheme).

PORTSMOUTH CORPORATION has accepted the tender of the English Electric Co. for switchgear, at £2 651.

DEWSBURY GUARDIANS have accepted the tender of F. Whitton and Sons for internal telephones at the Guardians' Institution, at £313.

The tender of Stewarts and Lloyds for piping and valves for the Electricity Department, £200, has been accepted by WALLASEY URBAN DISTRICT COUNCIL.

The tender of W. T. Henley's Telegraph Works Co. for a pillar box in connection with the electricity supply, at £85 17s. has been accepted by BURY ST. EDMUNDS CORPORATION.

For a 500 kVA converter, with switchboard extension the tender of the Metropolitan-Vickers Electrical Co., at £2 850, has been accepted by NEWCASTLE-UNDER-LYNE CORPORATION.

For supplying three Sturtevant fans for public lavatories the tender of the Eastern Armature Winding Co., £75 10s., has been accepted by BETHNAL GREEN (LONDON) BOROUGH COUNCIL.

The tender of the Knighton Electric Supply Co. for public lighting from August 24th to the middle of April next, at £125, has been accepted by KNIGHTON URBAN COUNCIL. The tender of the gas company was £147.

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* Particulars from the Department of Overseas Trade.

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Electricity Supply.

Extensions and Developments.

Extensions to mains at a cost of £354 are to be undertaken by the CANNOCK Urban Council.

FULHAM Electricity Committee recommends the expenditure of £8 784 on additions to mains and cables.

DUMFRIES Town Council has applied to the Electricity Commissioners for a loan of £23 639 for additional plant and cables.

MALVERN Urban Council has applied to the Electricity Commissioners for a loan of £11 000 for extensions to the electricity works.

BLACKBURN Board of Guardians has decided to apply for an additional loan of £1 079 for the installation of electric light at the Poor Law Institution.

PORTSMOUTH Town Council has applied for a loan of £12 000 for laying cables, etc., along the route of the proposed new road from Gladys Avenue to Hilsea Lines.

CARDIFF Electricity Committee has adopted the report of the sub-committee appointed to consider proposed electrical extensions at Llanishen, estimated to cost £19 000.

HOLYWOOD (Belfast) Urban Council has engaged Mr. T. W. Parkinson to report on the electric lighting scheme and on the suitability of the proposed power station site.

The DUNBLANE and District Electricity Supply Co. has applied to the Perthshire County Council for permission to construct overhead and underground distributing cables in various parts of the Borough of Dunblane.

DARTFORD Urban Council has sealed an agreement for the supply of electricity for power to the Purification Works of the West Kent Main Sewerage Board, with a guaranteed minimum consumption of 27 500 kWh per quarter, on a 100 kW demand basis, and a loan of £3 750 has been applied for to cover the estimated cost of the necessary cable and switchgear.

A new sub-station was opened at HEDNESFORD last week. The station has been erected by the Cannock and Rugeley Colliery Co. for the double purpose of housing the equipment required to take a supply of energy from the Cannock Urban Council and for accommodating the transformers and switchboards required by the Council to give a supply to Hednesford.

Tapping New Areas.

EASTLEIGH Urban Council has informed the Southampton Town Council that it is prepared to take a supply of electricity for public lighting, and also for the public offices, but that the question of a supply for power needs further consideration.

Alterations in Charges, Proposed and Actual.

The desirability of reducing lighting charges is being brought to the attention of SOUTH SHIELDS Electricity Committee.

CANNOCK Urban Council has decided to reduce the minimum charge for electricity supplied to small consumers from 11s. 8d. to 5s. per quarter.

OBAN Town Council has made the following reductions in the charges for electricity :—Lighting, from 11d. to 9d. per kWh, special power, from 3d. to 2½d., power from 6½d. to 5½d., and heating and cooking, from 3d. to 2½d.

EASTBOURNE Town Council has reduced the charge for electricity for heating by ½d. per kWh, for power by ½d. and ¼d. per kWh, according to the quantity used, and the charge for street lighting by £674 a year.

AYLESBURY Town Council has applied to the Ministry of Transport for an order to fix the maximum charge for electricity at 9d. per kWh, with minimum payments of 11s. 3d. for each winter quarter, and 7s. 6d. for each summer quarter.

The rateable value system of charging for electricity supplied for household consumption, whereby the consumer is charged a fixed annual sum according to the rateable value of his house in addition to 1d. per kWh registered by meter, is to be introduced at HULL.

ROTHERHAM Town Council has revised the charges for electricity as from the June quarter meter reading for power and heating, from 75 per cent. to 50 per cent. above pre-war charges ; lighting, from 50 per cent. to 25 per cent. above pre-war charges ; for cinematograph motor generators, from 4d. to 3·3d. per kWh.

Inquiries and Orders.

MARLOW Urban Council has decided to oppose the application for an order by the Electricity Co. unless the company agrees to light all the roads in the town, at present served with gas.

WESTBURY-ON-SEVERN Urban Council has consented to the application of the West Gloucestershire Power Co. for a Special Order enabling it to distribute electricity within the council's area.

EASTRY Rural Council has decided to object to the application of Sir Charles Bright and Partners for an Order to supply electricity in the council's area, on the ground that the time is premature for such an Order.

SOUTH MOLTON Ratepayers' Association, having urged the Town Council not to proceed with an electric lighting scheme on the ground that it would not pay, has decided to petition the Electricity Commissioners opposing the scheme.

The Lancashire Electric Power Co. has applied to the Electricity Commissioners for a Special Order to supply electricity in ADLINGTON urban district. Any objections must reach the Secretary, Electricity Commission, Whitehall, London, by July 22nd.

Surprise is expressed in HOVE at the delay of the Electricity Commissioners in giving their decision in reference to the recent inquiry as to the application for a loan for the construction of a new central converter station in Hove Street, which is said to be urgently needed to cope with the increased demand for energy.

BEDFORD Corporation is applying to the Electricity Commissioners for a Special Order extending the Corporation area for electricity supply to Kempston urban district and certain parishes in Bedford and Biggleswade rural districts. Objections to the Secretary, Electricity Commission, Whitehall, London, by July 23rd.

Electrical Distribution of Yorkshire, Ltd., has applied to the Electricity Commissioners for a Special Order to generate and supply electricity in BURLEY-IN-WHARFEDALE urban district and certain parishes in WHARFEDALE rural district. Objections to the Secretary, Electricity Commission, Whitehall, London, by September 13th.

The EGHAM AND STAINES ELECTRICITY COMPANY has applied to the Electricity Commissioners for a Special Order to extend the company's area of supply so as to include the parishes of East Bedfont, Hanworth, Shepperton, Harmondworth, Harlington and Cranford in the Staines rural district. Objections to the Secretary, Electricity Commission, Whitehall, London, by September 7th.

Personal Items.

Mr. H. W. N. RICHARDS, formerly electric traction engineer to the London, Brighton and South Coast Railway, has been appointed assistant electrical engineer to the Southern Railway.

In recognition of his services to the Department of Engineering the Council of Sheffield University has conferred the title of Emeritus Professor of Mechanical Engineering on Dr. W. RIPPER.

Mr. E. A. ANDERSON, electrical engineer, of South Gosforth, has been selected out of over forty applicants for the post of resident engineer to the Amble Urban Council.

Mr. WILLIAM HUTTON, who is retiring from his position as clerk to the Birmingham Tramways Committee after twelve years' service, was on Tuesday presented with a travelling trunk from the committee and staff.

ALDERMAN J. MOXON, chairman of the Newport Electricity and Tramways Committee announces his inability to withdraw his resignation from the position, although the Committee recommended at its last meeting that the resignation be not accepted.

Our readers will be interested to learn that Mr. J. DALZIEL, electrical assistant to the chief mechanical engineer of the Midland Railway Co., was one of the five competitors in the "Graphic" competition at Bisley last Saturday who made "possibles" at 300 and 500 yards.

MR. J. E. EDGECOMBE, formerly borough electrical engineer, of Kingston-on-Thames, who lately resigned the appointment of director of the Electric Lamp Manufacturers' Association, Great Britain, Ltd., has joined the board of the Stearn Electric Lamp Co., Ltd., 12, Grosvenor Gardens, London, S.W.1.

A recommendation of the Electricity Committee that the electrical engineer, Mr. JOHN SENIOR, be asked to resign, has been approved by the Ilkley Urban District Council. The Associated Municipal Electrical Engineers in a letter to the Council described such action as unwarranted and a gross injustice to Mr. Senior.

MR. GEORGE V. TWISS, who founded the Twiss Electric Transmission, Ltd., and has acted as managing director since its inception, has now retired from that position, retaining, however, his financial and other interests in the company and seat on the board ; he has now been appointed advisory director. Mr. Twiss has taken separate offices at Broad Sanctuary Chambers, 11, Tothill Street, London, S.W.1, for the purpose of attending to this and also private work.

MR. HERBERT JONES, who has been appointed electrical engineer to the Southern Railway, has devoted practically the whole of his time to electric traction. His first electric railway work was done with the City and South London Railway, and in 1898 he moved to the Waterloo and City Railway. As electrical engineer to the London and South Western Railway he, in 1912, prepared a scheme for the electrification of the company's London surburban lines, which was adopted the same year.

MR. J. W. BLAKEMORE, who has been traffic superintendent for ten years, has accepted the position of deputy manager of the Salford tramway undertaking, subject to the approval of the Council. Since the resignation of Mr. G. W. Holford, about four months ago, Mr. Blakemore has been acting manager of the tramways, and will continue in this post until Mr. Moffet, whose appointment as manager the Council will be asked to confirm at its next meeting, takes over the duties about September.

PROF. ANDREW GRAY is resigning the chair of Natural Philosophy at Glasgow University—which he had occupied since 1899—at the end of September. In his earlier days, as private secretary to Sir William Thomson (Lord Kelvin), he assisted in the carrying out of the greater part of Sir William's researches on the "Effects of Stress on Magnetisation." He is the author of a number of treatises, including "Absolute Measurements in Electricity and Magnetism," "The Theory and Practice of Electrical Measurements," "Magnetism and Electricity," and "A Treatise on Bessel Functions."

OBITUARY.—We regret to learn that Mr. ROBERT T. TURNBULL, a director of Turnbull and Jones, Ltd., electrical engineers, New Zealand, was killed in a motor accident on July 12th.

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Electric Traction.

Tramway Extensions and Developments.

Extensions on the Fulwood tram route were opened at SHEFFIELD last week.

TORQUAY Tramways Co. proposes to relay part of its track in Torbay Road.

Tramway extensions costing over £45 000 are being considered by the JOHANNESBURG Town Council.

CARDIFF Tramways Committee has decided to purchase, at a cost of £569, a machine for eliminating rail corrugation.

The Mayor of Holborn last week said there were indications that the LONDON County Council intended again to seek the sanction of Parliament to a scheme of tramways through Holborn, down Farringdon Street, and into the City of London.

SUNDERLAND Town Council has authorised the extension of the tramway system from Sea Lane to Whitburn, a distance of 1¼ miles, at an estimated cost of £16 000, and from the Royalty to Silksworth, a distance of 3¼ miles, at an estimated cost of £48 800.

Fares, Receipts and Passengers.

HALIFAX Tramways Committee is considering the issue of tokens instead of contracts.

Notwithstanding recommendations to reduce fares, CARDIFF Tramways Committee has recommended a contribution of £6 863 to rate relief.

For the week ended July 7th, receipts on the MERSEY RAILWAY amounted to £5 058, bringing the total for the first 27 weeks of the year to £123 167.

A decrease of £1 238, compared with the corresponding week last year, is recorded in the receipts on BRADFORD Corporation tramways for the week ended July 7th.

For the week ended July 10th receipts on the LANCASHIRE United Tramways totalled £2 894, a decrease of £41 on the corresponding week of last year.

Receipts on the MADRAS Electric Tramways during the fortnight ended June 30th totalled 52 412 rupees, an increase of 14.6 on the corresponding period of last year.

Receipts on LONDON tramways controlled by the "Underground" group totalled £44 914 during the week ended July 7th, a decrease of £26 on the corresponding week last year.

At the final sitting of the Tramways' Charges Advisory Committee, appointed by the Ministry of Industry and Commerce to inquire into the charging powers of the DUBLIN United Tramways Co., it was stated that proposed reductions in fares would result in a loss of £132 793, which would leave the receipts £14 738 less than the working expenses of 1922. On the other side it was submitted that the Committee should not give power to the tramway to pay more than three-fourths of the 1914 dividend, and the time had come for the 1d. fare to be resumed.

Traction News in Brief.

NEWPORT Corporation is opposing a proposal to run motor 'buses into the town.

The heat wave has given rise to several suggestions for improving the ventilation of tram cars.

Of the 149 fatal accidents in LONDON during the first quarter of 1923 only seven were caused by tram cars.

Funerals by tramcar were suggested as a possibility by the chairman of the Liverpool Burials Committee last week.

An electrical device now fitted to ticket machines by the LONDON Underground Co. causes the machines when out of order to reject passengers' money.

Telegraph and Telephone Notes.

It is reported from Peshawar that a direct telephone line through the KOHAT PASS has been completed and is now working.

Reuter states that, in view of the deficit in the Post Office accounts, the AUSTRIAN GOVERNMENT is proposing a general increase in postal, telegraph, and telephone rates.

The net revenue for 1922 from SWEDISH telegraphs and telephones amounted, states an Exchange message, to 27 750 000 kr., or 7 000 000 kr. more than in 1921.

Said to be the largest cable ever laid in the Atlantic and the fastest in the world, the new ATLANTIC cable between London and New York will, it is reported, be laid by the beginning of August.

ITALIAN submarine cables are to be laid by the Compagnia Italiana Dei Cavi Telegrafici Sottomarini between Italy and Greece, Italy and the Azores, and between Italy, Spain, Brazil, Uruguay and Argentina.

An important scheme of TELEPHONE DEVELOPMENT is being carried out, particularly in regard to underground cables in the Manchester, Liverpool, and South and North Wales areas. A large cable is being laid between Manchester and Liverpool which will eventually enable communication to be maintained by means of direct underground wires between Manchester and Liverpool and most of the other important commercial centres, including London, Birmingham, Leeds, Edinburgh, Glasgow, Newcastle-on-Tyne, Hull, Nottingham, Bristol, Cardiff, and Swansea. In Birkenhead and in the Walton and Old Swan areas of Liverpool up-to-date central battery switchboards will be installed in new exchange buildings now in course of construction, while at Cardiff an extensive addition to the existing central battery switchboard is contemplated. At Swansea the latest type of automatic exchange is being installed.

Wireless News.

Wireless Trading in Italy.

The Department of Overseas Trade has received copies and translations of Royal Decrees containing regulations concerning the wireless service in ITALY and the granting of concessions and licences to companies, public bodies and private individuals for the installation and use of wireless plant. These may be inspected by interested United Kingdom parties on application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

Wireless from the Arctic.

British listeners-in may have an opportunity of tapping messages from an exploration party in the North Polar regions during the coming autumn and winter. The expedition, led by Dr. Donald B. MacMillan, has already left Wiscasset, Maine, for ELLESMERE LAND, to the west of Greenland, in the interests of natural history research. When the exploration ship, the "Bowdoin" becomes frozen in for the winter, attempts will be made to communicate by wireless with members of the American Radio Relay League, who are scattered all over the United States. According to the "Wireless World," there should be no more difficulty in receiving from the expedition ship in this country than in America.

Wireless and Motor Cars.

An interesting demonstration of the progress which has been made in the adaptation of wireless receiving sets with concealed aerials to private cars was given last Saturday by the MARCONI Co., when a party of fifty people in a fleet of cars was driven to Windsor; while there, the guests, in closed cars, heard, comfortably and clearly, the concert from the London broadcasting station. The apparatus is neatly enclosed in the car, and beyond a small covered switch-box fixed near the seats, and the head-pieces, there is nothing noticeable. The receiving set is a complete unit, and can be transferred to the house and connected up in the ordinary way. In the motor the car accumulators provide the filament current. A two-stage amplifier and loud speaker can be added to the set, if required, in which case, while the car is standing outside a house, the loud speaker can be taken inside on a long lead and used without removing the set from the car.

Institution of Electrical Engineers.

Election of New Members of Council.

The result of the ballot for the election of members of the Council of the Institution of Electrical Engineers for the session 1923-24 is as follows:—President, Dr. A. Russell; Vice-President, Sir James Devonshire; Hon. Treasurer, P. D. Tuckett; ordinary members of Council, J. M. Donaldson, Dr. W. M. Thornton, Colonel T. F. Purves, G. W. Partridge, P. Rosling; associate member, S. W. Melsom. The following ordinary members of Council were not elected:—W. M. Selvey, F. W. Purse, J. N. Waite, J. H. Parker.

The report of the committee of the North-Western Centre states that by the formation of the new Centre in Liverpool the membership of the North-Western Centre is substantially reduced, but the growth of the Institution work in Liverpool and North Wales has been sufficient to warrant the creation of a new Centre. The committee notes with pleasure the increasing support given to the Centre by the "small-current or telegraphy" members.

Miscellaneous.

As the result of a fire which occurred in the JOHANNESBURG electric power station on Tuesday, states Reuter, the whole power supply is cut off.

DIPLOMAS in electrical engineering have been obtained at University College, London, by E. G. Brunker, J. E. T. Cogle, C. K. Irwin, and J. Meek.

The staff of FRANCIS POLDEN AND Co., LTD., electrical engineers, London, spent a very happy day at Eastbourne last Saturday. The chairman of the company, Mr. F. C. Polden, was present, supported by Mr. Oswald, a director, and the heads of the office staff.

An outbreak of fire last Friday at the premises of the SIEMENS AND ELECTRIC LAMP Co., LTD., 38-39, Upper Thames Street, London, burnt out the fourth floor which housed the publicity department. No damage was caused to the remainder of the building and consequently there will be no interference with the firm's business.

Last Saturday the employees of the HART ACCUMULATOR Co., of Stratford, London, held their 25th annual outing, when an enjoyable day was spent at Hastings. Following a luncheon at Ferrari's Restaurant, short speeches were made by Mr. F. J. Holmes, the general manager, to which Mr. R. Wheatley, works superintendent, suitably responded.

Business Items.

The business of REID AND Co., electrical engineers, 108, High Street, Ayr, has been transferred to Messrs. Thomas McCulloch and Richard Currie, who will continue the business under the name of Reid and Co.

The VINCENT SWITCHGEAR MFG. Co., of Sampson Road North, Birmingham, has just opened a branch at 1, Union Street, Belfast, where their manager, Mr. Garmany, has representative stocks of all Vincent products.

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Companies' Reports, Dividends, etc.

ELECTRICIAL UTILITIES CORPORATION.—Declaration is made of a dividend of 1¼ per cent. on the preferred stock for the quarter ended June 30th.

GREENWOOD AND BATLEY.—For the year to March 31st last the trading left an available balance of £44 928, of which depreciation (£5 000) and interim dividends absorbed £17 224, leaving £27 704. Payment of the final dividends reported in our previous issue leaves £15 480 to carry forward.

GENERAL ELECTRIC CO.—The dividend announced in our issue of July 6th and the accounts summarised in that issue were adopted at the annual meeting on July 12th, when Mr. Hugo Hirst, who presided, said the results were satisfactory, although the year had been one of special difficulty. He was optimistic as to the future of the company, and although he did not anticipate a boom he believed that better times were in store.

EDMUNDSONS' ELECTRICITY CORPORATION.—Presiding at the annual meeting last week, Mr. P. D. Tuckett, in referring to the net profit for the year of £52 103, a sum £20 000 in excess of that of the previous year, said the improved results were due in part to a larger output and in part to the fall in costs. In spite, however, of that welcome reduction in their costs, they were still more than double the comparable figure for 1914, with no immediate prospect of any substantial further reduction. Their financial position had been greatly strengthened by the improved position of their sub-companies, the advances to which had been considerably reduced. Excluding the Lancashire Power Co., their additional connections amounted to 3 688 kW, a somewhat smaller addition than in the previous year, but trade depression had militated against power connections, and consequently a much larger proportion of their connections were for lighting. There was still ample scope for development, and all the tendencies were in favour of the extended use of electricity.

Cable, Telegraph and Telephone Companies.

MARCONI INTERNATIONAL MARINE COMMUNICATION CO.—Presiding at the annual meeting on July 13th, Mr. Godfrey C. Isaacs said the profit for the year showed an improvement of over £53 000. Still further improvement was shown in the figures for the first five months of the current year. Good progress had been made during the year in the fitting of British steam trawlers with wireless apparatus. Many technical problems had to be solved before broadcasting at sea could become an accomplished fact. This matter was well in hand, and there seemed no reason why eventually additional revenue should not accrue to the company through this channel. They had opened new depots at Hong Kong and Port Said, in order that adequate inspection of ship stations on the routes affected should be ensured.

EASTERN EXTENSION AUSTRALASIA AND CHINA TELEGRAPH CO.—The report for the year ended December 31st last states that the gross revenue amounted to £2 061 543, from which is deducted £755 440 for the ordinary expenses, and £319 937 for maintenance of cables and special expenditure, leaving a balance of £986 166. After providing £231 266 for income tax and corporation tax payable in England, and £30 096 for interest on the mortgage debenture stock, there remains a balance of £724 802, to which is added £307 880 brought forward, making a total available balance of £1 032 682. From this balance the directors have transferred £250 000 to the general reserve fund. Four dividends of 2½ per cent. each have been paid, amounting to £400 000, making a total distribution for the year 1922 of 10 per cent. free of income tax. These appropriations absorb £650 000, leaving a balance of £382 682 to be carried forward.

Supply and Lighting.

COUNTY OF LONDON ELECTRIC SUPPLY CO.—The directors have authorised the payment of the following interim dividends on account of the year 1923:—3 per cent. upon the fully paid preference shares, 3 per cent. upon the partly paid preference shares, calculated from the due dates of the instalments to June 30th, 1923; 4 per cent. upon the fully paid ordinary shares and 4 per cent. upon the partly-paid ordinary shares. All are payable less tax, on September 15th.

BOURNEMOUTH AND POOLE ELECTRICITY SUPPLY CO.—An interim dividend is declared on account of the year ending December 31st next of 3½ per cent., less tax, on the ordinary shares, payable on August 15th.

KENSINGTON AND KNIGHTSBRIDGE ELECTRIC LIGHTING CO.—The directors have declared an interim dividend of 5 per cent. on the ordinary shares for the half-year ended June 30th last.

New Companies.

MELDONS, LTD.—Private. Cap., £6 000 in £1 shares. Electrical engineers and contractors. Reg. office: 28, South Anne Street, Dublin.

COLEY AND SWINNERTON, LTD.—Private. Cap., £2 000 in £1 shares. Electricians, etc. Reg. office: Bon Accord Works, St. John's Square, Wolverhampton.

TREDEGARS (1923), LTD.—Private. Cap., £20 000 in £1 shares. Electrical engineers and contractors, etc. Reg. office: 7, Brook Street, Westminster, London, S.W.

A. DEAKIN AND CO., LTD.—Private. Cap., £1 000 in £1 shares. Electrical and heating and ventilating engineers. Reg. office: Victoria Ironworks, Walmgate, York.

Forty Years Ago.

"The Electrician," July 21st, 1883.

ELECTRIC LIGHTING AT WALHAM GREEN.—The Butchers' annual fête, held on Tuesday, July 17th, at the Almshouses, Walham Green, was lighted by five Crompton arc lamps of 4 000 candle-power each, supplied with current by two Burgin machines driven by a portable steam engine. Messrs. R. E. Crompton and Co. have lighted this fête for the last four years very successfully, but until this year fewer lights were used, and the large marquee in which the ball is held was lighted with candles. The committee, however, being so well pleased with the former lighting of the grounds, determined to use electricity inside the ball tent, and therefore instructed the contractors, through their indefatigable chairman, Mr. Calcutt, to fix two arc lamps in place of the candelabras usually containing a large number of candles. The effect of the lighting both inside and out was very fine, and gave great satisfaction.

* * * *

THE EDISON ELECTRIC LIGHT.—The Criterion Theatre, Piccadilly, is to be lighted throughout with about 600 Edison incandescent lamps. The generating plant will comprise two Armington and Sims horizontal high-speed engines, having 13 in. cylinder by 13 in. stroke, running at 275 revolutions per minute, and driving on to counter-shafting from which will be run four Edison *l* dynamos, each capable of sustaining 150 sixteen-candle lamps. Each engine will be capable of indicating 84 horse-power at 70 lb. pressure, and either engine will thus be able to take the whole load in the event of accident or repairs to the other. The wiring will be arranged on eight circuits, each under independent control, by means of a specially designed regulator capable of lowering or raising the brilliancy of the lamps from normal candlepower to nil. The contract for the work, which will be carried out by the Edison Electric Light Co., stipulates for the completion of the installation by the beginning of September.

* * * *

A COMPROMISE.—A foreign paper devoted to gas-lighting interests announces an invention which promises to bring the two rivals, gas and electricity, into close partnership. Through an ordinary gas flame a curved metallic rod is passed, the said rod consisting apparently of platinum, though this is not very clearly stated. A slight current of electricity, such as would be supplied by one or two small elements, passed through this rod will be found, it is said, immensely to increase the illuminating power of the gas flame. A light four or five times as great as that of the unassisted flame, and at a cost of one-third, is the result announced, though as to all such calculations it really seems to be of little use to take any notice of them when inventors and their friends trot out their little bantlings; but if it should prove to be the fact—and the statement is one which any electrician may put to immediate test, and would hardly, therefore, have been put forward without some degree of truth—that a slight current passed through a platinum wire will affect a gas flame as asserted, it may have very important results in connection with domestic arrangements for lighting and heating. The relative proportion of luminous and heat rays is completely altered, it is affirmed, and the arrangement is capable of furnishing "all gradations, from the brilliant flame to the most calorific radiations." It is very well known that a gas for heating purposes only could be supplied to housekeepers at a much lower rate than for lighting, and, if this invention should be capable of acting as it professes, it seems very possible that a gas supply of the cheaper description, adapted for heating alone, may, by the co-operation of the electric current, be converted instantly into an illuminating agent. In the interests of consumers, therefore, it is to be hoped that this reported invention genuine.—"Globe."

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER (Special Swedish Issue).—"Swedish Furnishing." Special articles and illustrations of the Gothenburg Jubilee Exhibition.

THE CHEMICAL AGE.—"The Treatment of Effluent Spent Liquors"; "The Chemistry of Colloidal China Clay," by A. B. Searle.

THE EUROPEAN COMMERCIAL.—"Monthly Review of the European Steel Industry"; "Position of the Austrian Mining and Metal Industries"; "Industrial and Economic Developments in Latvia."

THE FRUIT GROWER.—"Market Garden Law"; "Compatibility in Spraying Mixtures"; "The Routine of Importing."

GARDENING ILLUSTRATED.—"The Educative Value of the Flower Show"; "Summer Pruning"; "Rose Budding."

THE GAS WORLD.—"Manufacture of Blue Water Gas"; "Australian Gasworkers' Demands"; "Improved Working Results from a New Plant."

THE HARDWARE TRADE JOURNAL.—"Sheffield Steel Products, Ltd.: The Reconstruction Scheme"; "Hints on Ticket Writing"; "The Trade Barometer: Comparisons of Hardware Export Figures."

The LONDON, MIDLAND AND SCOTTISH RAILWAY is reported to be contemplating the electrification of the route from Preston to Carlisle, and is said to be building an experimental electric locomotive.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

BENNETT (J. L.) AND CO., LTD., 17A, South Castle Street, Liverpool, electricians. £19 19s. 7d. May 31st.

McGHEE-SPENCER AND CO., Erick Street Works, New Bridge Street, Newcastle-on-Tyne, electrical engineers. £14 15s. 4d., June 4th; £14 5s. 10d., June 4th; and £10 12s. 4d., May 31st.

SWINDEN, Charles R. W., 18, Queen Victoria Street, E.C., electrical engineer. £46 13s. 6d. May 1st.

WHITEHOUSE, Mr. J. H., 16, Martin Street, Morriston, Swansea, electrical engineer. £14 16s. 1d. June 4th.

YOUNG, Messrs. (a firm), 186, Above Bar, Southampton, radio engineers. £17 17s. 10d. June 11th.

Mortgages and Charges on Limited Companies.

MIDLAND WIRELESS MANUFACTURING AND SUPPLY CO., LTD., Hanley. Registered July 3rd. £500 debentures; general charge.

Satisfactions.

EAST ANGLIAN ELECTRICITY, LTD., Felixtowe. Satisfaction registered July 7th. £2 000, balance of amount registered December 6th, 1922.

TORPOINT ELECTRIC SUPPLY CO., LTD. Satisfactions registered June 29th, £220, registered January 24th, 1916; also registered June 29th, £1,280, registered February 16th, 1917.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

COOKE, Walter Ellerslie, trading as UNIVERSAL LIGHTING CO., 206, High Street, Hounslow, electrical engineer and wireless dealer. A meeting of creditors last week decided to confirm the deed of assignment already executed to Mr. James Partridge as trustee. The statement of affairs presented showed liabilities £1 765 (unsecured trade creditors, £1 226), and net assets of £161, a deficiency of £1 604. Debtor started business at Reading in September, 1921. He sold the business there for £600 on June 30th, 1922. For a period of seven months the debtor was carrying on at the Reading business and at the above address. The trading of the Reading business showed a profit of £314, while the Hounslow business showed a loss of £2 407.

ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., manufacturing electrical engineers, 109, New Oxford Street, London, W. Unsecured liabilities amounting approximately to £20 000 against net assets of £3 000, or a deficiency of about £17,000, were disclosed at the statutory meeting last week of the creditors in this voluntary liquidation. The total liabilities of the company were reported as £24 500, the principal being bankers and cash creditors £13 130, income tax claims and wages unpaid £770, and trade and general creditors £10 600. With regard to the assets, the cash in the bank exceeded £3 000, but with the exception of about £50 the bankers claimed the whole of the money as a set-off against the amount due to them. The directors had valued the stock at £1 110, but here again the major portion was claimed by the bank as against advances made. The book debts totalled £4 670, but about 25 per cent. were thought to be irrecoverable. The lease of the premises in Oxford Street had been valued at £1 200, but it might be difficult to realise that figure at the moment, and in addition it was mortgaged, and the mortgagee was in possession. The prospect for the ordinary creditors was somewhat doubtful.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-Up Voluntarily.

WIRELESS AGENCIES, LTD. By resolution, July 3rd.

Bankruptcy Information.

MICHAEL, John, 6, Sneyd Terrace, Silverdale, and 20, George Street, Newcastle-under-Lyme, both in the county of Stafford, electrical engineer. Receiving order, July 12th. Debtor's Petition.

Notices of Intended Dividends.

CARTWRIGHT, Thomas Stanfield, 90, Wellington Street, Stockport, carrying on business under the style of T. S. CARTWRIGHT AND CO., electrical contractor. Last day for receiving proofs, July 28th. Trustee, J. G. Gibson, Byrom Street, Manchester, Official Receiver.

WEEKS, William Edward, of 59, Victoria Street, Bristol, wholesale electrical dealer. Last day for receiving proofs, July 28th. Trustee, J. P. Emett, 18, St. Nicholas Street, Bristol.

Partnership Dissolved.

THE RADIOWAVE CO. (Emanuel DAVIS, Harry NORDEN and Phyllis Hannah SAVITT), wireless instrument manufacturers, 81, Dean Street, Oxford Street, W.1, by mutual consent as from June 25th, 1923. Debts received or paid by P. H. Savitt.

Bankruptcy Proceedings.

BRITISH RADIOPHONE CO., Downing Street, Bulwell, Nottingham, makers of wireless apparatus. The statement of affairs in this compulsory winding-up shows liabilities of £1,653 against assets of £125, a deficiency of £1,528. Debtors, Norman and Mabel Williams and Walter Cook, attributed their failure to lack of capital, loss by cancellation of a contract, and loss by inability to obtain delivery of raw material. Norman Williams stated that the business was started in partnership on August 1st, 1922. They had none of them any experience in the trade, but they employed a man who understood wireless apparatus. No capital was provided, an overdraft being obtained of £50, and later loans were obtained amounting to about £500. Orders to supply sets and parts were received, and one contract was taken up to supply 300 sets for £615, but debtors were unable to complete this contract, with the result that it was cancelled and they lost about £100. They then commenced a mail order business, but had been unable to supply the goods. Creditors started to press for payment, and the stock was sold under an execution. It was stated that they had plenty of orders on hand, but through lack of capital had been unable to execute them. Debtors were ordered to file a cash account and a goods account in respect of their transactions.

WRIGHT, Robert (trading as ROBERT WRIGHT AND CO.), electrical engineer, 34–36, Oxford Street, W. The statutory first meeting of creditors was held on July 12th at Bankruptcy Buildings, Carey Street, W.C. The Official Receiver said that in August last, with a view to manufacturing wireless, debtor opened works in Cricklewood Lane, and in the following month he opened a wireless department at 34–6, Oxford Street. He took an apprentice, who paid a premium of £500, and a little later the father of that gentleman invested another £500 in the business (wireless branch), at interest, being given an appointment at £3 a week. In February last the debtor appointed a works manager on condition that he invested £300 in the business, at interest, and in return he was to receive £4 10s. a week and a bonus on the profits. At the end of that month an arrangement was made between the debtor and his works manager to take premises at 72, Merton Road, Wimbledon, and for the debtor to put in stock to the value of £300 as against the other's £300 cash, those premises being opened as the Reputation Radio and Electric Co. The debtor said that his failure and insolvency were due to losses on contracts, to insufficient staff, to slack trade and to delay in the settlement of the wireless licensing question. No statement of affairs had yet been lodged, but he had roughly estimated his liabilities at £3 864 and valued his assets at £1 250.

Prices of Metals, Chemicals, etc.

TUESDAY, July 17.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£68 0 0	—	£1 0 0
Electro Wirebars ..	,,	£73 0 0	5s.	—
H.C. Wire, basis ..	per lb.	10 5/8d.	—	—
Sheet	,,	10¾d.	¼d.	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2⅛d.	—	—
Brass 60/40—				
Rod, basis	,,	7½d.	—	—
Sheet, basis	,,	10d.	—	—
Wire, basis	,,	10¼d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 15 0	—	2s. 6d.
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 10 0	—	—
Lead Pig—				
English	,,	£25 5 0	—	10s. 0d.
Foreign or Colonial	,,	£24 0 0	—	2s. 6d.
Tin—				
Ingot	,,	£179 0 0	—	£2 10 0
Wire, basis ..	per lb.	2s. 4⅛d.	—	⅜d.
Aluminium Ingots	per ton	£120 0 0	—	—
Spelter	,,	£28 12 6	5s.	—
Mercury	per bottle	£10 7 6	—	—

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2¾d.
,, (Roll-Brimstone)—,, £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. ,, £26 per ton, £7 10s.
Boric Acid (Crystals). ,, £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2½d.; plantation 1st latex, 1s. 1⅞d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

196 544 METROPOLITAN-VICKERS ELECTRICAL CO. and N. E. NORTH. Controller for electrical control systems. (18/1/22.) (Divided Application on 187 038. Addition to 187 038.)
196 639 L. J. RICH. A.-C. signalling devices. (31/10/21.)
196 657 W. ANDREWS-TESTER and S. THOMPSON. Control of a.-c. motors. (12/1/22.)
196 661. J. F. MONNOT. Electrical switching-devices. (20/1/22.)
196 686 METROPOLITAN-VICKERS ELECTRICAL CO. and D. R. DAVIES. Switch-gear. (26/1/22.)
196 688 L. G. PRESTON, H. G. HUGHES, and S. R. MULLARD. Thermionic valves. (26/1/22.)
174 636 GES. FUR DRAHTLOSE TELEGRAPHIE. Radio receiving systems. (31/1/21.)
196 697 F. H. LORING. Electrical apparatus for production of oxides of nitrogen in the manufacture of flour. (27/1/22.)
196 701 R. CAVEDONI and E. MARINELLI. Incandescent lamps. (30/1/22.)
196 719 W. DEACON. Electric automatic road signal device for cross-roads and road turnings. (7/2/22.)
196 726 METROPOLITAN-VICKERS ELECTRICAL CO. and I. N. WHITESMITH. Commutators for electrical machines. (8/2/22.)
196 729 V. ORTEGA. Thermo-electric apparatus for heating water, etc. (9/2/22.)
196 750 BRITISH THOMSON-HOUSTON CO. (General Electric Co. N.Y.). Synchronous electrical machines. (21/2/22.)
196 753 F. C. B. CHASE. Fitments for use in connection with wiring systems. (23/2/22.)
196 775 PARK ROYAL ENGINEERING WORKS, LTD., and W. J. DAVIS. Switch-gear of truck type. (16/3/22.)
177 793 E. PERUZZI and S. PRETI. Printing telegraphy convertible from line to radio-transmission. (31/3/21.)
196 783 A. AVISS. Collapsible boxes or cartons for packing electric lamps. (31/3/22.)
196 785 FERGUSON, PAILIN, LTD., and G. PAILIN. Automatic air and oil break electric switches. (31/3/22.)
196 798 H. PARODI. Electric railway tracks with third or fourth rail conductor. (12/4/22.)
181 331 ANC. ETAB. BARBIER, BENARD, ET TURENNE, Soc. ANON. Automatic commutating switches. (10/6/21.)
196 817 H. LUCAS and W. H. EGGINGTON. Incandescent lamps. (1/5/22.)
196 829 BERRITE, LTD., and F. FERNIE. Insulation of conductors. (20/5/22.)
196 830 WESTERN ELECTRIC CO. Motors for use on a.c. systems. (22/5/22.)
181 020 M. LATOUR. Electrical outfit for use as a toy or for demonstrations assisting the realisation of commercial electrical machines. (4/6/21.)
182 478 METROPOLITAN-VICKERS ELECTRICAL CO. A.C. power transmission systems. (30/6/21.)
186 031 METROPOLITAN-VICKERS ELECTRICAL CO. Automatic reclosing circuit-interrupters. (16/9/21.)
196 848 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electrical machines. (26/7/22.)
191 703 VOX MASCHINEN-AKT.-GES. Electric winding devices for spring motors. (16/1/22.)
188 670 MARCONI'S WIRELESS TELEGRAPH CO. Methods of receiving telegraphic signals. (12/11/21.)
196 946 PREMIER COOLER AND ENGINEERING CO. and H. STEVENS. Devices for cooling electrical machinery. (1/11/21.)
196 968 W. W. BURNHAM. Switches. (15/8/22.)
196 971 F. E. PERNOT and L. J. RICH. Means for effecting phase adjustment of electrical systems. (4/1/22.)
184 436 PHILIPS' GLOEILAMPENFABRIEKEN. Manufacture of insulating sheets or layers. (8/8/21.)
174 613 A. WIRTH. Electric lighters. (26/1/21.)
196 980 WESTERN UNION TELEGRAPH CO. and J. V. FOLL. Synchronous telegraph systems. (27/1/22.)
196 986 C. B. KERSTING and U. BEATON. Windings of electrical coils. (30/1/22.)
196 990 H. BARON (F. ALDENDORFF). Automatic electric switching systems. (30/1/22.)
197 001 SIEMENS BROS. AND CO., and H. G. WOOD. Electricity supply systems. (2/2/22.)
197 006 BRITISH ELECTRICAL TRANSFORMER CO. and S. C. MOUNT. Electrical and mechanical connections or joints. (2/2/22.)
197 013 A. DE G. SPINO. Voltaic cells. (3/2/22.)
197 014 R. LONGUE. Means for preserving an electric motor against an injurious surrounding medium whilst ensuring lubrication and cooling of motor. (3/2/22.) (Addition to 159 862.)
175 615 H. G. H. DE J. D'AVENAS. Rectifying and connecting and disconnecting switches for alternating currents. (15/2/21.)
197 028 T. MCKENNA (DICTOGRAPH PRODUCTS CORPORATION). Signal systems for telephones. (7/2/22.)
175 280 D. LODDER and G. VERDONK, JUN. Electrical plug-contacts. (9/2/21.)
197 040 EDISON SWAN ELECTRIC CO., and C. E. HIATT. Vehicle head-lights, etc. (9/2/22.)
197 046 J. A. E. A. ELLIS. Changeable electric code switch. (10/2/22.)
197 052 J. CLIFTON, J. ROBINSON and J. SPENCER. Time switches. (13/2/22.)
197 058 D. C. CROWE. Telephone systems. (14/2/22.)
197 066 T. W. S. HUTCHINS. Electro-deposition of metals. (15/2/22.)
175 972 HART MFG. CO. Switches. (24/2/21.)
197 072 A. W. MATHYS (WILSON-MAEULEN CO.). Electrical resistance thermometers. (16/2/22.)
197 077 J. B. BOLITHO. Receiving-apparatus for wireless and other tuned signalling. (20/2/22.) (Cognate Application, 30 993/22.)
197 079 R. J. KAULA and A. H. RAILING. Insulators for supporting conductors. (21/2/22.)
197 084 C. P. RATCLIFFE, W. K. BARKER, and S. G. JONES. Electrical instruments, etc. (22/2/22.)
197 087 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electrically-heated tools. (23/2/22.)
197 089 F. C. B. CHASE. Fuses for use in electric wiring systems. (23/2/22.)
197 093 WESTERN ELECTRIC CO., LTD. Telephone exchange systems. (24/2/22.)
197 098 H. J. WARNER and T. H. KINMAN. Wireless telegraph and telephone systems. (25/2/22.)
197 106 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Thermostatic electric circuit controllers. (1/3/22.)
197 109 METROPOLITAN-VICKERS ELECTRICAL CO., A. E. L. SCANES, and E. E. I. PILCHER. Cubicles or cells for enclosed switch-gear. (3/3/22.)
197 113 METROPOLITAN-VICKERS ELECTRICAL CO. and N. G. LANGRISH. Controllers for electrically-operated cranes and hoists. (7/3/22.)
197 140 A. ONWOOD. Inductances. (23/3/22.)
186 574 L. H. M. HUYDTS. Electric clocks. (30/9/21.)
197 144 C. J. RIXEN. Electric protective devices. (24/3/22.)
197 155 VACUUMSCHMELZE GES., and DR. W. ROHN. Induction furnaces. (31/3/22.)
197 157 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Mounting of pointers or needles in galvanometers. (3/4/22.)
197 160 FULLER'S UNITED ELECTRIC WORKS, and R. E. BESWICK. Vents for storage batteries. (7/4/22.)
197 167 J. B. TUCKER. Switches. (12/4/22.)
197 170 R. F. WOODBURN. Electrodes for electrolysis. (19/4/22.)
197 171 A. P., G. C., and P. A. LUNDBERG, and G. PEGG. Switches. (19/4/22.)
197 183 G. R. BAYNTON Dry batteries. (28/4/22.)
197 185 WESTERN ELECTRIC CO. Selecting switches. (29/4/22.)
197 190 H. LUCAS and J. H. CHAMBERS. Ignition magnetos. (6/5/22.)
197 196 A. P. STROHMENGER. Welding electrodes. (12/5/22.)
197 204 H. LEITNER. Storage batteries. (18/5/22.)
197 209 L. N. REDDIE (OFFICINE MECCANICHE ITALIANE). Frequency meters. (26/5/22.)
181 359 E. A. A. MIGNOT. Electrical contact-makers for use with the steering-wheels of vehicles. (11/6/21.)
186 590 CONCORDIA ELEKTRIZITATS AKT.-GES. Charging device for miners' electric lamps. (29/9/21.)
197 253 MATHER AND PLATT and E. W. BUCKLEY. Apparatus for automatically operating switches of electric pumps. (16/9/22.)
191 069 O. KURZ. Overhead supply systems for electric traction. (7/3/21.) (Divided Application on 176 769.)

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July 2nd.

17 045 H. A. MACKENZIE. Electric tramcars, etc.
17 087 R. G. CAVE. Variable electric contact maker.
17 089 H. G. LANSTE. Portable wireless receiving set.
17 092 WESTERN ELECTRIC CO. High frequency signalling systems.
17 095 G. W. WALTON. Telephone receivers.
17 105 H. P. T. LEFROY. Wireless signalling systems, etc.
17 111 E. J. LEVER and A. H. SOPER. Crystal detectors.
17 115 C. E. CROSSLEY. Producing electric current.
17 120 SACHSENWERK LICHT U. KRAFT AKT. GES. Electric conductor systems. (20/2/23, Germany).
17 137 J. COURTIER. Dual ignition apparatus.
17 139 J. CULLERIER. Transparent panels for lighting arrangements. (8/8/22, France).
17 143 H. WADE (PHILIP'S GLOEILAMPENFABRIEKEN). Electrodes for discharge tubes.
17 144 N. ASHBRIDGE. Radio receivers.
17 147 LODGE-COTTRELL, LTD. (METALLBANK U. METALLURGISCHE GES). Cleaning gases.
17 148 E. A. GRAHAM and W. J. RICKETS. Thermionic valves, X-ray tubes, etc.
17 149 E. A. GRAHAM and W. J. RICKETS. Ballast resistance lamps.
17 150 E. A. GRAHAM and W. J. RICKETS. Loud speaking telephone apparatus.

July 3rd.

17 158 S. H. GREEN. Wireless reception device.
17 159 S. H. GREEN. Wireless signal amplifier.
17 160 S. H. GREEN. Telephone signal magnifier.
17 162 S. J. H. WILKES. Variable condensers.
17 176 T. G. P. HEALEY. Electric meters.
17 184 M. WALKER. Electrostatic separator.
17 216 F. L. LASH. Wireless insulators and formers.
17 223 G. O. OPENSHAW. Structures for supporting wireless receiving instruments.
17 243 C. FIRPO. Therapeutic apparatus for producing and supplying electric current.
17 224 G. O. OPENSHAW. Terminal connectors.
17 250 AKT.-GES. BROWN, BOVERI ET CIE. Transformers with clamped concentric coils. (6/7/22, Germany.)
17 251 AKT.-GES. BROWN, BOVERI ET CIE. Anode castings for mercury vapour rectifiers. (12/7/22, Germany).
17 274 BRITISH THOMSON-HOUSTON CO., R. D. GIVEN, and W. J. POOL. Electric control systems.
17 275 A. F. SYKES. Electric sound-producing apparatus.

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17 287 R. R. PALMER. Holder for electric lamps.
17 298 W. F. GRAHAM. Generation of electrical energy.
17 310 M. M. WARD. Rotary current distributors for internal combustion engines.
17 322 E. J. CAPPER. Wireless systems.
17 324 WESTERN ELECTRIC CO. Electric networks. (9/8/22, U.S.)
17 325 WESTERN ELECTRIC CO. Electric condensers. (6/9/22, U.S.)
17 329 LODGE-COTTRELL, LTD. (METALLBANK U. METALLURGISCHE GES.). Electrica precipitation of suspended particles from gaseous fluids.
17 334 F. MORRIS. Electric controllers.
17 344 ENGLISH ELECTRIC CO. Electric controllers.
17 349 D. H. T. BOND. Recorder for Morse signals.
17 351 R. C. GRASEBY. Electric circuit controllers.
17 354 T. GRAHAM-FARISH. Connectors for electric circuits.
17 301 IGRANIC ELEC. CO., A. H. CURTIS, A. H. MACKLEY, and S. R. WRIGHT. Wireless apparatus.
17 363 IGRANIC ELEC. CO. and A. E. BROOKS. Adjustable inductances.
17 367 J. H. RUNBAKEN and W. TORRANCE. Magnetisation of pole-pieces of generators.
17 369 A. M. SJOO. Automatic relays.
17 381 BRITISH THOMSON-HOUSTON CO. and W. T. MUNRO. Elektron discharge devices.
17 395 and 17 396 CREED AND CO., F. G. CREED and E. A. WILLSON. Electric Telegraph systems.

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17 415 and 17 416 F., G. H. H. and W. PARKIN. Crystal detectors.
17 418 J. GEARY and B. PHILLIPS. Wireless telephony.
17 423 R. BURNS. Track and wheel brake shoe for tramcars, etc.
17 438 G. E. FOLKES (PACKARD ELECTRIC CO.). Temperature indicating devices.
17 442 E. ZAPPERT. Inductance coils.
17 445 T. G. BUCKINGHAM and W. J. JOEL. Burglar alarm.
17 450 C. H. JOHNSON. Loud speaking telephone receivers.
17 490 HOBDELL, WAY AND CO., and M. PAYNE. Electro magnetic transmission of power on vehicles.

July 6th.

17 519 A. H. PERKINS. Clips for electric cables for multi-cylinder engines.
17 520 F. B. COX. Variable resistances and control switches.
17 569 METROPOLITAN-VICKERS ELECTRICAL CO. Elastic fluid turbines.
17 533 C. E. DAWKINS. Variable condenser discharge tubes.
17 570 M. LATOUR. High frequency electromagnetic apparatus.
17 573 A. G. KERSHAW. Point and signal operating mechanism for double-wire transmission.
17 587 GENERAL ELECTRIC CO., LTD. Electric gas-filled discharge tubes. (31/1/23, Germany.)
17 596 SIGNALAPPARATEFABR., J. KRACHER, A. G., and M. GERSCHLER. Electric switches.
17 605 FELTEN AND GUILLEAUME CARLSWERK AKT.-GES. Junctions between coil boxes and cables. (6/7/22, Germany.)
17 608 P. V. SUMMER. Telephone, etc., earpiece.

July 7th.

17 617 J. P. GARNETT. Variable tuner for wireless waves.
17 625 A. MARR. Telephone receivers.
17 638 MACFARLANE ENGINEERING CO., and J. C. and W. A. MACFARLANE. Generators for electric welding.
17 664 G. F. NICHOLSON. Wireless telegraphy, etc.
17 673 METROPOLITAN-VICKERS ELECTRICAL CO. Steam turbines.
17 683 DAVID AND SON (DERBY), A. ABELL and I. S. MACKENZIE. Miners' electric lamps.

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July 27, 1923.

ANNUAL MARINE NUMBER.

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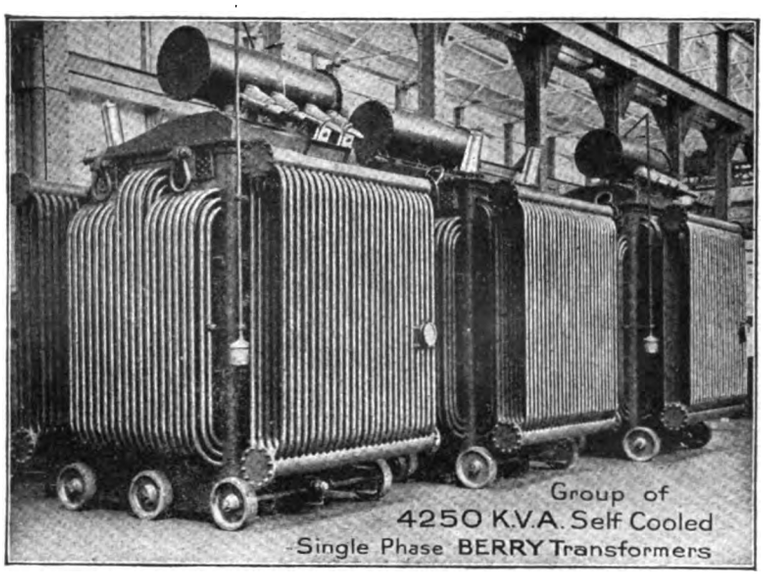

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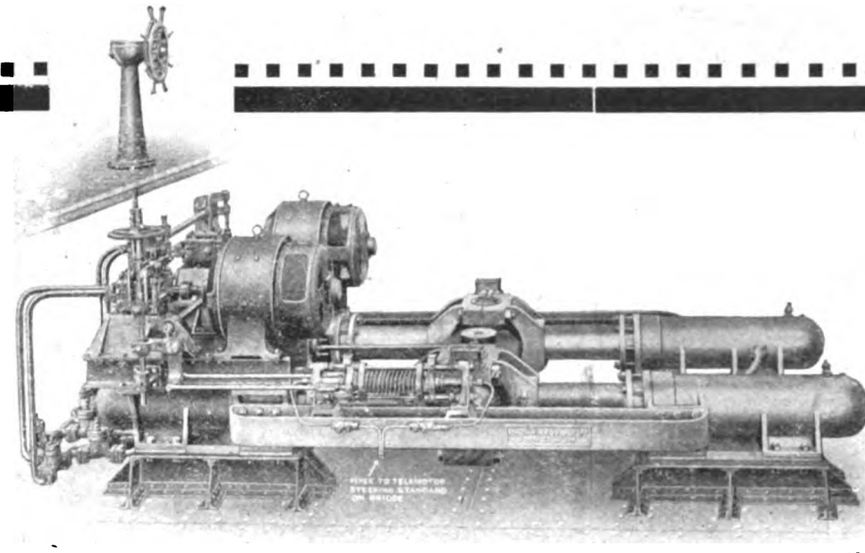

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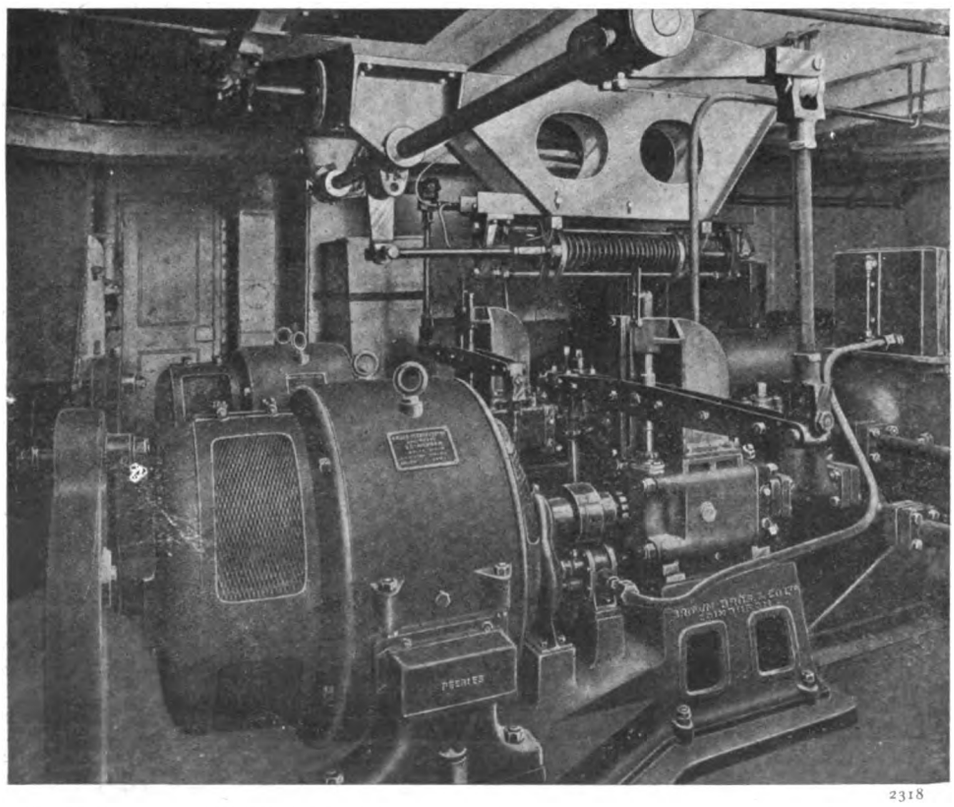

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Two 40 B.H.P. Enclosed-Ventilated D.C. Motors operating the Electro-Hydraulic Steering Gear on board the Cunard Liner s.s. "Scythia."

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THE ELECTRICIAN

ESTABLISHED 1861.

THE OLDEST WEEKLY ILLUSTRATED JOURNAL OF

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"The Electrician" Index.

Copies of the Index to Vol. XC of "The Electrician," which concluded with the issue of June 29th, are now available free of charge. Application should be made to the Circulation Manager, 8, Bouverie Street, London, E.C.4.

Notes of the Week.

London's Electricity—Further Complications.

THE problem of electricity supply in London, and especially of the part the companies are playing in connection with it, becomes more and more complicated. As will be remembered, last February the Commissioners proposed to establish a Joint Authority, most of whose powers were compulsorily transferred to two committees, representing the Local Authorities and the companies respectively. The companies objected to this transfer as *ultra vires*, and the point is still under consideration by the Court of Appeal. The scheme also provided that compulsory purchase should be postponed until 1971, and that payment should be at Inland Revenue rates, the Joint Authority being the purchaser instead of the London County Council. This extension was to be dependent on the adoption of a satisfactory sliding scale of charges. *Ultra vires* or no, therefore, the companies have been approaching the London County Council and, according to a report of the Special Committee on Electricity Supply, certain modifications of the Order have been proposed. These modifications have been communicated to the Commissioners and to the Conference of Local Authorities owning electricity undertakings in Greater London and are said not to impair the main principles of the Commissioners' scheme. But as they comprise financial and administrative independence, including, we suppose, the disappearance of compulsory purchase, and the right of appeal to the Commissioners over the head of the Joint Authority, there are not unlikely to be differences of opinion about this. It is suggested that in view of the large measure of autonomy to be given to the companies, their representation on the Authority should be very small. The suspicious will see in this an attempt to short-circuit the Joint Authority, an attempt which would at least be consistent with the policy of the companies in the past.

An Important Traction Contract.

THE present, for one reason or another, is a stagnant period for electric traction in this country, though it is rumoured that the sections between Preston and Carlisle and between Manchester and Oldham on the London, Midland and Scottish Railway are shortly to be converted. It is, therefore, with more than usual pleasure that we learn that the board of the South-Eastern and Chatham Construction and Power Co. have let two important contracts—one to the English Electric Co. for motors and the other to the Metropolitan-Vickers Electrical Co. for control gear, in connection with the electrification of the suburban lines of the South-Eastern section of the Southern Railway. The letting company is, of course, an organisation formed under the Trade Facilities Act for the express purpose of the electrification of this system, and these equipments will be used for operating the suburban services within a fifteen-mile radius of Charing Cross. We understand that the contracts involve the supply of no less than 508 motors of 300 H.P. each with the appropriate controlling apparatus, and are thus among the largest, if not the largest, which have been placed for main-line electrification. Not only is it gratifying that such work has been gained by British firms, but it is pleasant to learn that it will do much to relieve unemployment, a personnel of many thousands being required for its completion within two years. We hope that these contracts, which the companies concerned are to be congratulated on securing, are but the forerunners of many others.

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Imperial Wireless Communication.

SOME interesting facts regarding the Imperial Wireless Chain were extracted from the POSTMASTER-GENERAL by a deputation of the Empire Press Union on Monday. These were that two applications had been received for licenses to erect stations and distribute news, one from a cable company (presumably the Eastern Telegraph Co.) and the other from the Marconi Co. With regard to the latter, agreement had almost been reached, and there would probably within a month be nothing to prevent the erection of a high power station in this country. The Post Office had already given orders for the erection of a station at Rugby, which it was expected would be finished in about twelve months, though the designs were not yet complete. The present station at Leafield was to be developed. The basis of the licence would be private enterprise under State control, an arrangement that was necessary for strategic reasons. The application of the cable company was to communicate with India and had therefore been referred to the Indian Government. An important point was that the wireless rates would always be lower than the cable rates and this should settle the complaint of the Empire Press Union that communication was no longer so satisfactory as it used to be. After many years' discussion and indecision, it seems therefore that we shall not have to wait much longer for Imperial wireless communication, an event which will not only bring every part of the Empire closer together, but will have a great bearing on the technical development of this branch of electrical science.

Selling Illumination.

A MONTH or two ago we gave an account of an organisation which had been established by the General Electric Co. to produce a better lamp. In this week's issue we describe an organisation which has been established by the British Thomson-Houston Co. to discover and demonstrate better methods of selling light. Both movements are significant for more than one reason, and as our congratulations were freely given to the first company for their enterprise they may be as freely accorded to the second for their determination to work in a field where many weeds require to be rooted up before useful crops can be planted. The need in the lighting field is, in fact, for new methods. Our inventors have provided us with a highly efficient lamp which may be further improved, but which neither electrical engineers nor the general public use as they should. And it is, as we have said, to discover and show how light should be used that the new Lighting Service Department of the British Thomson-Houston Co. has been inaugurated. This requires a change of ideas. The customer must no longer buy, nor must the contractor sell, an agglomeration of wire, fittings and lamps which, when joined together, provide him with an unknown amount of light and illumination. The customer must be encouraged to demand, and the contractor must be encouraged to supply, an amount of light sufficient to illuminate a particular shop, room or office so that work or play may be carried on in it safely, easily and economically. If Mr. BUSH and his assistants succeed in inculcating this new outlook they will have done much.

An Ideal to Work for.

IT is hardly necessary to insist upon the need for this change. While there have been great improvements in lamps there has not been a corresponding improvement in the apparatus in which they are used. Or, rather, general advantage has not been taken of the improved apparatus that is available. The result is patent in every street and in many a shop and factory. Waste, glare, discomfort, danger! But there is no necessity for any of these. The Home Office Committee put 3 ft.-candles as a minimum for factory illumination. We recommend our readers to go to Savoy Street and see what this means in a large room. Then let them get Mr. BUSH to give them the 60 ft.-candles he recommends, and see the difference. They will think it rather bright; and we agree with them, because, like them, we are not educated up to it. But we would have them note that, though there is brightness, there is no glare and no discomfort and no dark patches and none of those other factors which make for bad lighting. The same is true at the intermediate illuminations, say 10 ft.-candles, which may be looked upon as the first stage we must endeavour to make a standard. The great point, however, is the method rather than the result. Electric lighting can give many advantages if it is properly used; to abuse it is unwise, uneconomical and unhealthy. For all these reasons we hope the electrical industry will give the British Thomson-Houston that co-operation for which they ask in this most important work of improvement.

Eastern Telegraph Progress.

THOUGH the accounts of the Eastern Telegraph Co. and the Eastern Extension Australia and China Telegraph Co. for the year ended December 31st, 1922, reflect industrial and political conditions in a falling revenue, they will in future, perhaps, have an historical interest as being almost the last time that these companies have concerned themselves solely with submarine telegraphy. It is rumoured that they are entering the wireless field not because submarine telegraphy is played out, but because, as has been pointed out before in certain districts, it will be a useful adjunct to the older form of communication. That submarine telegraphy has a long life before it is seen by the fact that the revenue of the Eastern Co. was £3 413 000, still a large sum, though £610 300 less than last year. This is ascribed to industrial depression, which greatly reduced the use of cable facilities. Fortunately this was anticipated by sound finance, while decreases in expenses amounting to £276 300 helped matters. Taxation was increased by nearly £45 000, but the net result was a payment of a 10 per cent. dividend, free of tax, absorbing £500 000, a contribution of £400 000 to reserve, and a carry forward of £515 300, these last two items being respectively £100 000 and £52 800 less than last year. The sum added to reserve is at once to be applied to new cables and cable renewals. Under the circumstances these are quite satisfactory results.

Satisfactory Results.

THE revenue of the Eastern Extension Co. has decreased to £2 061 500, a drop of £332 000 over last year. Expenditure rose by £69 500, mainly due to increased taxation, bringing the net profit down to £724 800. Ten per cent. dividend is again paid, while the reserves have been drawn upon to the extent of £170 000, leaving them at £3 083 700. On the whole these results cannot be looked upon as unsatisfactory, and bear witness to the unremitting care with which the two companies are managed. Every advantage is taken of the latest scientific knowledge bearing on their work, and an efficient research department is maintained. Mention may also be made of the generosity of the company in providing a club and playing fields for the staff, amenities which are greatly appreciated by those returning on leave from the overseas stations.

Marine Progress.

Though, industrially speaking, matters are admittedly better than they were twelve months ago, the statement that we made in our special Marine Issue last year to the effect that the shipbuilding and shipping industries were suffering more than any others from the trade depression still remains true. On the other hand, the cloud has lightened considerably, as the articles which we publish in our Marine Issue to-day show, and there is no doubt

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that as a result of the good foundation work which has been done during the lean years, in a very short time electrical equipment will be able to demonstrate its economic and engineering possibilities when employed for all sorts of purposes on board ship.

Electric Propulsion Progress.

Dealing briefly with the year's progress, and considering first the interesting problem of electric propulsion, we may refer to the article by Mr. CHARLES RETTIE, which we publish elsewhere in this issue. It appears that little has been done in this country, almost the only examples of electrically propelled vessels to which British shipbuilders can lay claim being the "San Benito," which was built at Belfast, and the four ships which are being built at Birkenhead by Cammell Laird and Co. for the United Fruit Co. The electrical equipment of this latter fleet has been provided by the British Thomson-Houston Co., and is described elsewhere in this issue. It consists essentially of four 850 H.P. Diesel engines driving direct current generators both for propelling and general power purposes. The motor is really two separate machines with an aggregate capacity of 2 500 H.P. when running at 95 revs. per min., and is controlled from a central position. The generator field is controlled by a potentiometer arrangement and proper acceleration and deceleration is assured by means of an overload current relay. Owing to the special conditions there are no circuit breakers between the generators and the motor, and the same applies to the excitation circuit. Generators can be put in or taken out of circuit without stopping the propelling motor, while the latter being in two parts allows three-quarter speed to be maintained if a breakdown occurs in either portion. A special design of generator and motor has been adopted to allow of easy repair and testing.

Some Technical Problems in Propulsion.

There is, of course, as we pointed out when commenting on the Paper which Mr. W. R. L. EMMETT read before a recent meeting of the Institute of Naval Architects, still a good deal of controversy about the suitability of electric propulsion as a system. That phase will pass as it has passed in other fields where the electric drive has been adopted and for the same reasons. It is a matter of demonstration and of breaking down prejudice, and the work has well begun. But differences of opinion also exist on technical matters. For instance, the usual discussion is going on as to the relative suitabilities of alternating and direct current; and, again, as to the relative suitability of synchronous and induction motors where the former system is used.

In our opinion, the employment of direct current is likely to be limited. It may receive an application on smaller ships where regulation is not difficult, but even here alternating current has certain obvious advantages, and the use of the latter on ships over 5 000 tons may well become universal. A study of the problem of marine electric propulsion makes it clear why this is so, for the conditions on board ship, which for obvious reasons have kept down the pressures used to the lowest economic limit, do not apply in the case of the propelling generators and motors where there is not the same risk of contact.

The Advantages of the Cascade System.

The relative claims of the synchronous and the induction motor are really decided by the character of the ship it is desired to equip. For a cargo boat sailing for long voyages at the same speed and requiring relatively little manœuvring the high power factor of the synchronous motor gives it some claim to consideration. On the other hand, where the runs are short, or there is a great deal of manœuvring, the induction motor should possess the advantage, though the smaller air gap and lesser accessibility are points which tell against it. A system, however, which has much to recommend it, and which Mr. RETTIE boldly proclaims as the coming system, is the cascade motor The details of this arrangement were dealt with in THE ELECTRICIAN last year by Mr. L. V. HUNT and by Prof. MILES WALKER more recently, and need not be repeated. This system gives a very high efficiency combined with simplification, flexibility and easy regulation, and though its power factor is relatively low, this is not of great moment on board ship. It is interesting to note that this system was to be adopted on the new American electrically-driven battle cruisers, whose construction was abandoned as the result of the Washington Conference. On the alternating current side alone there is, therefore, an interesting problem to be considered and solved. But a solution can only come through practical experience, of which there is unfortunately very little to draw upon at present in this country. And we certainly do not want to be dependent on the Americans in this matter above all others.

Satisfactory Progress in Many Fields.

Apart from electric propulsion, the development in the use of electricity on ship board may be written down as satisfactory. This is partly due, rather curiously, to the increasing employment of the Diesel engine for propelling purposes and the consequent desirability of using electricity for driving the auxiliary machinery. In this way not only have steam mains and their losses been eliminated, but an opportunity has arisen for taking advantage of the greater economy and ease of control of the electric motor when applied to such services as driving winches, hoists and capstans. With this extension it is to be hoped will come a greater realisation of the comfort and safety it can bring, especially when used for driving fans, a class of machinery whose uses in the mercantile marine have been too often confined to bare necessity.

Cooking Development.

We are also able to chronicle a satisfactory advance in the use of electricity for cooking purposes. Having in view the conditions which exist on board ship, it is not going too far to say that if there is any place at all where electricity should be employed for cooking, it is afloat, whether in the liner or the tramp. For cramped space, atmospheric conditions and constant movement of a more or less pronounced kind are always factors in the existence of the sailor, and electric cooking can help him to support these with the minimum of discomfort. The descriptions which we publish elsewhere in this issue show that this fact is being realised, and further satisfactory progress in this direction may be expected. The same argument applies with equal force to heating apparatus and to all the various pieces of equipment which can be conveniently classified under the heading "domestic."

The "Faraday."

Finally, we may refer to a branch of the electrical industry which, though not actually marine, is most certainly connected with the sea, that of submarine telegraphy. It is nearly the oldest of electric applications, but it is not among the least successful. In this week's issue we give some photographs of the new "Faraday," which was launched on February 16 last, and is now loading with 1 000 tons of cable for the Commercial Cable Co. When that work is completed she will proceed on her maiden voyage. As international communication is the most potent factor in civilisation, her influence on human progress is not likely to be less profound than that of her predecessor.

Taking the broad view then the electrical industry has little reason to be dissatisfied with progress in marine work during the past twelve months. If shipbuilding revives, there will most certainly be a great demand for electrical equipment of all kinds, and the stress of competition may even cause British shipowners to experiment with electric propulsion to a greater extent. They will find it worth their while.

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Recent Developments in the Electric Propulsion of Ships.

By CHARLES RETTIE.

When the steam turbine was first introduced for ship-work it was not because it was more economical than the reciprocating engine, but rather from the fact that, with the increase in the size of the ships and the high speed required, it was found that the reciprocating engine had reached its limit; as a matter of fact, it has been stated by one authority that the efficiency of the "Mauretania's" turbines was only 62 per cent. It is just as well to remember this fact when the question of the relative advantages of the electric drive over any other power is being discussed, as too much has been said on the question of economy. My own opinion is that the electric drive on ships will be adopted, not because it is more economical than any other system, but because it will prove more efficient and have a greater flexibility of control, though no doubt economies will eventually come in with its extended use.

A Lesson from the Past.

The accident has not been forgotten which happened some years ago to the old "City of Paris," when the piston rod went through the bottom of the ship and flooded both engine rooms, and though she was a twin screw ship she had to be towed into port in a disabled condition. Since the introduction of the steam turbine for the propulsion of ships their efficiency has been raised at the sacrifice of reliability by the introduction of gearing. Only recently one of our large Atlantic liners had to put back to port with her gearing all stripped, and having to transfer her passengers to another ship is a very serious business, and, according to recent reports, orders for double reduction gearing for other ships have been cancelled in favour of single reduction gears, which goes to show that the gearing of steam turbines for the propulsion of ships is anything but perfect, except perhaps in the case of single reduction gears, whereas the electric drive has proved itself efficient and a success, and any defects that have developed on the ships which have been fitted with it is due in nearly all cases to poor design, and not to any fault on the electrical side.

Little Progress in this Country.

With reference to recent developments which have taken place in the introduction of electricity for the propulsion of ships very little has been done in this country, but quite a number of all classes of ships have been fitted up in the United States. The "San Benito," which was built at Belfast, is an exception, and has been highly successful. There was an interesting vessel in the Liverpool Docks last year fitted up on the same principle as the "Wulsty Castle," but the propeller motors were fitted right aft, whereas in the "Wulsty Castle" the motors were in the engine room. The ship was called the "Mod" and was built in Norway, but unfortunately was lost on her first voyage.

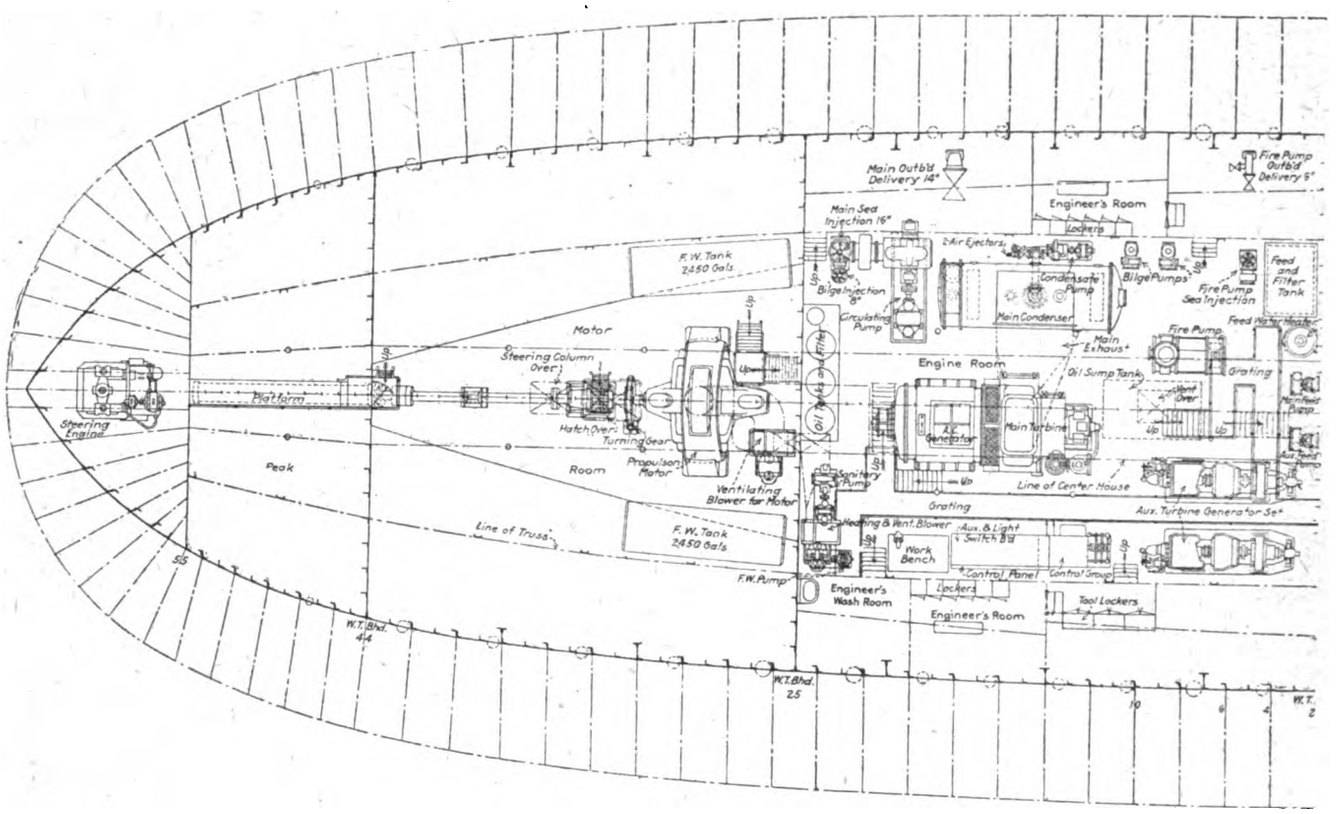

FIG. 1.—HOLD PLAN SHOWING ARRANGEMENT OF PROPELLING

I have tried to get particulars of her, but beyond the fact that the propeller was * reported lost I can get no information. It is a pity, as great things were expected of her, and it would be interesting to know how she did go down, especially in the light of the fact that the motors were placed in a separate compartment to eliminate the long length of shafting and to economise space, and, as I understand, to run unattended†.

It is a question whether such a course is wise in the design of an electric ship, as trouble might develop with the motors in a heavy seaway, and, being out of control, the captain or officer in charge would be unable to keep the ship's head to sea and this would cause her to founder.

The Use of Synchronous Motors.

There has been a good deal of controversy lately as regards the use of synchronous motors in preference to those of the induction type for the electric propulsion of ships.

For ships of 5 000 tons or less there is no reason why the

* "Liverpool Journal of Commerce," Feb. 22, 1922.

† Since writing the above, the author has heard from the owners of the "Mod" that the machinery worked satisfactorily and was in full working order at the time the vessel sank. They further state that they have a sister ship to the "Mod," and their experience with her leads them to the opinion that there is no special advantage in placing the motors aft.

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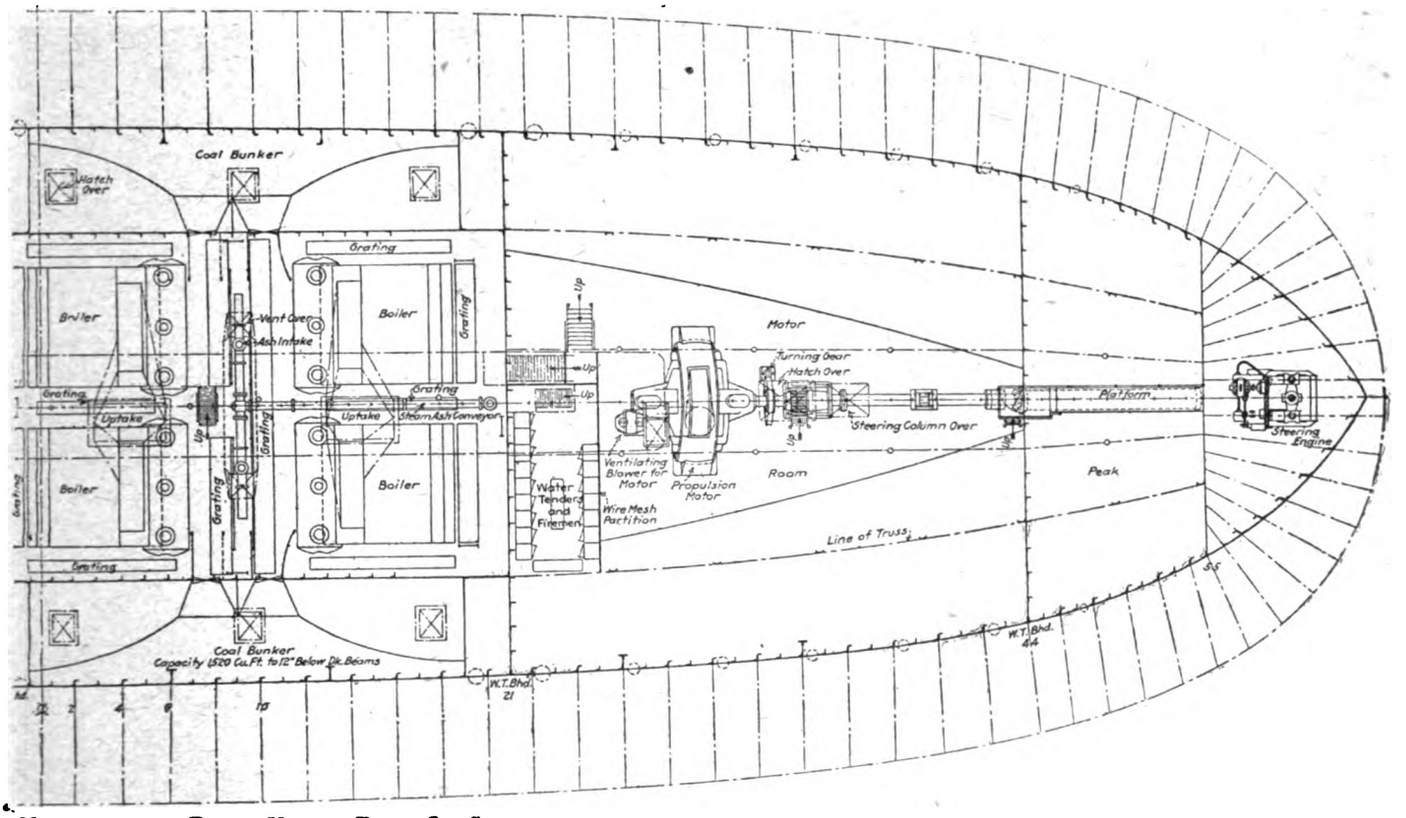
Diesel electric drive, in conjunction with direct current generators and motors, should not be used where the question of the regulation offers no difficulties; but with ships of over 5 000 tons alternating current would have to be used on account of the complications which arise in use direct.

For large powers—for instance, in ships of the "Hood" class of the British Navy—motors of about 20 000 H.P. would be used, so that direct current motors would be out of the question; on the other hand, the control of the alternating motors is more difficult.

The synchronous motor is essentially a constant speed motor, and I cannot understand why such machines have been used or preferred for the electric propulsion of ships, except that in the case of cargo ships going on a long voyage, where the question of economy is more important than the control of the vessel, therefore on account of the high power factor the synchronous motor would be the best; but, on the other hand, on such trade routes as the North Atlantic, where there is so much ice, bad weather and fog, and consequently a good deal of manœuvring, the induction motor would be the one to use.



MACHINERY ON BOARD UNITED FRUIT CO. SHIPS.

Quick Reversal a Feature.

I was on board the "Eclipse," one of seven ships fitted up with the electric drive by the General Electric Co. of America, when she recently visited Liverpool. She is fitted with an induction motor for the main drive and has travelled thousands of miles and given every satisfaction. I noticed the air gap on the motor was very small. The synchronous motor has the advantage over the induction motor in that respect in having a greater air gap, also the parts are more accessible and easily removed when at sea for repairs; but, on the other hand, there is a story of the same ship going through the Suez Canal and being prevented from going ashore on account of the quick reversal of the motor. It is a question whether the synchronous motor would have responded so quickly. In fact, there is another account of a sister ship to the "Eclipse," the "Invincible," in a collision with another ship was able to reverse with her induction motor in four seconds from half speed ahead to full speed astern.

The Coming System.

Before touching on the question of the cascade system, which, in my opinion, is the coming system which will be used in our large fast liners, I would like to draw attention to Fig. 2, from the Journal of the American I.E.E., which shows a system of electric drive for ship's motor with a phase advancer which was described by Mr. W. E. Thau, of the Westinghouse Co. of America, in a lecture he gave before the Naval Architects in December, 1921. Though the synchronous motor has a high power factor the economy gained is more apparent than real, on account of the fact that the motor has to be separately excited by an auxiliary engine taking considerably more steam than in the case of an induction motor receiving its excitation through the main generator. The diagram referred to shows a system whereby the power factor of an induction motor can be raised to unity and at the same time retain all the advantages of the induction motor over the synchronous motor.

With reference to the use of cascade motors for the electric propulsion of ships, there was an interesting comment in "La Industrie Electrique" for July 10th, 1920, where the writer states: "It can therefore be concluded that by putting in cascade two motors with an equal number of poles, each having an efficiency of 94 per cent., the speed of rotation is reduced to about half the original, and a total efficiency of about 5 per cent. less than the efficiency of the single motors is realised. If for single motors there was an initial efficiency of 96 per cent., as is possible with units of about 10 000 kW power, for the cascade arrangement a reduction in efficiency of nearly 2 per cent. would be obtained; the loss of power is in consequence very small and cannot be a sufficient reason for abandoning the eventual application of this system for the propulsion of ships. It is known, on the other hand, that coupling in cascade is accompanied by the lowering of the power factor and consequently requires an increase in the sections of the copper wiring, especially in the supply lines; but there is no need to concern oneself over this on board ship where the lines only have a developed length of a comparatively short distance."

"This would perhaps be a reason for not applying the

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system in land installations, and for some years coupling in cascade has been resorted to in railway traction. The reasons which are unfavourable to the application of the system to the propulsion of ships can be reduced to two—the necessity for rigidly connecting two motors and the too large difference between the two speeds, which are in the ratio of 1 : 2. On the other hand, it must be recognised that with cascade coupling one obtains an appreciable simplification by avoiding in the windings the necessity for changing the number of poles."

Speed Problems on American Battle Cruisers.

"Let us consider, for example, the large American battle cruisers, on which the design provides for the installation of 8 motors of 22 500 H.P. arranged in pairs on four shafts. The maximum speed is 35 knots and the cruising speed 18 knots. If one takes into account the fact that the propeller thrust is greater at the higher speeds, it is clear that this cruising speed must require a larger rate of revolution than half the maximum rate; cascade coupling is pointed to in this case. It will be naturally convenient to couple in pairs the motors which are on the same shafts; one eliminates thus the objection relative to the interdependence of the unit motors, since the two motors only form a single unit, and the shafts still continue to remain completely independent of each other."

Before the Washington Conference the United States Government had commenced the building of six battle cruisers, which were to have a power of 180 000 H.P. each and to be electrically driven. The ships that were being fitted up by the Westinghouse Co. were to have cascade motors, and those that were being fitted up by the General Electric Co. were to have induction motors equipped with slip rings but no external resisters, similar to the following description: "The rotor is wound with a low resistance winding near the periphery of the rotor and beneath this a high resistance squirrel cage winding. The low resistance winding is connected to the slip rings. To make the high resistance winding carry the current during reversal of propeller the low resistance winding is opened by means of contactor switches connected across the slip rings. If this motor is wound to give two different speeds, the slip rings can be made neutral for high speed running and thus need not carry heavy current. All reversals are accomplished with the low speed connection."

The orders for these battle cruisers have since been cancelled through the agreement drawn up by the Powers. Two of the hulls have been turned into aeroplane carriers, but will still be electrically propelled. One of the ships will be ready for launching in the summer of 1924. They are 850 ft. long and will have a speed of 33 knots.

The diagram (Fig. 3) reproduced from THE ELECTRICIAN, of April 13th last, gives a very good idea of the possible use of the cascade system for the electric propulsion of ships and was shown by Prof. Miles Walker in one of his lectures on the "Control of the Speed and Power Factor of Induction Motors."

A Promising Field.

The Diesel electric drive opens up a promising field for the propulsion of ships, as several units can be installed on board ship, so the question of total breakdown is eliminated, as one unit can be cut out without stopping the ship at sea for repairs. The Diesel electric drive also does away with

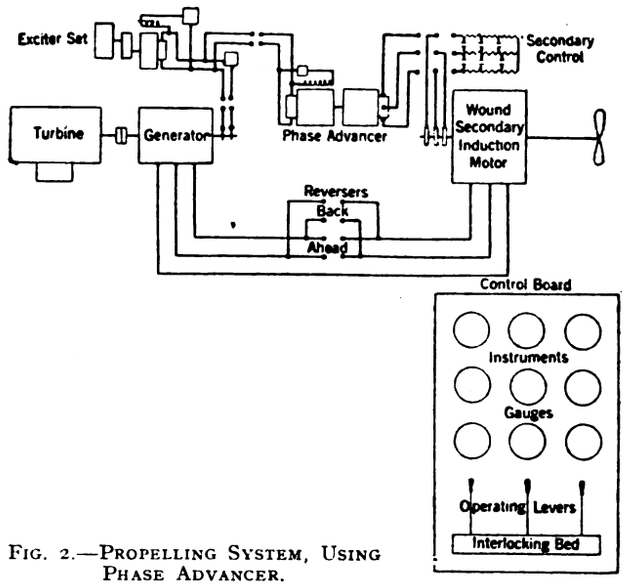

FIG. 2.—PROPELLING SYSTEM, USING PHASE ADVANCER.

the necessity of having compressed air for starting or reversing, so that the engines can be made much smaller than when used for direct drive, and there is also the possibility of driving the generators through gearing which will still reduce the size of the engines and will more than compensate for the extra space and weight required for the electrical equipment, and there is also the possibility of having the controller on the bridge, as has been done in some cases, such as the trawlers on the banks of Newfoundland. A Diesel engine recently fitted up in Germany with gearing showed a saving of 300 tons over that which would have been required if the engines had been designed for direct drive. The three fruit boats which are being built by Messrs. Cammell Laird for the United Fruit Co. are to be electrically driven, one of which will soon be ready for sea, but as particulars of same have already been published in the press I do not wish to say anything here except to show a sketch (Fig. 1) taken from the "Liverpool Journal

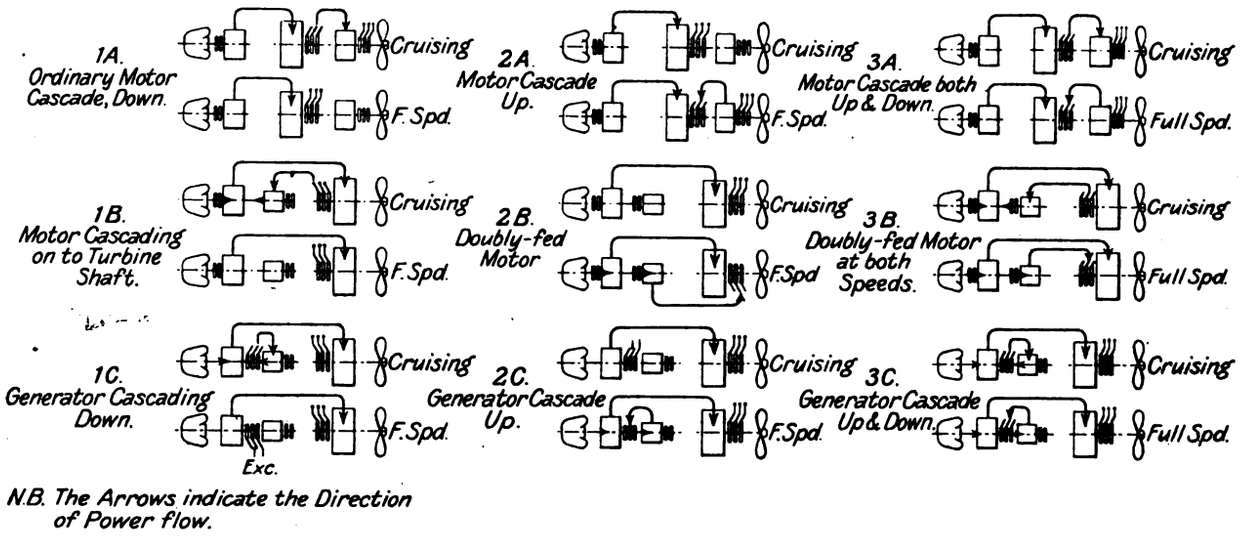

FIG. 3.—THE CASCADE SYSTEM FOR MARINE PROPULSION.

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of Commerce" for February 15th last.* The ships will be fully guaranteed. I have been all through the first ship, which is well advanced, and saw one of the engines complete with generator and auxiliary in the test bed; it was giving every satisfaction and I believe the ship will be a success.

Electrically Operated Ferry Boats.

In conclusion, I would like to refer to another interesting application of the electric drive on ships, and that is the propulsion of double-ended ferry boats. The usual practice is to have one or two shafts with propellers either end, but it has been demonstrated that there is a great loss of power on the forward propellers whatever way the boat is going, and that a much better arrangement would be to have one generator with an electric motor on each propeller, so that when the ferry boat is going ahead the

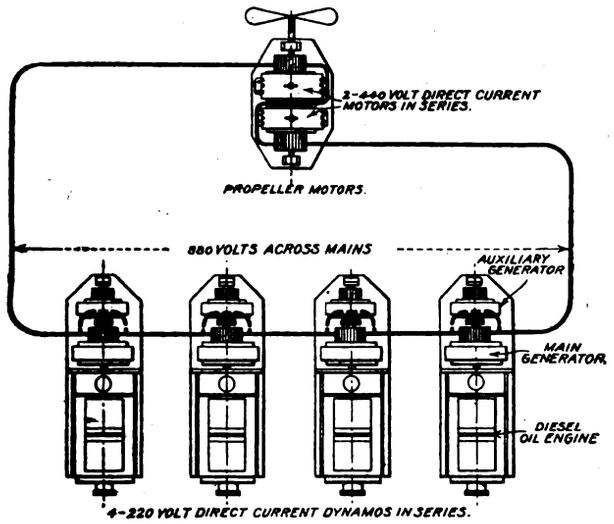

FIG. 4.—PROPELLING SYSTEM USED ON ELECTRICALLY DRIVEN FERRY BOATS AT NEW YORK.

ahead propellers can be run slow, while the after propellers can be run at their full speed without altering the speed of the main generator. In the preliminary designs shown of the three new ferry boats for the City of New York, in "Marine Engineering and Shipping Age" of the same city, there are two propellers, one either end (shown in accompanying sketch plan, Fig. 4, which I have taken from the same journal), and driven by three-phase induction motors and are wound for two speeds. The stern propeller will develop about 2 100 H.P. at about 176 rev. per min., and another stator winding will give the bow propeller about 100 H.P. by 132 rev. per min.

The outside diameter of the motors will be approximately 10 feet. There are a number of double-ended ferry boats on the River Mersey, where the above arrangement would be an advantage. At present the Mersey craft are fitted with two shafts, four propellers and two engines. If they had the electric drive there would be four motors and one generator, which I feel sure would be more advantageous than at present and also show a higher economy.

Copper in the United States.

Electrical Apparatus Takes Half Entire Production.

A great increase in the use of copper for miscellaneous purposes has resulted from the comparatively low price, and the extensive publicity campaign of the Copper and Brass Research Association. About 60 to 65 per cent. of the virgin copper sold is cast into bars for wire; 15 to 20 per cent. for ingots and ingot bars, to be remelted for castings and alloys; 10 to 15 per cent. for slabs to be rolled into sheets and strips; 3 per cent. as cathodes, for remelting; 3 per cent. in special shapes, such as billets and anodes, and 3 per cent as Bessemer, blister or converted copper. More than half of the copper used is used for electrical apparatus; electrical manufactures, 30 per cent.; wire and rods not otherwise included, 16; telephones and telegraphs, 8·75; automobiles, 8·5; ships, 7; bearings and bushings, 6·5; buildings, 6; machine fittings, 2·75; railways, 2·5; ammunition, 2; and coinage, only 0·3 per cent.

[* A description of the electrical equipment of these ships is given on p. 86 of this issue.—ED. *E.*]

Electrically Driven Auxiliaries on Ships.

No Foundation for the Statement that They are Unreliable.

In commenting on the various systems of driving auxiliaries now in use in marine work, the "Motor Ship" says that the statement occasionally made that electrically operated auxiliaries on deck are unreliable lacks foundation. If there were any question of reliability, the first machinery to be replaced would be the steering mechanism, which is nearly always electrically or electro-hydraulically operated in Diesel-engined ships. Electric winches are extensively used, and electric practice is nearly always extended to the anchor windlass; but first and foremost it should be emphasised that, if reliance be placed in the use of electricity for steering, no opening can be found for opponents of electrical plant to gain a footing for argument against the adoption of the system.

Electrically Operated Steering Gear Preferred.

A list of more than fifty large motor ships—most of them built fairly recently—shows several outstanding items: About four-fifths of the total favour electro-hydraulic steering gear, the remainder being fitted with electrical mechanism working without the interposition of a pump. Two tankers in the list are provided with steam pumps, steam winches, and other plant, but have electro-hydraulic steering gear, while others apply electric drive to the steering mechanism, although (apart from a small electrically-operated ballast pump) no other electrical plant is to be found outside the engine-room, in each case. This indicates that the owners, while preferring to employ steam plant for cargo pumps, winches, and the windlass, do not hesitate to instal electrically-operated gear for steering purposes. It will be appreciated that the use of steam steering gear would necessitate a donkey-boiler being in operation during the whole of the voyage, whether it were required for other purposes or not; nevertheless, it is a favourable point on the side of the electric and electro-hydraulic steering gear advocates when they are enabled to demonstrate their case in this manner.

No Valid Excuse for Use of Steam Engines.

There would not seem to be any valid excuse for continuing the employment of steam engines as auxiliary plant on the score of greater reliability. The steering gear of a ship is a piece of mechanism subjected to extremely hard service, and a breakdown may conceivably be infinitely more serious than in the case of a pump or winch. The legitimate conclusion to be drawn, then, is that, when it comes to a requirement of absolute reliability, electric or electro-hydraulic steering gear must displace steam plant.

Development of Electric Cooking.

Some time ago a well known Swedish shipowner stated that he was converting the galleys on all his motor ships to electric cooking. It is, therefore, interesting to note that on the "Tantalus" electricity is used wholly for cooking purposes; this is the first Holt liner on which such an arrangement has been employed. The plant, which was built by Wilsons, of Liverpool, requires a maximum of 40 kW, but this demand is, of course, not maintained for a long period. It seems open to doubt whether electric cooking represents an economy over oil firing, but it is certainly cheaper than coal, at any rate on a motor ship. The regulation is very simple, and one of the advantages is that, when the requisite temperature is reached, the maintenance of that temperature is a matter of extreme ease, whilst for cleanliness and comfort to the cooks it will be difficult to improve upon the electric galley. Throughout the whole of the accommodation, and in the seamen's quarters forward, heating is effected by electro-vapour radiators of the "high-low" type, which are so frequently adopted on motor ships. They seem to afford an ideal solution to the heating problem, avoiding the necessity for maintaining steam in the boiler and having certain advantages over the radiant type for cabin use.

It is reported that the 50 000 kW GENERATING SET which C. A. Parsons and Co. are building for the new Crawford Avenue station of the Commonwealth Edison Co. will consist of three turbines, a 14 500 kW high-pressure element running at 1 800 revs. per min., a 29 000 kW intermediate turbine running at 1 800 revs. per min., and a 6 500 kW low-pressure turbine running at 720 revs. per min. Each will have its separate generator, but the intermediate and low-pressure turbines will be arranged in tandem on the same bed-plate with the generators at either end.

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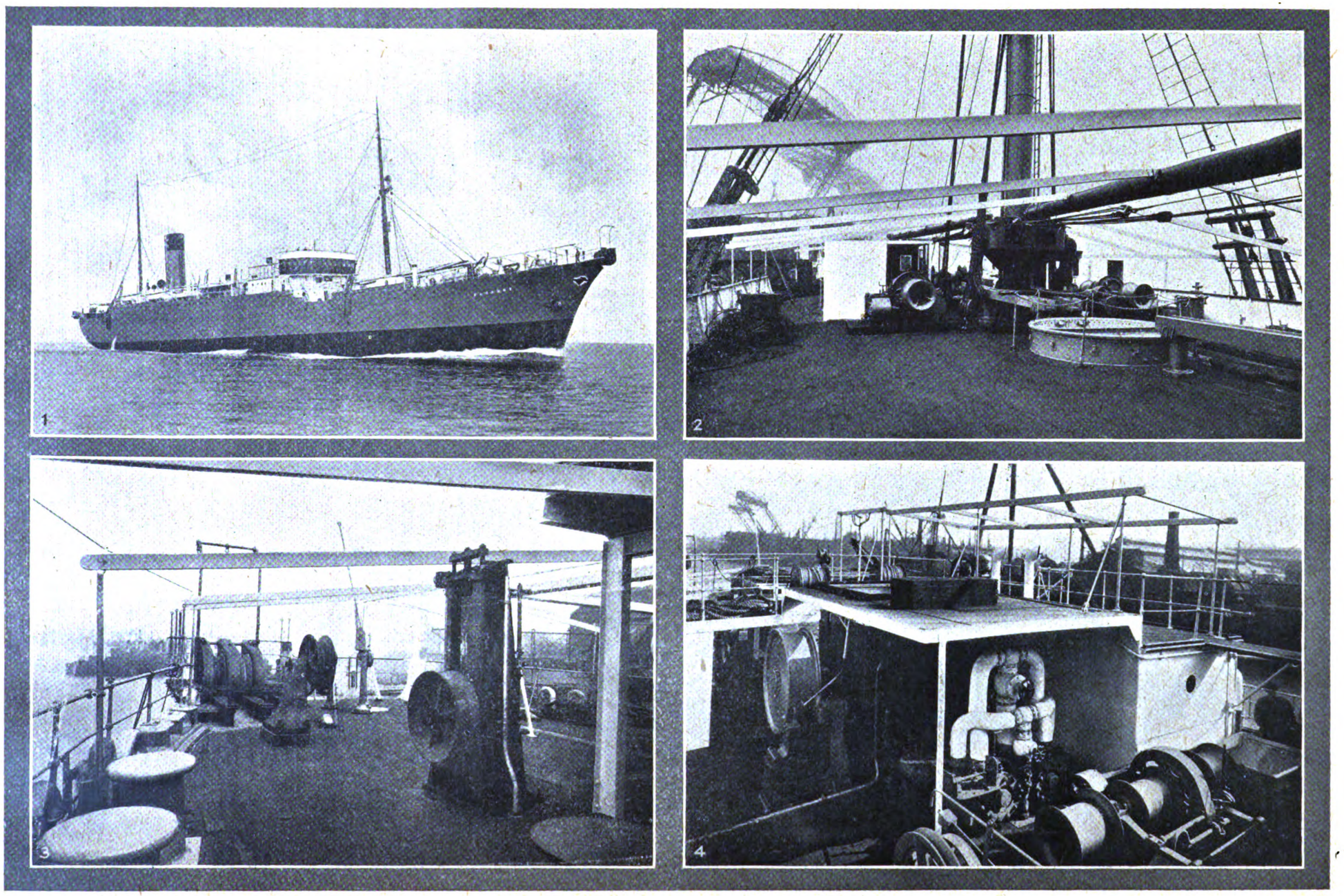
THE C.S. "FARADAY" IN PICTURES.



1.—The New "Faraday" Ready for Sea.
2.—Forward Deck from the Bridge.
3.—Right Aft.
4.—A View Aft showing a Paying Out Machine.

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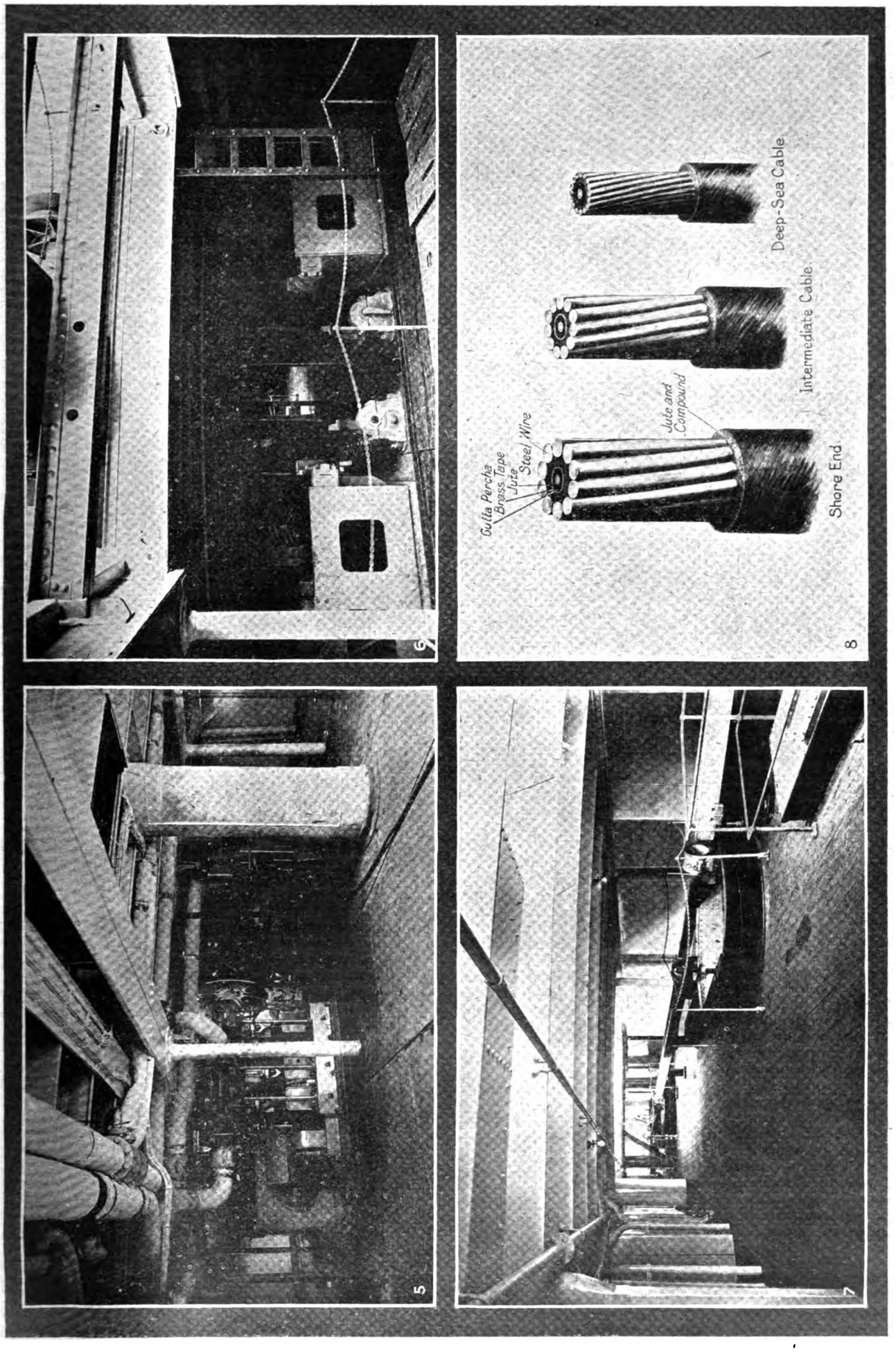
The Cable Machinery and the Cable.



6.—Another View of the Picking Up Machinery.
8.—Views of the First Cable the "Faraday" is to lay.

5.—Main Deck showing a View of the Picking Up Machinery.
7.—Shelter Deck showing Cable Troughing and one of the Cable Tanks.

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The Latest Diesel Electric Ship.

A B.T.-H. Equipment for a Fruit Trader.

The increasing employment of the Diesel engine on shipboard is more than once stressed in the course of the present Marine Issue of THE ELECTRICIAN. And it is interesting to find that this development, far from limiting the use of electrical apparatus, is rather assisting its development. This is proved by the description we give below of the electric propulsion equipments which are being supplied by the BRITISH THOMSON-HOUSTON Co. to the four ships which are being built for the fruit trade of the United Fruit Co. by Cammell Laird and Co.

Each of the three ships in this fleet is provided with a main generating plant consisting of four 850 H.P. Cammell Laird-Fullagar Diesel engines, each engine being direct coupled to a 500 kW generator for use on the propelling circuit, and a 200 kW generator for supplying power for auxiliary purposes. All the generators are designed for full power at 220 V, and suitable switchgear is provided which allows any of the propelling generators, either one, two, three or four, to be used for supplying power for propelling the ship. The propelling generators are connected in series for propelling purposes with a total voltage of 880 V at full power.

Control Arrangements.

The auxiliary load is controlled through five point selector switches, this arrangement enabling it to be distributed over the four auxiliary generators and any one of the four propelling generators which can be taken off the propelling circuit for this purpose. In addition, arrangements are made whereby any one (or two if necessary) of the five generators available for auxiliary power can be run at a reduced voltage, this arrangement being principally devised in order to give a convenient speed control on the large refrigerating motors.

Propelling Motor Design.

The propelling motor is rated at 2 500 H.P. at 95 revs. per min., with a temperature rise which will ensure safety to the insulation when operating at full power continuously in the tropics. It comprises two units, each complete with a separate magnet frame, armature and commutator. The two armatures are electrically connected in series and are mounted on a solid shaft supported between two pedestal bearings. All the propelling generator and motor fields are separately excited from one of the auxiliary generators, and starting, stopping and reversing is effected entirely by varying the excitation of the main generators or generator as the case may be.

The control is carried out by means of a lever attached to a small controller fixed to the front of a sheet steel panel carrying the necessary instruments. This lever moves in a fore and aft direction on either side of a central stop point, and all the operator requires to do when manœuvring is to move the lever on to the speed point required either ahead or astern.

Generator Field Regulation.

The actual variation of the propelling generator fields during manœuvring is effected by means of a reversing potentiometer rheostat in each field circuit, all the rheostats being simultaneously operated through gearing by a small electric motor. A movement of the control lever merely switches this small motor into circuit, and by means of follow-up gear the small motor switches itself out and stops when it has moved the field rheostats to a position where a field strength is obtained on the generators, corresponding to the speed point at which the lever is at rest on the controller.

In addition, a special type of overload current relay is placed in the main circuit, and this is arranged so that should the operator attempt to accelerate or decelerate too quickly and so cause an excessive power current to flow in the system the relay interrupts the supply to the small rheostat motor. Although, therefore, the lever may be operated quickly, the varying of the generator field strength is only carried out when the relay again completes the supply circuit to the small motor. This allows the operator to carry out orders in the quickest possible manner and safeguards the equipment against careless handling.

Operating Conditions and the Use of Protective Apparatus.

No overload protection in the way of main circuit breakers or main power interrupting devices is provided in the propelling circuit, it being considered preferable on plants of this description to leave the stressing of the equipment under abnormal conditions entirely at the discretion of the engineer on watch. In connection with this point it is as well to bear in mind that the motor is on a circuit entirely different from the usual power circuit on land, and is, moreover, of a size which is equal in capacity to the generating plant, and in consequence not so liable to prolonged overloads. Also a ship requires considerable power to bring it to rest quickly, and so the conditions are quite different from those obtaining in electric traction, where it is easy to arrange if necessary for an interruption of the power supply to bring the train quickly to a standstill.

Normally the propelling system is connected through a circuit breaker and current limiting resistance to the ship's structure at the point between the two motor armatures. If an accidental earth occurs on any part of the main circuit which will open this circuit breaker, a loud ringing bell in the engine room gives audible warning. The excitation supply is not provided with any automatic circuit breakers or fuses. The whole of the excitation is taken from a common source and an overload relay is placed in this circuit which causes the warning bell to ring if any overload or short circuit occurs.

Instrument Panel.

The instrument panel is provided with an electric propeller speed indicator giving the revolutions ahead and astern, one indicating wattmeter for each engine set which gives the sum of the auxiliary and propelling loads in kilowatts and enables the operator to see at a glance the load conditions on each engine without having to calculate it from the volt and ampere readings of the two generators. Adjacent to each of these wattmeters is a handwheel by means of which the fields on each of the propelling generators can be adjusted, and consequently that particular propelling generator's contribution to the propelling power circuit can be varied so as to maintain full load on the engine. It also enables any particular engine load to be conveniently reduced, if this is desired, by reason of a minor defect in the engine which is not important enough to warrant a complete stoppage. A voltmeter with a six-point switch is provided to enable the operator to read the voltage of any of the four main generators, the motor volts and the exciter volts. An ammeter is provided which reads the propelling power current, which is, of course, also the current supplied by the generators in series, while a wattmeter calibrated in electrical horse-power provides a convenient way of measuring the power developed by the motor without the operator requiring to make a mental calculation from the varying volts and amperes.

The two last-mentioned instruments are placed near the speed indicator, and a hand wheel is conveniently placed alongside, which operates a rheostat in the propelling motor field circuit, so enabling the motor field to be varied and the speed accurately adjusted to compensate for temperature variation or light draught conditions. The same handwheel also enables the speed of the propeller to be easily adjusted so that when propelling the ship with a reduced number of engine sets the engine or engines, as the case may be, can be fully loaded.

When we point out that four engines will give 95 propeller revs. per min., three engines 88 revs. per min., two engines 76 revs. per min. and one engine 63 revs. per min., the importance of this point will be readily seen. The figures given above will, of course, be effected by such factors as propeller efficiency at reduced powers and auxiliary power required, but it should be borne in mind that the fuel consumption per S.H.P. is the same at ¼, ½, ¾ and full power.

Constant Unity Load Factor Possible.

Another feature of the equipment is the simple manner in which a generating set can be put into or taken out of service without entailing a stoppage of the propeller motor. Even if the set which it is desired to shut down is supplying the excitation the operator at the control panel can by means of a convenient hand wheel transfer the excitation to another auxiliary generator without leaving his post. Each propelling generator is provided with a protected type of switch panel carrying four operating handles and suitable interlocking gear which enables a generator to be put in the propelling circuit or taken out without damage by careless switching. These panels also allow of any one of the propelling generators

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to be used for auxiliary load. This last feature is very useful in port, because it enables the refrigerating plant to be run at its full capacity if necessary, and also to provide ample power for operating the cargo winches, which are specially arranged with a view to handling the cargo with the minimum of time in port.

From the above description it will be seen that everything is so arranged that it is a comparatively simple matter to keep a unity load factor on every engine when it is operating.

At the commencement of a trip with a fruit cargo on board the refrigerating load (approximately 500 H.P. total) will be requiring its maximum power supply, and the various capacities of the individual electrical units have been so proportioned that when this load is at its minimum the propelling portion of the equipment can absorb all the rest of the output of the four engines. In addition to paying special attention to providing simple means whereby maximum economy in fuel consumption can be obtained at widely different powers and sea speeds, the arrangement of the equipment was made to take full advantage of the multiple unit system in the case of failure of any portion of the power installation.

Regulation Arrangements.

As already mentioned, each propelling generator is provided with an isolating switch panel enabling any unit to be taken out of circuit as desired. Each unit is also provided with its own field regulating rheostat so that a defect in a rheostat can be repaired at sea, if necessary, without entailing a stoppage of the propelling motor. This also applies to the two separate motor field systems.

The propeller motor consisting virtually of two motors in series also allows of one motor being available and capable of about ½ speed in case of a breakdown occurring to the other. It may be remarked that shaft or bearing trouble might occur, but these portions are very liberally designed with special attention to lubricating arrangements, and anyone who has had experience with these portions of electrical machinery knows that these parts can be made extremely reliable. No provision is made for isolating one of the motor armatures from the circuit except by an entire interruption of the power.

Safety First Arrangements.

On the control panel in the engine room a small switch is provided by means of which the entire excitation is removed from the system by a large solenoid operated contactor. A padlock is provided with this switch, and as a precaution against accidents, due to the motor being right aft in the ship, the engineer is instructed never to touch any live portions of the motor unless he has locked the excitation switch out and has the key in his possession. As a precaution against failure of the small rheostat operating motor which might conceivably fail when manœuvring the vessel in narrow waters, a hand wheel is placed close to the control lever by means of which the propelling generator field rheostats can be manually operated.

This hand wheel is normally disengaged from the rheostat operating shaft, but is always ready for instant engagement should the propeller speed fail to respond to a movement of the control lever. When engaged it automatically cuts the small rheostat motor out of circuit. The control lever is so arranged as to allow a complete full power reversal being carried out in about 8 secs. The effort required to do this operation manually is too great to allow of it being done in this period, and the hand wheel is geared so that it can conveniently be operated through a full power reversal in about 30 secs.

Power Returned to System on Reversal.

When bringing the propeller to rest prior to a reversal, the power which is returned to the electrical system due to the action of the water causing the propeller to keep rotating in a forward direction and which in turn drives the excited propeller motor as a generator, is dissipated in motoring the propelling generators. The propelling generators in turn partially or entirely supply the motive power to rotate the engines and auxiliary generators, and due to the considerable amount of power required to overcome the friction load of a Diesel engine at full speed (about 30 per cent. of its normal output) this forms a very convenient means of dissipating the braking energy.

In order to prevent the operator from slowing up the propeller motor too quickly by means of the automatic control, a safeguard is fitted in the form of a limit switch fitted to each engine. These limit switches control the supply to the small rheostat operating motor and are set so that when the engine governor cuts off the fuel supply, due to the engine speed rising, this switch is opened and the rheostat motor stops. This effectively prevents any racing of the engines and allows the auxiliary generators also to do their share in absorbing the braking energy. With the emergency hand gear no protection against racing is provided as the time taken for manual operation is too long to allow of this condition to arise.

Signal Arrangements.

On the top of the control panel is provided a lamp indicator which can be easily seen from most parts of the engine room. This indicator comprises four blue lamps, representing No. 1, 2, 3 and 4 propelling generators respectively. These lamps are automatically switched in or out, as the case may be, when the isolating switches for the respective propelling generators are in a similar position. Four red lamps are also fitted, each lamp representing No. 1, 2, 3 and 4 auxiliary generators respectively. The red lamps are automatically switched in by the excitation selector switch, and serve to show at a glance which generator set is supplying excitation current, a point which has to be watched when shutting down a generating set. The convenience of this indicator will be readily appreciated by anyone who is familiar with the conditions occurring in the engine room of a ship at sea, particularly an engine room of this description.

Provision for Repairs.

With regard to provision for carrying out repairs to the electrical equipment, special attention had to be given to this. On a ship of this description, and, as a matter of fact, on most ships, the electrical engineer has a much more difficult problem to contend with than on land. The machinery has to be very closely built into the vessel, and space for access in case it is necessary to carry out repairs has to be cut down to the very minimum. Also it is extremely important that repairs should be made in the minimum time in view of the heavy harbour and dock dues charged on the vessel when in port, in addition to the losses incurred directly as a result of the hold up.

The motor and propelling generator magnet frames are made cylindrical and fitted into special cradles which allow the frames to be rotated so as to allow of the lower magnet coils being taken out, if necessary, without removing the armatures. This arrangement was necessary in the case of the above machines so as to get the shaft centres as low as possible, and due to the arrangement it was not necessary to provide any clearance between the bottom of the magnet frames and the ship's structure to allow of the bolts being withdrawn before the pole pieces could be removed. This makes all the field coils accessible without disturbing any armatures. A very limited amount of head room only is available, but if all the magnet poles are removed from the bottom halves of the magnet frames sufficient space can be obtained for the top half so as to enable armature winding repairs to be carried out in position. This arrangement is particularly necessary in the case of the propelling motor, as otherwise it would be necessary to open up the ship's structure to get the armature out of the vessel. Special provision is also made to enable the insulation of the whole of the propelling equipment to be quickly and conveniently tested in sections when in port, so that the readings can be logged at regular periods and in this way defects located before an actual stoppage occurs.

For use during a voyage a leakage current indicator is provided and readings taken once every watch. In order to obtain these readings the engineer who visits the motor room momentarily opens the earth circuit breaker. This in turn causes the warning bell to operate in the engine room, which besides indicating that the bell is in order also serves to warn everybody that they are liable to an 880 V shock if they touch any of the live parts of the main propelling circuit. In connection with this point, the whole of the propelling equipment is so easily rated that strict instructions are given that no commutator adjustments or cleaning has to be carried out without first of all isolating the machine from the propelling circuit.

Tests on Nickel Steel Forgings.

In certain severe breakdown tests carried out in America with ROUGHING TOOLS ON 3 per cent. NICKEL STEEL FORGINGS in which high frictional temperatures were produced, it was found that the performance of commercial low tungsten-high vanadium and cobalt steels was superior to that of the high tungsten-low vanadium type, and special steels containing about 0·25 per cent. uranium or 0·75 per cent. molybdenum. The average power consumption in all cases was practically the same.

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Electric Propulsion for the New San Francisco-Oakland Terminal Railways Ferryboats.*

By L. RASK.

The new ferryboat, "Hayward," that operates between San Francisco and Oakland, is the first ferryboat in the world to use steam turbine electric drive, with a Ward Leonard system of control for manœuvring. This boat will carry the passengers of the Southern Pacific Railroad from the Oakland Terminals over the Bay to San Francisco and also its share of the large number of people that daily pass back and forth between San Francisco and Oakland, Berkley and Alameda.

The dimensions of the boat are as follows : Length over all, 240 ft. ; breadth moulded, 42 ft. ; breadth over guards, 62 ft. 7 in. ; depth moulded, 19 ft. 6 in. ; depth loaded, 11 ft. 6 in. The speed of the boat is 13 knots.

Boiler Plant.

The boiler plant consists of two Babcock and Wilcox water tube boilers. These boilers have a total heating surface of 5 000 sq. ft., and will generate a steam pressure of 225 lb. per sq. in. They are equipped with superheaters capable of raising the temperature of the steam 65 deg. F. above normal. The boilers are fitted with Coen oil burners working under normal draught and are guaranteed to supply steam at 210 lb. per sq. in. and 50 deg. F. superheat.

Propelling Equipment.

The propelling equipment consists of a steam turbine geared to a direct current generator which furnishes power to the two main motors, one on each propeller shaft, and a starting control system for both generator and motors. There are also several electrically operated engine room auxiliaries. Power for these auxiliaries as well as for the general lighting of the boat is obtained from a small generator which is direct connected to the main turbine-driven generator. For port use, and when the main unit is shut down, the auxiliary power is obtained from one of two 35 kW turbine driven direct current generators.

The main generator is rated 1 000 kW 500 V, is shunt wound, and has a considerable overload capacity for short periods. It obtains its excitation from the exciter which is direct connected to it. The main motors are each rated at 1 200 H.P., 125 revs. per min., 500 V. They are located at opposite ends of the boat and are direct coupled to the two independent propeller shafts. Under normal operation, one motor drives the stern propeller at 125 revs. per min., and the other motor the bow propeller at 100 revs. per min. When the ferryboat makes its return trip the speed relations of the two motors are reversed so that the stern propeller, which formerly was turning 100 revs. per min., now is turning at 125 revs. per min., and the former stern propeller, which now is the bow propeller, is turning 100 revs. per min. The electrical connections are so made that whichever happens to be the bow propeller driving motor for the time being will automatically take the speed corresponding to that which gives zero slip on the bow propeller, thus increasing the propulsion efficiency. The stern motor at the same time will automatically take over the duty of driving the ship at whatever speed is called for from the bridge.

This method of driving the propellers is a complete departure from that heretofore used with recriprocating engines when the engine is connected to a continuous shaft through the length of the ship and both propellers are always revolving at the same speed.

Control Equipment.

The main control equipment consists of two parts—a panel and a controlling rheostat. The panel carries the switches for the motors, generator, and the necessary overload and inter-locking device. The controlling rheostat consists of a suitable dial rheostat and resistances for varying the excitation of the main generator, which results in varying the speed of the propelling motors. In the middle of the panel are two field switches, one for each motor, mounted horizontally. Between these two, and in a vertical position, is located the control and excitation switch, which is so constructed that it must be opened before the other two switches can be opened. This arrangement insures against accidental opening of motor fields under load. The two motor field switches are triple-pole, single-throw, two of the knife blades having the same polarity, one supplying the motor field, and the other the holding coil of the motor line contactor. This prevents the closing of the motor line contactor unless the field switch is closed.

Increasing or decreasing the revolutions of the propeller, as well as reversing its direction of rotation, are all obtained by means of a potentiometer type of rheostat, which is connected across the field of the main generator. This rheostat consists of a bank of resistors mounted in a rugged angle iron frame with a dial switch built up on an ebony asbestos base. The whole structure is suitably covered by a sheet metal box. This rheostat is located in the engine room. Communication between the bridge and the engine room is obtained by means of the usual type of ship's telegraph.

The total weight of the propelling equipment is 212 000 lb.

It was on account of the reliable and successful operation and ease of manœuvring obtained with the turbine electric machinery of several large cargo boats, as well as of battleships and coastguard cutters, that the owners decided to equip this erryboat with this form of drive.

* From the "General Electric Review."

The C.S. "Faraday" Completing for Maiden Voyage.

On Monday we had an opportunity of inspecting the new cable steamer "Faraday," which is now lying off Siemens Brothers and Co.'s Woolwich works loading 1 000 miles of submarine telegraph cable—weighing in all over 4 000 tons —for the Commercial Cable Company. When this is done she will proceed on her maiden voyage to lay this cable between New York and Fox Bay, Nova Scotia. This cable is of a specially heavy type, designed by the cable company's engineers for fast working. It is insulated with gutta percha, and the weight of the copper conductor is 450 lbs. per nautical mile. The armouring is of eight different types, this being rendered necessary by the varying depths of water between the points to be connected, and also to the fact that a large portion of the route is over fishing ground where the cable is liable to be disturbed by ships' anchors, etc. During the process of manufacture, the cable and all its component materials have been rigorously tested and passed by the cable company's engineers.

The "Faraday" was launched at Newcastle on February 16th, 1923, and in our issue of March 23rd we gave a complete account of her design and equipment. We supplement this in our present issue by a number of interesting photographs which give an excellent idea what sort of vessel she is and how the cable machinery is arranged, and some further details about the equipment.

It will be remembered that the "Faraday" is to be operated by fuel oil, and it may be added that Siemens electrical distance thermometers are installed in the tank so that readings can be taken at convenient points between decks, and a continuous record obtained. An electric helm indicator is fitted so that the angle of the ship's rudders is shown on the navigating bridge.

Siemens patent ahead and astern revolution indicator is provided for each engine. This apparatus indicates to the officer on the bridge that the orders to the engine room have been carried out, and shows the first and every revolution, as well as the direction of rotation of each engine.

Loud-speaking marine telephones are installed on the bridge and various points on the ship. The Siemens "look out" indicator is also fitted, which enables the "look out" man to signal to the bridge the position of any object he observes. Electrical indicators are provided for the navigation lights, to show whether these are functioning correctly.

The wireless telegraph station is fitted with a Siemens quenched spark, 1½ kW set with extra valve-type reception.

Illustrations of the new "Faraday" are given on pages 84 and 85.

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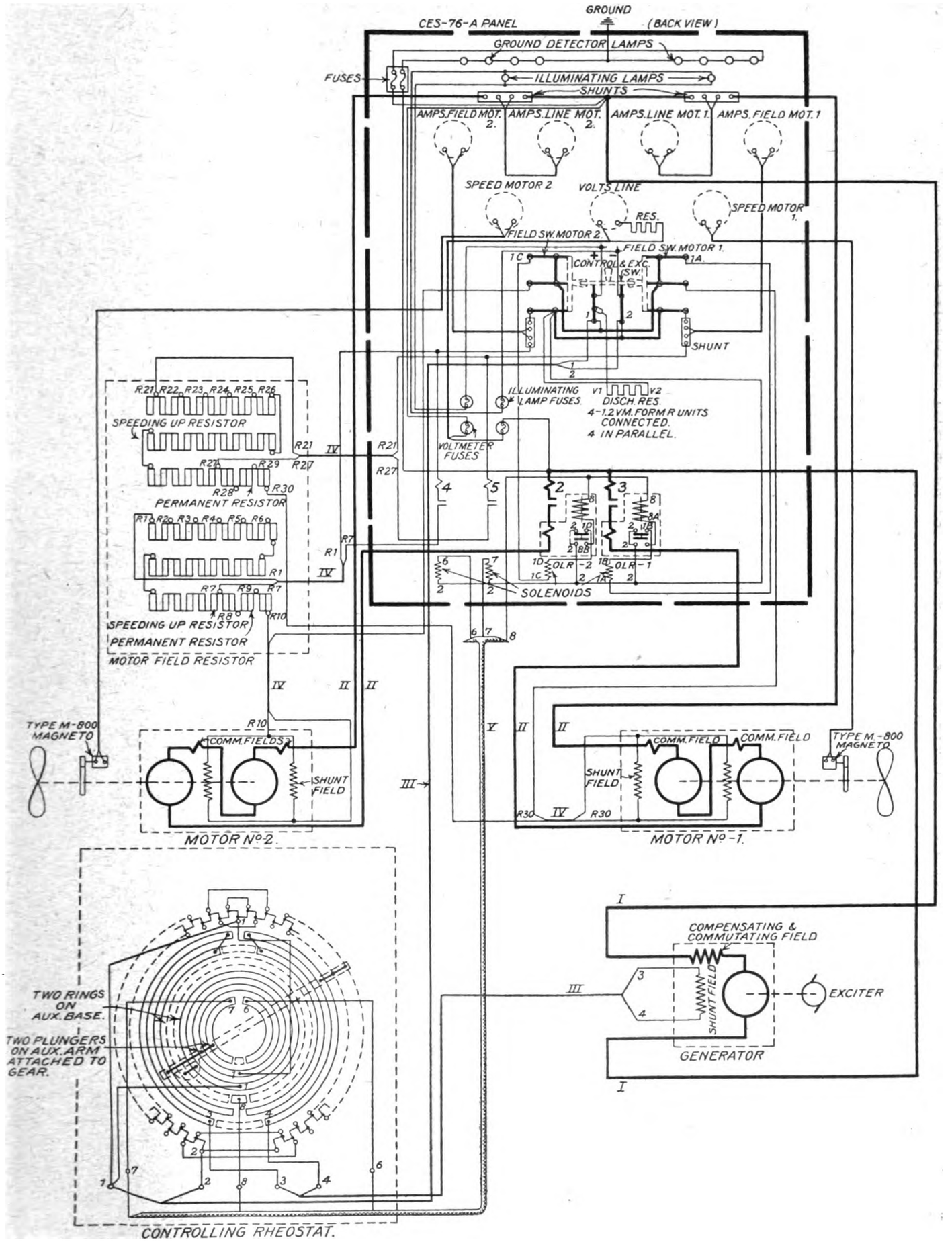

DIAGRAM OF CONNECTIONS OF PROPELLING MACHINERY ON SAN FRANCISCO'S NEW ELECTRICALLY PROPELLED FERRY BOAT.

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Hauling Apparatus for Marine Work.

Electrically-Driven Winches and Windlasses.

Owing to the increasing use of oil engines for the propulsion of vessels and the absence of steam on board, the demand for electrically driven winches is steadily increasing. A firm that has had a wide experience in this class of work is CLARKE, CHAPMAN and Co., for they have supplied all types in vogue up to the present, including purely electric winches of both the worm geared and the spur geared pattern, as well as electric hydraulic winches.

Spur Gear Winch Most Usual.

The spur geared winch (Fig. 1) is the most usual pattern, the motor driving an intermediate shaft through spur gearing

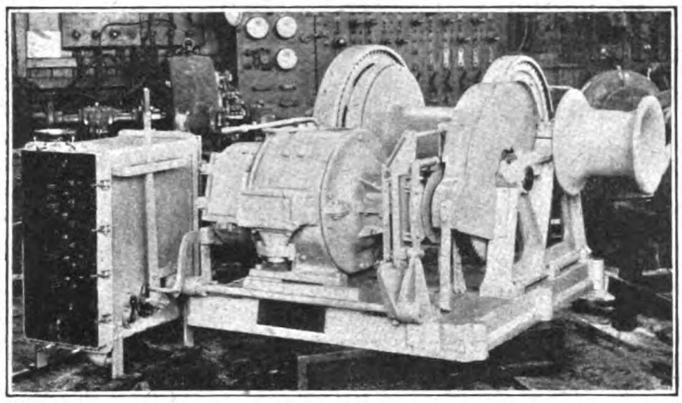

FIG. 1.—ELECTRICALLY DRIVEN SPUR GEARED WINCH.

with machine cut teeth. Two steps of the gearing having machine moulded helical teeth are fitted between the intermediate shaft and the main shaft to give two lifts and speeds, either step of the gearing being put into operation by means of sliding clutches, which are mechanically interlocked.

The centre lifting barrel and the two warping ends are keyed on to the main shaft and two brakes are fitted, one working on a sheave cast with the lifting barrel end is applied by a foot lever, while the other, which is of the automatic pattern, works on the sheave on the motor spindle and is applied by a spring and removed by a magnet as soon as current is put on. The winches are mounted on a strong cast iron bedplate and all gearing is adequately protected.

Advantages of Worm Geared Winches.

The worm geared pattern is suitable for use on board ship, as the gearing is thoroughly enclosed in strong cast iron case containing oil and is consequently quite weatherproof. The worm gearing is substantial, the worm being of steel forged solid with the shaft and the worm wheel having a phosphor bronze rim bolted to a cast iron centre. Both the worm and the worm wheel are accurately machine cut and a roller

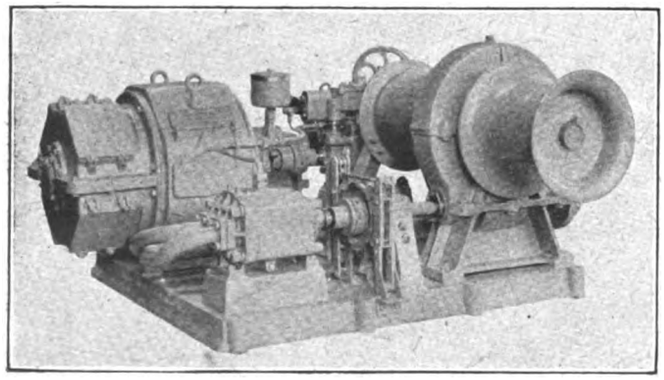

FIG. 2.—AN ELECTRIC HYDRAULIC WINCH.

bearing is fitted to take the thrust of the worm. This gearing only provides one speed mechanically, but to obtain a good range of speeds for dealing with the various loads, the field of the motor can be automatically altered by means of a load discriminator, which increases the speed of the motor and lift light loads at high speeds. It is usually arranged for this discriminator to be brought into operation by the man working the winch, but in case he should misjudge the load, adequate electrical protection is provided so that the motor is automatically brought back to normal speed and consequently protected against heavy overload.

Electric Hydraulic Winches.

In the electric hydraulic winches (Fig. 2) the electric motor is arranged to drive a hydraulic pump constantly and in the same direction. This hydraulic pump is connected by pipes to a hydraulic motor, which in turn drives the barrel shaft through worm or spur gearing. The lifting and lowering of the load is entirely controlled through the pump portion of the hydraulic machine, the control gear varying the amount of oil delivered to the hydraulic motor as well as the direction of delivery. In this way any speed between zero and full speed can be obtained in either the hoisting or lowering directions. The introduction of the hydraulic machines has considerably simplified the electrical gear, as only a starter is required to bring the electric motor up to full speed. It is then left running at that speed and in the same direction whilst cargo is being dealt with. Winches embodying both the "Hele-Shaw" hydraulic gear and the "Williams-Janney" hydraulic gear have also been supplied by the same firm, the former type driving, as is well known, through spur gearing and the latter through worm gearing.

Watertight Motors Essential.

Owing to the exposed position of winches it is essential that the motors be absolutely watertight, also of robust construction, owing to the heavy nature of the work, and these points have received most careful attention and adequate provision has been made for them in the Clarke, Chapman designs. The

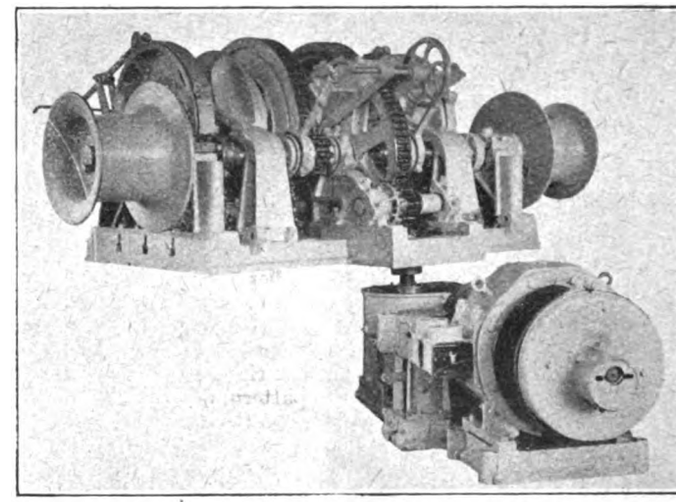

FIG. 3.—A TYPICAL ELECTRIC WINDLASS FOR MARINE WORK.

constant and heavy working of the control gears in purely electric winches also demands that particularly robust gear should be supplied, and the drum type or "cam" type of control gear, which these makers recommend, is enclosed in strong watertight cases, which are usually arranged as a separate unit for placing in convenient position near each winch.

An important item of equipment is the windlass for working anchors and cables and for warping the vessel. In motor vessels the electrically driven windlass (Fig. 3) had been found the most desirable type, and Clarke, Chapman and Co. have supplied a very large number of these machines, notably to Burmeister and Wain, of Copenhagen, since about 1910 for their motor vessels.

The most usual type of windlass has the mechanical portion on the forecastle deck and is driven by an electric motor placed on the deck below, the electric control gear also being placed in the latter position but being operated from the deck on which windlass is fixed.

Owing to the heavy strains to which a windlass is subjected, it is essential that all parts be particularly robust, and for that reason the bedplate, sideframes and centre stands are of massive section. The firm's well known direct grip is employed for engaging the cable holders with the main driving

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wheels when it is desired to lift the anchors, this being accomplished by means of handwheels placed outside the sideframes which slide the cable holders into gear with the wheels, the cable holders having brass bushes so as to revolve freely on the main shaft when paying out the cables. For the latter purpose, powerful screw band brakes are provided.

Gearing Arrangements.

All gearing in the windlass is of cast steel and all shaft bearings are adjustable. The main wheel pinions, intermediate wheel and clutch for the intermediate pinion are fitted on squares solid with the shafts and all gearing is amply protected by guards. Large warping ends are fitted on the intermediate shaft for warping the vessel. The worm gearing is of steel forged solid with the shaft, and the worm wheel has a bronze rim strongly bolted to a cast iron centre, these being accurately machine cut and running in a case containing oil. The thrust of worm is taken by a roller bearing. The worm wheel is fitted to a vertical shaft passing up to the deck above where it is fitted in a suitable bearing formed in the windlass bedplate.

Clutch and Braking Equipment.

Between the electric motor and the worm gear, already described, a slipping clutch is fitted in which the friction plates are of special treated material. The function of this clutch is to slip in the event of an overload or of the anchors being drawn up too quickly into the hawse pipes, the clutch being adjustable and affording mechanical protection to the whole gear. An automatic brake is also fitted. This works on the drum of the slipping clutch, the brake being applied by a spring and removed by a magnet.

Control Gear.

The control gear in the smaller or middle sizes of windlasses consists of a reversing drum type controller, a resistance of patent strip pattern mounted in a wrought-iron frame with an expanded metal cover and a circuit breaker having no volt and adjustable overload releases. This circuit breaker is electrically interlocked with the controller and can be reset by returning the controller to the off position after the circuit breaker is opened for any reason. The controller is operated by a hand wheel mounted on a pedestal and placed on the forecastle deck in a suitable position. In the larger sizes of windlasses the control gear is either of the "cam" type or the contactor pattern.

"Cam" Type Controller.

The "cam" type controller consists of a series of mechanically operated switches of such a design that they cannot be operated slowly in either the opening or closing directions. They are operated by a hand wheel on the deck above and through gearing. If the contactor pattern of controller is employed, the contactor panel is placed on the deck below in a suitable position and is controlled by a watertight master controller placed on the windlass bedplate on the deck above.

These windlasses can also be arranged with the motor on the windlass bedplate driving through worm and spur gearing. The motor in that case is made watertight to resist seas washing over it, but the control gear is usually placed on the deck below as already described.

Electric Hydraulic Windlasses.

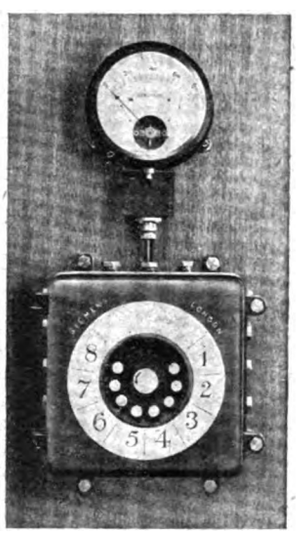
Several electric hydraulic windlasses have been fitted in first class passenger liners in which the electric motor and the pump end of the hydraulic machine have been placed on the deck below and connected by pipes to the hydraulic motor which is placed on the windlass bedplate and drives through worm and spur gearing as previously described. In this electric hydraulic windlass the motor runs continuously at the same speed and in the same direction, the windlass being entirely controlled through the hydraulic pump by a wheel on the deck above, which varies the amount of oil delivered to the hydraulic motor and the direction of delivery, any speed between zero and full speed in either direction being obtainable. A warping capstan can be arranged to stand ahead of the windlass on the forecastle deck or on the deck above if the windlass is arranged on the main deck, the capstan being driven by bevel gearing and fitted with a clutch for engaging or disengaging. These capstans are usually fitted with hand bar holes for working separately by capstan bars. Separate warping capstans can also be supplied for placing aft or in other positions desired.

Siemens Pyrometers for Internal Combustion Engines.

The increasing use of Dieselengines on board ship has brought with it a demand for instruments which shall show that the engine is operating correctly. As is well known, misfiring, incorrect mixture and other faults have the effect of causing fluctuations in the temperature of the exhaust gases, and the measurement of these temperatures is therefore an indication of the correctness or otherwise of the engine's operation. To measure these temperatures with accuracy and facility, a pyrometer is obviously the most suitable apparatus, and the equipment made by Siemens Brothers and Co., which comprises pyrometers, multipleway switch and temperature indicator, is therefore worthy of attention.

Details of the Equipment.

In the Siemens equipment, the pyrometer consists of an iron-constantan thermo-couple. It is protected by a steel sheath with closed end and is fitted with an enclosed terminal head with a cable gland. It is fixed in position by means of a gun-metal adaptor whose lower portion is screwed permanently into the exhaust manifold at the point at which it is desired to ascertain the temperature of the exhaust. The steel sheath is provided with a collar which fits into the gun-metal adaptor and can be fixed thereto by means of a screwed hexagonal cap.



Multiple-way Switchboard for Siemens Pyrometer Installations

The Pyrometer

This arrangement enables the pyrometer to be removed easily and quickly for examination. As a rule, a pyrometer is provided for each cylinder, the pyrometer being fitted into each section of the exhaust manifold. These pyrometers are connected through a multiple-way switch to a single indicator on which the temperature of the exhaust from each cylinder may be, in turn, read off.

Indicating Arrangements.

The multiple-way switch is of the press button type and is mounted in a water-tight metal case which is provided with the necessary glands for the cable. The temperature of the exhaust from any particular cylinder is determined by simply depressing the button corresponding to the pyrometer in that cylinder's section of the manifold. On depressing a second button, the first is automatically released and its pyrometer disconnected so that two pyrometers are never connected to the indicator at the same time. To release the last button depressed, a knob is provided at the centre of the switch face which, when turned slightly, returns the last button to the off position.

In order to avoid the use of an unnecessarily large switching apparatus and a large number of individual switches, press buttons are fitted corresponding to the number of cylinders of one engine only, and a selector switch is provided which, upon being turned to the right or the left, exposes either the word "Port" or "Starboard" and at the same time connects the pyrometers of the port or starboard engine to the indicator.

The temperature indicator is mounted in a water-tight metal case provided with a cable gland. The movement is of robust construction and has been designed for use in situations where it may be subjected to hard usage.

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"Metrovick" Electrical Plant for Use on Board Ship.

It will not surprise readers of THE ELECTRICIAN to learn that the METROPOLITAN-VICKERS ELECTRICAL CO. are not newcomers in supplying equipment for the application of electricity for use on board ship. This being so, it is interesting to recall that the turbo-generating plant installed on the s.s. "Aquitania," which comprises four 400 kW sets, was manufactured by the firm, and the success which attended the operation of these sets was no doubt responsible for the Cunard Steam Ship Co. placing an order with the company for twenty-two 375 kW, 220 V, three-wire d.c. turbo-generators for installation on their new post-war liners; two of these sets are installed on each vessel. These turbo-generators, though of course much smaller, embody all the essential features which are to be found in modern large power station plant, including oil relay governing and automatic overload valves. The turbines are of the "Rateau" impulse type and operate at 4 500 revs. per min., driving the generators at 1 000 revs. per min. through a single reduction gearing. One of these sets is illustrated in Fig. 1.

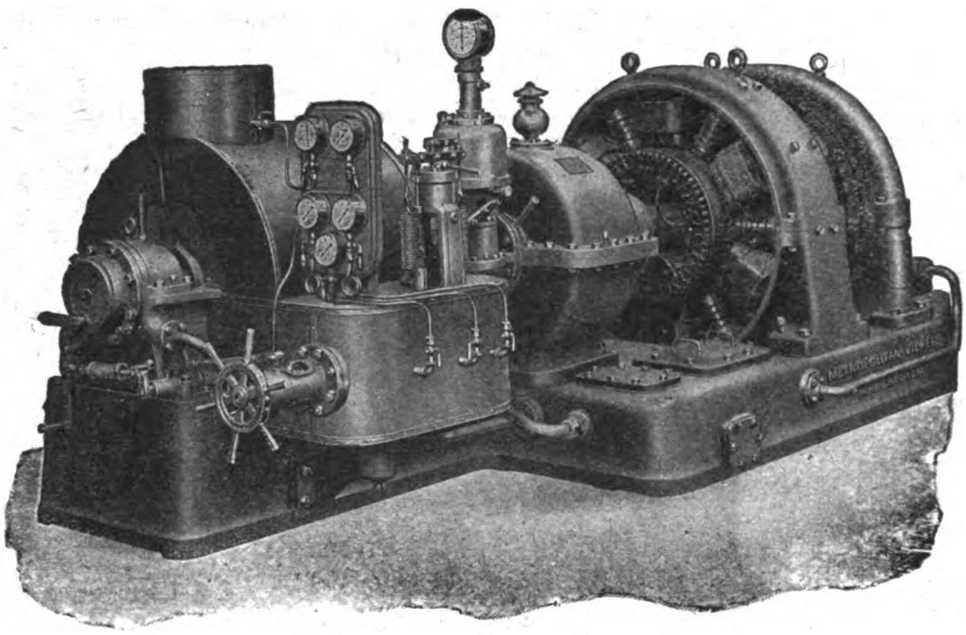

FIG. 1.—375 kW METROPOLITAN-VICKERS MARINE TURBO-GENERATOR.

Another large contract for auxiliary turbo-generators which the company has recently executed was the supply of forty-four 95 kW sets for installation on oil tankers for the British Tanker Co., Ltd. In this case the turbines operate at 7 500 revs. per min., and the generators are of the alternating current type, generating at 220 V, three-phase, 50 periods; alternating current being especially suitable for use on oil tankers, thus distinguishing them from most other ships where the employment of direct current is usual.

Motor-Driven Auxiliaries.

The company also supplied the motors for driving the auxiliaries on these tankers, together with necessary switch and control gear. An illustration of one of the cargo oil pumps is given in Fig. 2. The motor is of the squirrel cage pipe ventilated type, and a small fan is provided for ventilating it. The control gear is so arranged that it is necessary for the fan to be in operation for a short period before the main motor can be started up, thus ensuring the motor being entirely free from oil fumes before current is switched on.

The Diesel Engine and Electricity on Shipboard.

The advent of the Diesel engine-driven vessel has opened up a new field for the application of electricity for driving auxiliaries, for which purpose it is extremely suitable. The Metropolitan-Vickers Electrical Co. have also developed a special line of apparatus for use on this type of vessel, where conditions are not favourable for the ordinary commercial type of machine, on account of oil fumes which are usually present. As a result of their experience in this field the company supplied the generators, motors, switch and control gear for the motor ships "Conde de Churruca" and "Arnus," and have at the present time six 40 kW generators under construction for installation on motor ships building for the British India Steam Navigation Company.

Electrically-Operated Deck Machinery.

The company has also devoted a good deal of attention to the question of electrically operated deck machinery, and, in conjunction with Harfield and Co., of Blaydon-on-Tyne, has developed a line of winches, windlasses, and capstans which incorporate all the latest improvements which have been found desirable from actual practice. The winches are made in two types; the first being spur gear driven and fitted with drum type controller. The second type is primarily designed for use on passenger boats, the drive being of the worm type running in an enclosed oil bath, and controlled by means of contactor gear operated by a master controller placed in a convenient position. This winch operates silently and without vibration, and the type of control gear employed makes operation as simple or even simpler than a steam winch. This type of winch is being adopted by leading shipowners for motor vessels they are now building. The design of this worm-driven winch has recently been modified, with the result that the space occupied has been considerably reduced.

Another speciality of the company which is finding great favour amongst shipowners is their line of electric fans, which are now being fitted in large numbers on board ship. The motor casing and base are made of pressed aluminium, which gives an exceedingly light yet strong construction.

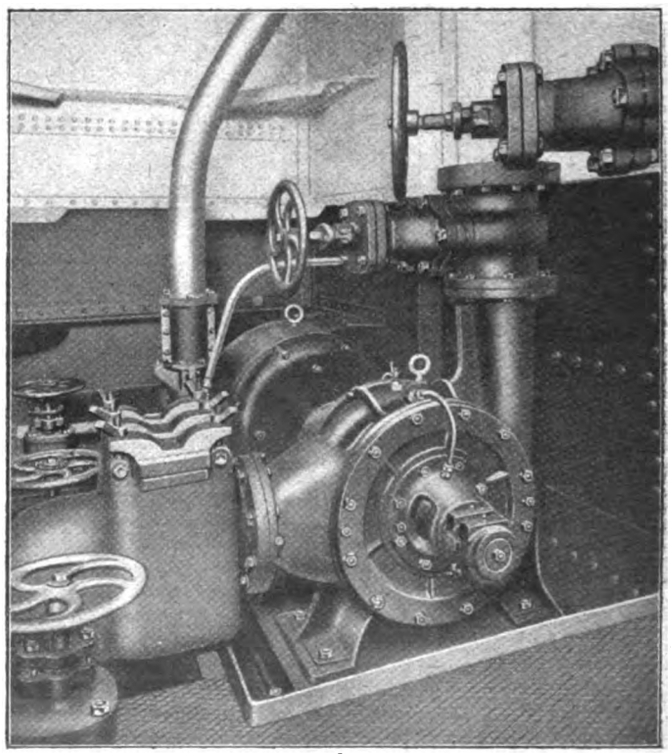

FIG. 2.—75 H.P. MOTOR DRIVING CARGO OIL PUMP ON TANKER VESSEL.

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Manufacturing Marine Specialities.

Some Notes on the Products of Laurence, Scott and Co.

As our readers probably well know, LAURENCE, SCOTT and Co., are celebrated among electrical firms for having devoted themselves largely to the manufacture of electrical power apparatus for use on board ship. One result of this specialisation is that they have to date supplied the equivalent of some 350 000 B. H.P. in electric motors and generators for shipboard use—all of them of the direct current type.

This firm has also felt the effect of the Diesel engine in extending the use of electrically-driven auxiliaries on board ship. But it has been found that even with steam-driven ships there is a very great saving in the use of electrically-driven auxiliaries, especially for the deck machinery. The steam engines on winches, capstans, windlasses and steering gears are necessarily very uneconomical having all to be arranged for reversing, so that the expansive action of the steam is little used. To this must be added the varying and intermittent nature of their load, and on the top of all this are the enormous losses owing to the steam connections.

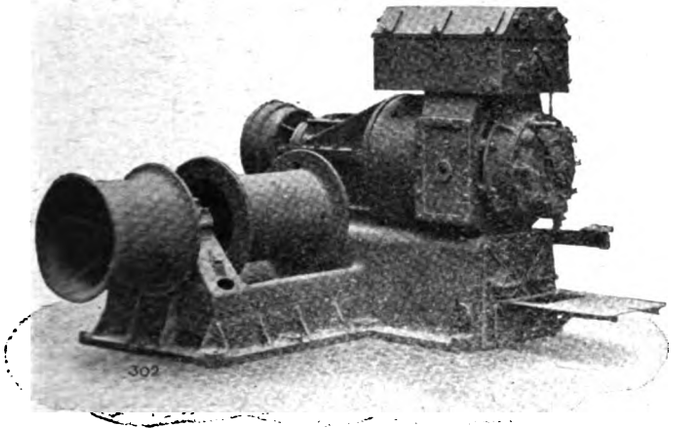

FIG. 1.—"SCOTT" SELF-CONTAINED CARGO WINCH.

Electricity and Fuel Saving.

The fuel saving when Diesel engines are used for generating the electricity for electric deck auxiliaries in place of steam auxiliaries has been put by American observers as 20 to 1. Probably this is some exaggeration, but shipowners who have had actual experience of both put it at 7 to 1, a ratio which is more than sufficient to counterbalance any extra first cost of the apparatus; there is also a considerable saving in the cost of distributing power by electric wires rather than by pipes, while the upkeep of both the electrical apparatus and the wiring is undoubtedly less than that of steam auxiliary machinery and its connections. It is only fair to point out that the earlier electrical gear for deck auxiliaries left something to be desired in this respect, and steam winches were also considerably faster in handling cargo than the earlier electric winches. This is now changed. A good deal of this improvement is due to the enterprise of Laurence, Scott and Co., as will be patent from a description of their "Scott" winch which we illustrate in Fig. 1. This winch has all its working parts—both gearing and braking and controlling arrangements—completely enclosed so that they will stand all the seas that other parts of the ship are capable of standing, and by means of a patented arrangement called a "load discriminator," a description of which has already appeared in THE ELECTRICIAN, the natural series effect of a series wound motor is accentuated to such an extent that the light-load speed of lifting is made to be some four times that of the heaviest load speed, the quarter load speed, about three times, and the half-load speed about double. This gives a winch that without any mechanical change-speed gear will lift a heavy load (only an occasional requirement, and one where speed does not matter) at a comparatively slow speed and so take comparatively small power, while at the lighter loads, which are generally more than 90 per cent. of the total number of loads lifted, the speed runs up as fast as can be conveniently managed. The whole arrangement is fool-proof and can be, and is, put in the hands of absolutely unskilled men off the dock side.

Electric Steering Apparatus.

The same firm also make an "all electric" stearing gear which is in use on some twenty-six large ships. The first of these gears was installed in 1914 on board the "Mississippi" of the Atlantic Transport Line and it is understood that the total cost of repairs to this electrical gear to date (June, 1923) has been under £5. The "Mississippi" came right through the war without mishap, and the facility with which she zig-zagged as a defence against enemy submarines is acknowledged to be one of the factors in her escapes from the Hun activities.

We may mention that this gear includes an electric telemotor, so that the steering is accomplished from the bridge, where the wheel operates one leg of a Wheatstone bridge, the galvanometer of the Wheatstone bridge being replaced by the exciting coils of an exciter running in connection with a motor-generator on the Ward-Leonard system. The generator of this system supplies a main motor which drives in turn the segmental pattern of steering gear known as the Wilson-Pirrie steering gear. The main motor also drives the other leg of the Wheatstone bridge until the galvanometer circuit (i.e., the exciter shunt windings) is in coincidence with the leg of the Wheatstone bridge operated by the wheel, when no current flows in the exciter shunt coil and the main motor comes to rest. The whole arrangement is thus perfectly simple and is to all intents and purposes quite silent. It is being installed in a number of large new ships.

Electric capstans and windlasses are also rapidly replacing steam-driven equipments. And here ingenuity again comes in. For by properly proportioning the motors to give a heavy torque for the short periods, their size and cost can be considerably reduced. The contactor gear that is used for operating them is perfectly reliable, so that anything that was required of steam equipments can now be accomplished by electrical means.

Armature Inertia and Windlasses.

There is one point that it is necessary not to lose sight of in connection with electric windlasses, and that is the inertia of the armature. If the anchor is raised at a high speed to a dead stop at the hawse pipe, the inertia of the armature being suddenly checked has been known to lift the whole windlass off its bedplate. To provide against this all windlass motors supplied by Laurence, Scott and Co., Ltd., are now provided with slipping clutches (Fig. 2). Another point to notice is that the warping condition with electric warping winches is now without any difficulty obtained by means of properly proportioned motors and their resistances.

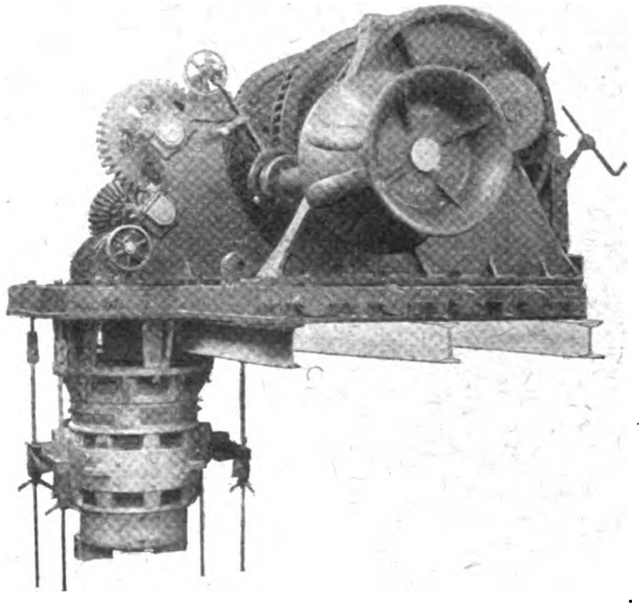

FIG. 2.—VIEW OF 3 3/16 IN. ELECTRIC WINDLASS DRIVEN BY LAURENCE, SCOTT VERTICAL MOTOR FITTED WITH MAGNETIC DISC BRAKE AND SLIPPING CLUTCH.

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Motor Control Panels for Use Aboard Ship.

How Special Requirements are Met by Modern Design.

The growing popularity of the Diesel engine as a prime mover for ocean-going boats of comparatively heavy tonnage has given a great impetus to the use of electrical apparatus aboard ship. Indeed, on the majority of motor-ships practically all the pumps, compressors and other auxiliaries are electrically driven. It is, therefore, not surprising to find the makers of electric control gear such as BROOKHIRST SWITCHGEAR, of Chester, developing special forms of motor starting panel for marine service.

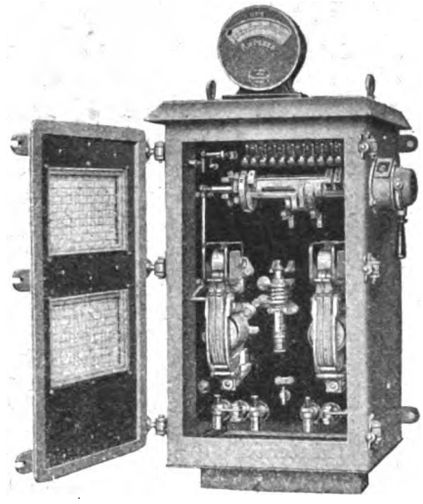

FIG. 1.—CONSTANT SPEED MARINE PANEL.

Points in the Design of Ship's Switchgear.

In designing switchgear for use aboard ship, certain special factors have to be borne in mind. These may be tabulated roughly thus :—

1. Weather.—The enclosing case must be weatherproof and splashproof, or even in certain cases entirely watertight.
2. Atmospheric conditions.—It is essential that the switchgear shall be proof against corrosion, particularly as regards moving parts. Hygroscopic materials, such as ebonite, should be avoided even for handles.

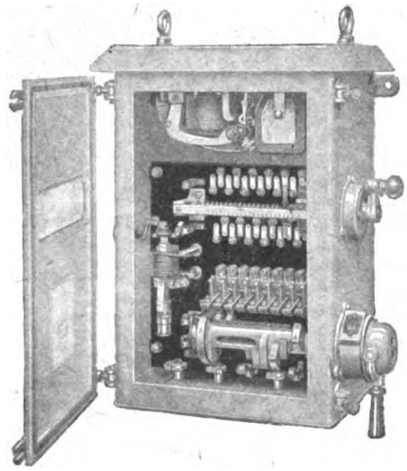

FIG. 2.—A STARTER FOR ADMIRALTY WORK.

3. Interference with the operation of the switchgear due to the roll of the ship.—It is necessary to guard against the switches being closed under the action of gravity due to an alteration in position.
4. Space.—In view of the confined space usually available, the gear must be as compact as possible.

The Brookhirst marine type starting panel (Fig. 1) consists of an adaptation of the standard drum type panel for industrial service, to meet the above requirements. The case is of sheet steel with a hood to render it splashproof. The front and back doors are provided with asbestos packing, and the whole case, though ventilated, is completely weatherproof. Where necessary, it can in addition be made watertight. The switchgear for constant speed applications consists of a drum type starter, two electrically operated contactors and a solenoid type overload trip. The whole of the gear is corrosion proof, and provision is made so that the contactors cannot close except in the course of the normal starting operation. The switchgear is arranged in such a fashion that the complete unit is exceedingly compact, and the overall dimensions such as can be accommodated aboard ship. Normally the overload trip and contactors are mounted below the starter, but they can, where desired, be arranged side by side so as to occupy less headroom.

A Robust Drum Starter.

The drum type starter is particularly suitable for use aboard ship on account of its essential robustness. Such a construction has, in fact, long been contemplated, but the difficulty has lain in providing against the starter handle being left in an intermediate position. The impracticability of successfully employing a spring return for this purpose led to the development of the "Brookhirst" patent "slow motion" ratchet handle. With this mechanism, the proper sequence of starting operations must always be carried through, or if interrupted, a new start can only be commenced after the drum has been manually returned to "off." "Inching," when desired, may be carried out either by means of the operating handle or by one or more distant push buttons.

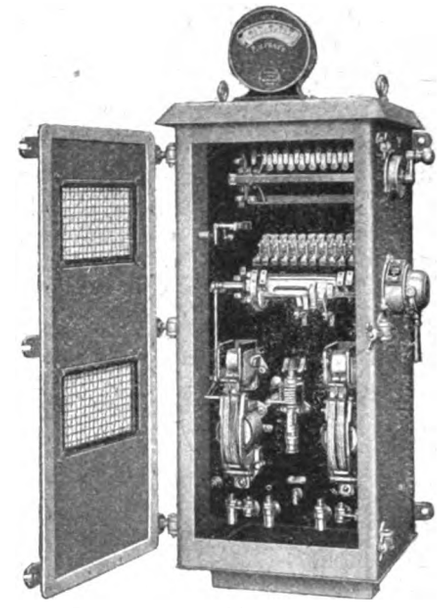

FIG. 3.—DRUM STARTER WITH HORIZONTAL SHUNT REGULATOR.

The motor is efficiently protected by the two magnetic blow-out contactors and the overload trip. The main current is never broken upon the starter contacts, but always by these contactors, whether as a result of a failure of supply, excess current, or by the action of stopping or "inching," either at the panel or elsewhere. Once opened, the contactors cannot be re-closed until the starter has been returned to "off." For variable speed applications, the switchgear includes a horizontal type shunt regulator (as Fig. 3) interlocked with the contactors in such a way that the latter cannot close unless the whole of the shunt resistance is out of circuit.

Special Designs for Admiralty Service.

The starting panels described above have been standardised for use in the mercantile marine, but in addition special designs have been prepared for Admiralty service. The principal respect in which these gears differ from the mercantile marine pattern is that for the smaller horse-powers the starter, although of the double-pole pattern, is supplied with no-volt release only. For the medium sizes both no-volt and overload releases are fitted (as shown in Fig. 2), and in the larger sizes, while the starter is provided with no-volt release only, provision is made for interlocking with a branch circuit breaker. These arrangements comply with the Admiralty specifications, as do also the mechanical and electrical details of the gears.

In conclusion, it may be remarked that the starting and controlling panels described above have been designed in close consultation with marine engineers and the makers of marine auxiliaries, and may be taken as representative of the most up-to-date practice in this field.

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Electric Cooking on Shipboard.

Some Effects of Cautiousness.

There are people who think that the current on ships, not being connected to any central station mains, costs nothing. Hence, they argue, the fact that electric cookery equipments are installed on shipboard is no criterion of their being good for other work—but those who "go down to the sea in ships" are extremely cautious people, and unless they are satisfied that any proposition is safe, certain, and economical—it finds no place in a galley. The fact, therefore, that so much electrical equipment is now fitted on to all sorts and sizes of ships makes it impossible in the scope of a short article to give any large number of instances of what has been done, but the few typical examples illustrated will show the progress that has been, and is being, made in this big field of cookery.

A Typical Modern Galley.

The s.s. "Antwerp," for instance was recently fitted up with electric cookery equipment consisting of a treble oven range with side heating elements, and the standard 2·5 kW rectangular solid type boiling plates over and above it, the total capacity of the range being 30 kW all on. The ranges are constructed of ¼ in. steel plate throughout, with the exception of the feet, the boiling plates, and the guard pillars, and one or two other little parts inside. In these cases the switchboards were made of wrought iron, hinged; all electrical parts, including the switches, lamps, and fuses being entirely enclosed. The whole of the connections throughout were of solid busbar construction of section approximately 1 in. by ⅛ in., mounted on porcelain supports, firmly locked to prevent vibration, but free of movement, with extension lengthways. The tops of the ranges were hinged, and could be lifted up for inspection and renewal of plates or elements as desired.

The hot press is a standard ships' pattern, having a plate creel and shelf, whilst the top is fitted with a recessed block tin brass mounted plate, complete with two carving wells, a separate illuminated switchboard being included.

Hot Cupboards.

A number of somewhat similar hot cupboards were supplied to the "Empress of Scotland," while the Canadian Pacific ocean services who run this boat also have a large number of the heaters shown (Fig. 1); their boat, the s.s. "Montlaurier," being recently fitted with a number of warming plates.

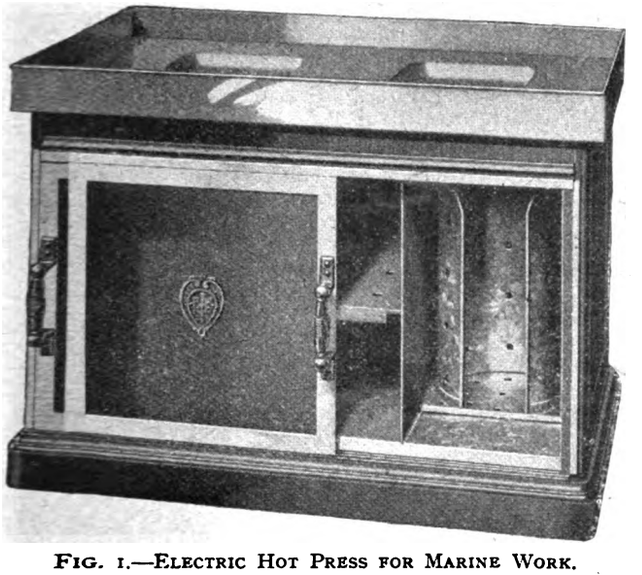

FIG. 1.—ELECTRIC HOT PRESS FOR MARINE WORK.

Roasting Ovens on Trial.

One of the vessels of the Orient Steam Navigation Co. recently made a trip to the Antipodes with two roasting ovens installed to see if these would give satisfactory service. These ovens, which we illustrate in Fig. 2. were standard No. 3 ovens, each having a cooking space of 22 in. by 22 in. by 26 in. They are strongly built, cast iron outer cases, mild steel inner cases with heat insulating lagging between. The ovens are fitted with side elements wired in parallel, arranged for series parallel control and for heat regulation. The switchboards are fitted with pilot lamps and mounted on standards as shown, the only alteration being that the doors were fitted with a catch, so that they would not swing open in rough weather, and instead of feet they were fitted with bolts for bolting to the deck. So satisfactory were these that further equipment has been ordered for the next boat.

We recently published a photo of a standard domestic Falco cooker as fitted for service on a private yacht, and we understand that it is giving every satisfaction. This is being used as an auxiliary to the coal fire range on the 800 ton twin screw steam yacht "Restless."

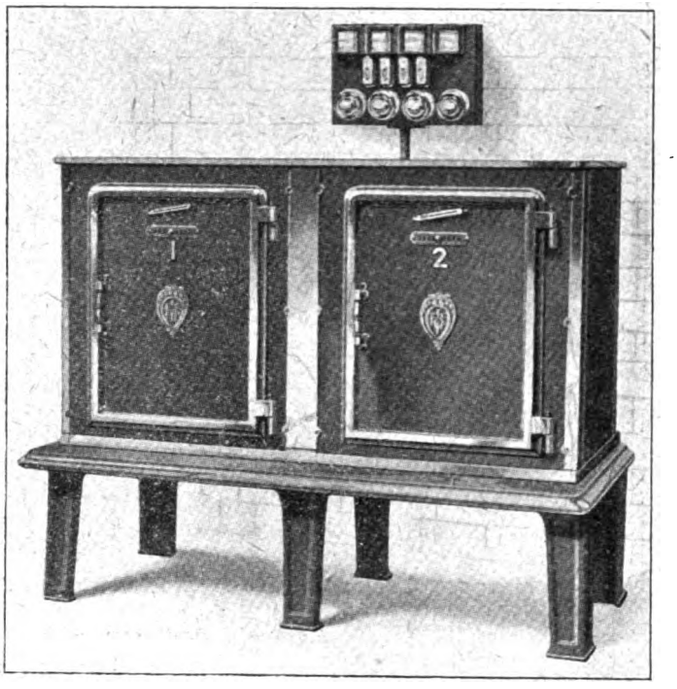

FIG. 2.—TWO ELECTRIC OVENS FOR AN ORIENT LINER.

All the apparatus described in this article was manufactured by THE FALKIRK IRON CO., who now effect their sales of electrical apparatus, as our readers are probably aware, through the HOTPOINT ELECTRIC APPLIANCE CO. We have just heard that this latter company's American organisation was responsible for the fitting out with complete electric cookery equipment of the "Leviathan," which has just made her initial trip across the Atlantic after being reconditioned following on her being taken over from the Germans. We hope to publish some particulars of the equipment on this, one of the largest liners in the world, at an early date.

Public Works and Transport.

The Forthcoming Congress and Exhibition

The King has consented to grant his patronage to the forthcoming PUBLIC WORKS, ROADS AND TRANSPORT CONGRESS AND EXHIBITION, which is to be held from November 22nd to 29th next at the Royal Agricultural Hall, London.

The arrangements are in the hands of the Congress Organising Committee, of which Sir Henry P. Maybury, Director-General of Roads, is Chairman, and which is comprised of representatives of the Ministry of Health (*ex-officio*) and all the principal associations of local authorities, public bodies and their officials, the object being to provide an opportunity for the discussion of the many problems which confront those who are responsible for the administration of the public services.

The expansion of industrial and residential areas throughout the country necessitates the periodical discussion of such public services as public lighting, sewage disposal, water supply, refuse disposal, and housing. The Congress will be attended by representatives from local authorities and other public bodies throughout Great Britain, whilst the attendance of a considerable number of representatives of the self-governing Dominions is anticipated. We understand that practically the whole of the available exhibition space has already been booked by firms specialising in materials, machinery, plant and vehicles used in connection with public works and municipal undertakings.

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Carron Cooking Apparatus.

Some Special Designs for Shipwork.

Many of our readers will have happy recollections of a trip to Scotland by the Carron Line in pre-war days and recall the company as shipowners. They are also well known as ironfounders, and having turned their attention to electric cooking equipment are not only in a unique position, but are well qualified to provide equipment for furnishing the galley or infusing a cheery warmth into the stateroom. It is interesting to note that for many years—long before electricity began to play such an important part in the ship—the CARRON Co. devoted themselves to ships' cooking and heating apparatus for coal, and, as may be expected, we find many of the principal

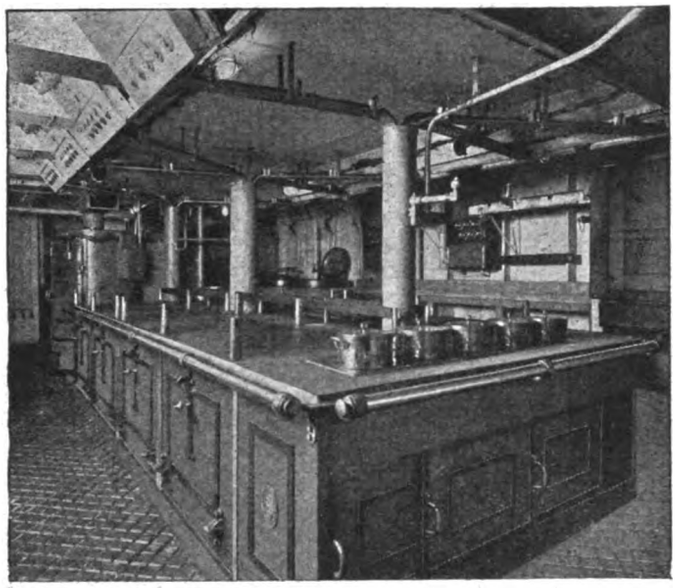

FIG. 1.—ONE OF THE ELECTRIC RANGES ON THE " PITTSBURGH."

steamships have adopted Carron appliances to cope with the increasing demands of passengers who expect equal service and comfort afloat as on shore.

As will be gathered the Carron Co., with their long association with ships' domestic requirements for all classes of vessels from the " tramp " to the " floating palace " or battleship, bring to the manufacture of ships' electric cooking appliances an experience which few firms can claim. In connection with such equipment the design and mechanical strength of the apparatus are of the utmost importance, and it is only

FIG. 2.—A BAKING OVEN ON THE " PITTSBURGH."

those firms having a long and varied association with marine work that can give proper attention and the minute care involved in the design and construction.

Turning to details, the Carron Co. have installed such important electrical cooking apparatus as baking ovens, central and bulkhead cooking ranges, hot presses, etc., some of which are among the largest electrically heated cooking apparatus at present in use.

Fig. 1 shows a large Carron electric island galley range. This is one of three which helps to cater for the needs of that giant electric ship—the White Star liner " Pittsburgh." It might here be mentioned that the whole of the cooking on board this magnificent vessel is done by electricity, the installation being the largest in the world on board ship. A considerable number of the appliances were supplied by the Carron Co.

The central electric range on the "Pittsburgh" in the first class galley is built on similar substantial lines to a coal fired galley range to withstand the hard work and rough usage to which such a range is necessarily subjected to on board a ship. The range has eight ovens with boiling plates over, each separate heating unit being controlled by three-heat series, parallel switches mounted on switchboards supported overhead on deck beams. At the end of range is a chef's hot closet with *bain marie*. The third class range is a replica of the first class without the hot closet.

Fig. 2 shows one of the Carron bakers' ovens, which is also fitted in the " Pittsburgh." This oven is big enough to keep the ship regularly supplied—she can carry 2 600 persons—and although usually kept to a temperature of 400 deg. to 500 deg. F. can, when necessary, be heated to 700 deg. F. The oven is constructed of mild-steel plate, having three compartments

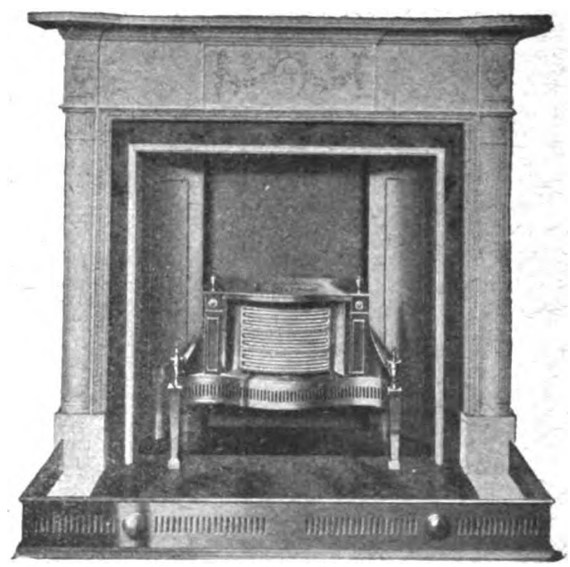

FIG. 3.—AN ELECTRIC DOG GRATE FOR SHIPWORK.

each with a baking area of 5 ft. wide by 3 ft. 9 in. deep. The heating elements which are placed in the top and bottom of each compartment are loaded to a maximum of 10 kW, and are controlled by rotary indicating switches with a fuse and pilot lamp to each circuit. Each oven is provided with an inspection window, lamp, pyrometer and steam jet. The maximum total loading is 30 kW. Ovens of similar construction have been fitted on the " Prinz Frederic Wilhelm " and the " Patricia."

Electric Heating on Shipboard.

The company are not less qualified to deal with the heating section of marine work than with cooking equipment. They are particularly well equipped to supply heating appliances to harmonise with the elaborate furnishings of the luxuriously equipped staterooms and living rooms of the modern liner. As we have previously pointed out in these columns the Carron Co. possess many unique and authentic period designs of dog grates, a number of which can be adapted to carry electric elements, at the same time retaining all their charm and dignity. Fig. 3 shows one of these electric dog grates finished armour bright, having panels and kerb in the same finish with a marble surround and hearth and an appropriate mantel. A neat little electric cabin heater is also made. This is of cast-iron and is constructed so that it can be fixed to bulkhead. The front is arranged to hinge down to allow of easy access to element. It has solid conductors throughout and is provided with a close meshguard.

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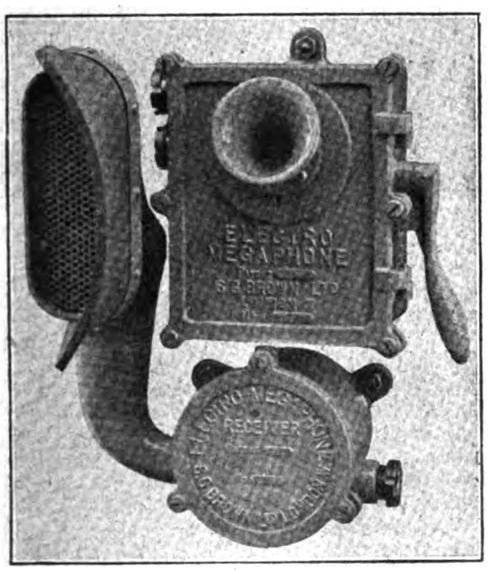
The Electro-Megaphone.

The increasing use of machinery, with all its complications and its dependence for its proper operation on the human factor, makes the need for rapid and easy inter-communication essential. This inter-communication, or instantaneous exchange of information, may be effected in many ways. But it may be taken as axiomatic that it must be two-way, and for this reason the telephone seems to be the most suitable apparatus. But the ordinary telephone has disadvantages of its own, as the person receiving the message has to hold the receiver to his ear and the surrounding noise may make it difficult for him to hear. To this drawback, the loud speaker is the obvious solution, but that again has disadvantages, including insufficient loudness and a great deal of distortion.

The electro-megaphone which has been designed by Mr. S. G. BROWN, it is claimed, is the successful outcome of an attempt to produce very loud telephone speech without loss of articulation. It is, in fact, a telephone into which a man may speak in a normal voice, and from the receiving end of which speech is emitted, magnified, so that it is possible to hear it with ease at distances as great as 60 yd. from the trumpet. The apparatus, which we illustrate herewith, comprises a transmitter in the form of a mouthpiece projecting from a ter-



VIEW OF THE ELECTRO-MEGAPHONE.

minal box, or of a handle which may be plugged into any one of a series of boxes.

The loud speaking receiver is of the well-known Brown patent reed type, to which is attached a correctly proportioned trumpet, which may be compactly shaped so as to lie alongside the transmitter box. In this position speech is received close to the ear of the operator when he is speaking into the mouthpiece. This type is especially useful in noisy places. Indeed, it has been found possible to receive with it in this way in a Diesel engine-room when the sound of the speaker's own voice was inaudible. Other forms, with larger trumpets may be hung from the ceiling. And where a large area has to be covered, several receivers, all of which are coupled to the same transmitter, may be employed.

Application to Marine Work.

In view of the need for serviceable means of inter-communication between the bridge of a ship, the anchoring and docking positions, and the engine-room, a type of the electro-megaphone in robust watertight castings has been specially designed for marine use, while a combined form of transmitter box and receiver trumpet has been supplied extensively for use in H.M. Navy. This form has also many applications in the mercantile marine. Used in conjunction with a portable hand transmitter, which may be plugged into circuit for speaking to any part of the ship from either side of the bridge, the electro-megaphone provides the captain with ready means of giving his orders clearly and very loudly. It combines in one handy form, in fact, the old-fashioned megaphone and the strictly limited and inflexible docking telegraph.

Navigation Light Indicators.

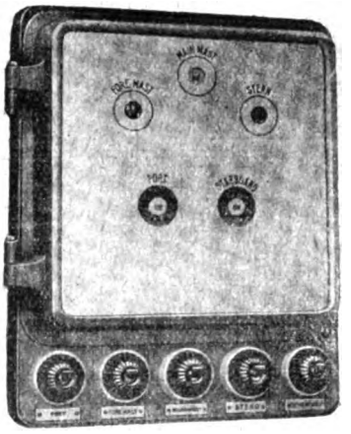
Among the manifold minor electrical devices in use on board the modern vessel is the navigation light indicator. This forms one of the most essential features of the navigation system, for by its use it is possible to tell at a glance in the chart room whether all the lights are burning correctly, or if any one of them is out of order.

A pattern of indicator that has the approval of the Board of Trade and Lloyd's is that made by GENT AND CO., who also specialise in the design and manufacture of electric bell indicators and electric clocks for marine use.

An Essential to Navigation.

Two modern patterns of indicator are manufactured by this firm. Of these a wood-cased pattern is still permissible in some circumstances; while our illustration shows the more modern iron-cased type, which has been specially designed to meet modern requirements, and to comply in all respects with Lloyd's latest regulations.

The case is of cast iron, with sheet steel panels. A zinc screen, protected by a glass front, is pierced with apertures, the edges of which are painted red, green, white, etc., and are labelled to correspond with the position of the various navigation lights, such as port, starboard, masthead, etc. Behind this screen, and arranged in rear of the case, is a single incandescent lamp so placed when lighted that it diffuses a general light inside the case. Each signal movement consists of a solenoid electro-magnet, having a long light armature, and carrying a transparent glass flag at one end. This, when operated, appears opposite the aperture in the screen. This movable flag carries the word "On" in white lettering on a red background. A fixed flag also transparent and carrying the word "Off," is arranged behind the aperture. The incandescent lamp when alight throws these signals into strong



AN IRONCLAD NAVIGATION LIGHT INDICATOR.

relief. The movable flag is arranged to close a separate alarm bell circuit when in the "Off" position.

Control Arrangements.

On the frame of the indicator, below the hinged iron casing, are arranged twin circuit tumbler switches, which control separately, but simultaneously, the signal and bell circuits. The navigation lights are wired in series with the coils of the signal electro magnets. The operation of the indicator is as follows: When any individual switch is depressed, the corresponding navigation light is illuminated and the signal magnet is energised, attracting its armature, displaying the word "On" at the aperture in the screen, which is labelled with the name of the light so controlled. The switch also closes the circuit of the alarm bell, but the armature of the signal magnet being attracted, opens the bell circuit at that point. The officer in charge knows therefore whether all the navigation lights are in working order immediately he closes each switch. Each circuit is in addition controlled by a separate single pole fuse. Should any of the lamps fail for any reason, the series circuit is broken and consequently the electro-magnet of the corresponding signal indicator is de-energised and fails to hold its armature up. The latter falls back, disclosing the fixed signal "Off," and at the same time closing the circuit of the alarm bell, which rings continuously and attracts immediate attention to the failure. The faulty circuit can, if desired, be switched off until the section has received attention, but the "Off" signal will remain until the circuit is restored and the lamp switched on again.

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The Idea of Selling Light.

The New Lighting Service Department of the British Thomson-Houston Co.

"The industry requires to adopt new methods in selling that part of the output of our stations which can be used for lighting purposes." This sentence taken from a short address given by Mr. A. M. Stephens at a Press visit to the new Lighting Service Department of the British Thomson-Houston Co., at 15, Savoy Street, London, on Thursday in last week, was the keynote of the proceedings on that occasion and is the germ of a great idea, whose development by the company will be watched with the greatest interest. The company are to be congratulated on their enterprise and upon their generous invitation to the whole industry to take advantage of the information they will collect in their new branch. They have embarked upon what is an important experiment. We are assured of their success.

By rights we should now proceed to give a description of the equipment of this new department detailing the various sorts and kinds of fittings which are there to be found, together with the arrangement of the circuits and the disposition of the switches. We should then go on to give an account of Mr. Bush's remarks and of his sermon on the necessity of selling light rather than fittings, wire and conduit. But all this would be rather dull and the best way will be to combine Mr. Bush and his sayings and doings with the equipment and

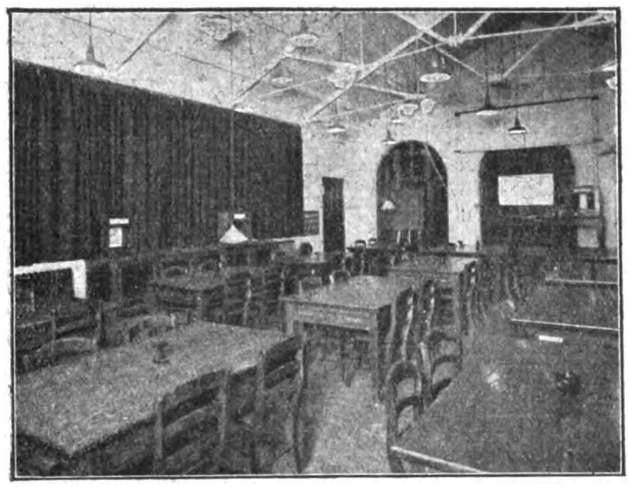

FIG. 1.—THE DEMONSTRATION ROOM OF THE NEW LIGHTING SERVICE DEPARTMENT OF THE BRITISH THOMSON-HOUSTON CO.

introduce a few of our own impressions so as to make what we hope will be a readable story.

Demonstration the Essential Factor.

The main portion of the new department consists of a large demonstration room of which we give two illustrations (Figs. 1 and 2). It is equipped with the usual platform, lantern, screen, blackboards, chairs and tables, but the real subject matter of the lecture is overhead, where a number of industrial lighting fittings such as are and not to be used, and such as are and ought to be employed in factories and other such places can be seen. These are all controlled from a small switchboard in one corner of the room and not the least impressive part of the demonstration was the synchronism between Mr. Bush and his switchboard attendant. Each table, besides pencils and paper, is provided with one or more foot candle meters, so that readings can be taken by the audience with different kinds of illumination at different parts of the room and Mr. Bush's lesson is thus rubbed in on the true Squeers plan. The room is also equipped with a number of small show cases, which indicate the effects of shade, speed, glare, shadows, coloured light and artificial daylight, and with a very handsome shop window, which can be illuminated in one or more ways, good and bad, for the purpose of demonstrating the possibilities of this very important selling agent. The stage now being set we can return for a moment or two to Mr. Bush.

The Bed Rock of the Electrical Industry.

He was in fighting mood. He attacked the people who think propaganda for electric lighting is superfluous. Electric lighting, he said, was the bedrock of the electrical industry and without it the demand for plant, cables and necessaries would cease because the excessive cost of current would prohibit their use. The thing to do is not to ignore the lighting load but to increase its use. A difficulty in the way of doing this is that the lighting branch of the electrical industry cannot show its goods like hatters can for example. The hatter can produce the finished effect before the sale is completed; with lighting, wire, fittings, lamps and electricity have to be purchased before the effect can be determined. Illuminating engineers recognise there is a need for better

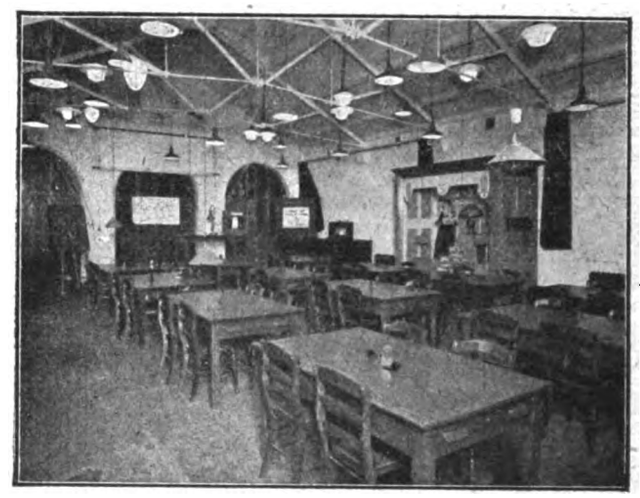

FIG. 2.—ANOTHER VIEW OF THE DEMONSTRATION ROOM SHOWING THE SHOP WINDOW EXHIBIT.

lighting conditions but the only way to obtain these is by demonstration. Hence the Lighting Service Department of the British Thomson-Houston Co. Or in other words, light must be sold and not fittings, reflectors and lamps.

We then proceeded to demonstration. A number of charts were shown, giving the results of investigations carried out by physicists, indicating that vision in all its aspects is considerably assisted by high intensity lighting. Figures were put forward showing the effect of lighting on the speed and accuracy of vision, and sustained vision. In all cases the result produced was entirely out of proportion to the increased illumination.

These facts were illustrated by an apparatus consisting of a cardboard cylinder revolving at constant speed. A number

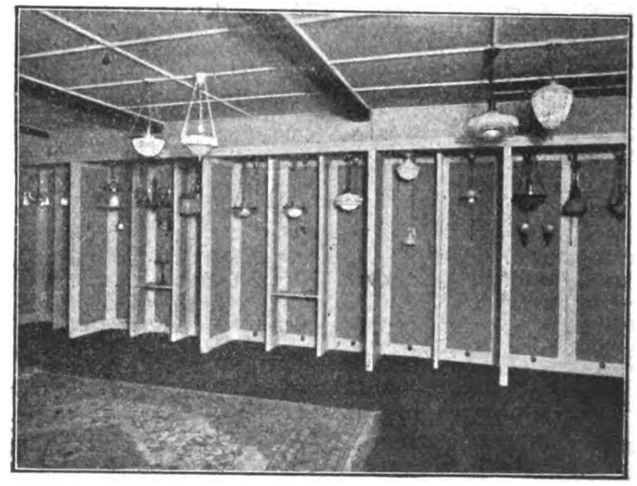

FIG. 3.—ROOM FOR THE EXHIBITION OF DOMESTIC LIGHTING APPARATUS.

of letters were printed upon this cylinder so that they could be followed with the eye as the cylinder rotated. Lamps of various candle powers were then switched on at intervals, producing the effect that the speed of the cylinder decreases as the illumination increases. This proved that the eye could see much more quickly under high intensities, as it could more easily appreciate the movement.

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Industrial Installations Compared.

As we have already mentioned, the room is equipped with a number of examples of illumination—good, bad and indifferent—for industrial uses. These were switched on, one after another, to show that high intensity lighting means not only greater comfort and safety, but increased production of the order of 10 to 25 per cent. As an observer, we agree we should not like to work at a moving machine in what we fear must be called a typically lighted factory. On the other hand, Mr. Bush's standard of 60 ft. candles is too high for us, though we understand that is a matter of education.

These demonstrations commenced with an installation of antiquated cord pendants with obsolete shades and assorted

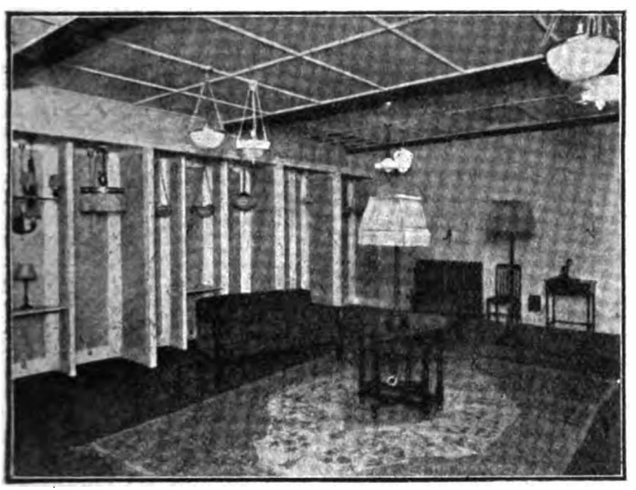


FIG. 4.—ANOTHER VIEW IN THE SAME ROOM.

lamps, giving a gloomy and depressing effect. Following this, the various steps that are necessary to build up a modern lighting system were shown in all its stages and culmination with an installation of the latest R.L.M. dome reflectors and bowl enamelled lamps. The combined unit gave perfectly even illumination with an absence of glare and harsh shadows. The quantitative value of the illumination thus provided was proved by readings on the foot-candle meter, which we have already mentioned. This is a handy little instrument that gives direct readings, and can be easily read even by the uninitiated.

Improved Domestic and Commercial Lighting.

Apart from the industrial demonstrations, general methods of improving domestic and commercial lighting were also indicated in one of the other rooms of the department. Later, other phases of illumination, such as street and sign lighting, will be dealt with in the same way as industrial lighting. Special apparatus is being installed for this purpose. Although certain equipment will be employed during these demonstrations, it may be emphasised that the sale of particular appliances is no part of the programme, the whole idea being to show in a general way the advantages of better lighting and the means whereby such results can be attained.

No Temporary Inspiration.

It should also be understood that the Lighting Service Department of the British-Thomson Houston Co. has not been merely set up as a temporary inspiration to the trade, or as an organisation for demonstrating effects. It is a permanent institution which will be constantly engaged in the investigation of lighting in all its aspects and applications. The general public will receive the benefit of the investigations carried out. The information being conveyed to them through the medium of handbooks, which will be written and distributed among the sections of the industries concerned with the specific subject dealt with.

Factory Lighting Designs.

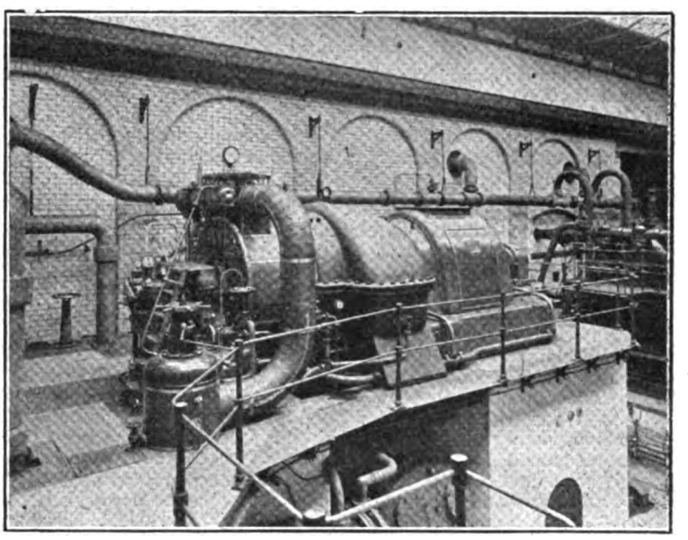
The first of these books has already been published. It is known as "Factory Lighting Designs." It deals, as the name implies, with designs of electric lighting for factories and workshops. From this book, given the quantity of illumination required for any industrial purpose, and the size and height of the shop, a design can be obtained to meet all requirements. Each design is illustrated to show the spacing of the units, and the candle power of the lamps used in the units and the resultant quantity of the available foot-candles on the work is given in tabular form. This booklet eliminates all tedious calculations, and it can be understood quite as easily by the consumer as the electrical contractor. A table at the end gives the amount of illumination necessary for almost any industry.

Co-operation Necessary.

Of course the department will prove of little value unless the trade generally will co-operate in the work which it is trying to carry out as we hope they will do. Mr. W. E. Bush, who is its controller, and his assistants, will be pleased to co-operate with all who are interested in this new movement for better lighting. If the movement is to be successful, it is necessary that it should have the assistance and co-operation of supply companies, contractors and manufacturers of lighting equipment. They can be of assistance to the Lighting Service Department by telling the story of its activities. The Department can be of service to them by providing them with the results of those activities.

Electricity Supply in Carlisle.

Electricity supply in Carlisle is going ahead under the management of Mr. C. W. Salt. Last year 5 886 680 kWh were sold, at an average price of 2·15d., while the coal costs stood at the low figure of 0·63d., with a total cost of 1·49d. This being so, it is not surprising to learn that it has recently been necessary to instal a new generator. This set we illustrate herewith. It is of the B.T.-H. type, with an output of 3 000 kW when running at 3 000 revs. per min. It was officially started on July 10th.



THE NEW B.T.-H. TURBO-ALTERNATOR AT CARLISLE.

But this is not enough for Carlisle. They have recently decided, with the approval of the Commissioners, to erect a new electricity works at a cost of £200 000, and so widen the margin which we understand at the moment is dangerously low. It may therefore be said that, as in many other places, electricity supply in Carlisle will play a great part in the development, health and happiness of the city.

British Association Programme.

Arrangements for the Liverpool Meeting.

Reference was made in a recent issue of THE ELECTRICIAN to the preliminary programme of the Liverpool meeting of the BRITISH ASSOCIATION to be held from September 12th to 19th, under the presidency of Sir Ernest Rutherford. From further particulars of the local arrangements given in "Nature," the inaugural meeting and Sir Ernest Rutherford's presidential address on "Electrical Structure of Matter" will be held in the Philharmonic Hall, which has a seating capacity of about 3 000.

On the last evening of the meeting a scientific soirée will be held at the University. This gathering, based on the lines of the Royal Society functions, will, it is believed, be of the greatest interest, as a very large number of exhibits and experiments illustrating recent developments in science will be on view. There will also be a series of lecturettes by eminent men of science. During the whole of the meeting, an exhibition of scientific apparatus, specimens, diagrams, etc., representative of the work of all the thirteen sections of the Association, will be on view in the Central Technical School.

RICHARDSONS, WESTGARTH AND CO., of Hartlepool, whose London agents are the British Central Electrical Co., Ltd., have secured a repeat order from the Central Electric Supply Co. for their electricity station at Grove Road for condensing plant for a 15 000 kW turbo-generator set.

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Parliamentary Intelligence.

London Suburban Tramway Services.

In reply to MR. EDE on July 18th, COL. ASHLEY said he understood that the question of running a through service of tramcars from London to Mitcham and Croydon by the Tooting Junction route was at present under discussion between the tramway authorities concerned.

All-British Cable Communication.

MR. HURD on July 19th asked the Under-Secretary of State for the Colonies whether the Government of Trinidad had accepted the proposals of the British Government regarding all-British cable communications; what was the attitude of the other West Indian islands; and what were the prospects of an early execution of the work?

MR. ORMSBY-GORE: The answer to the first part of the question is in the affirmative; the general attitude of the West Indian Governments concerned is favourable to the scheme, which has been put before them, and if the proposals commend themselves to the Canadian Government it is hoped that a beginning may be made with its execution during the autumn.

Pacific Cable Rates.

Sir T. BENNETT was on Monday informed by Sir L. WORTHINGTON-EVANS that the Pacific cable was fully occupied, and could not carry the additional traffic which would be attracted by a reduction of rates; and that in these circumstances the Pacific Cable Board considered it necessary in the first place to use the financial balances of the last few years in order to provide additional accommodation. He understood, further, that they proposed to consider the question of a reduction of rates as soon as there was accommodation for a substantial increase of traffic.

International Radio-Telegraphy Conference.

Replying to Mr. I. CROOKE on Monday, Sir L. WORTHINGTON-EVANS said that in view of proposals which had already been made by the French Government for the summoning of a general International Conference to cover the same ground, it was decided to postpone action until October in regard to a proposal of the Italian Government for an International Conference under the auspices of the League of Nations to consider the whole question of telegraphy and radio-telegraphy.

P.M.G. and Bradford's Electric Cables.

Mr. LEACH, on July 23rd, asked the Postmaster-General if his attention had been directed to the result of the test case between his Department and the Liverpool Corporation (House of Lords, June 22nd), in which it was held that Post Office wires laid in close contiguity to Corporation electric cables by his Department were so laid at his Department's risk in regard to possible damage; and whether a claim for damages under precisely similar circumstance against the Bradford Corporation of £59 9s. 3d., and paid by them under protest, would now be refunded?

Sir L. WORTHINGTON-EVANS: The answer to the first portion of the hon. member's question is in the affirmative; as regards the second part, a claim from the Bradford Corporation for refundment is receiving careful consideration, but my right hon. friend cannot admit that the circumstances of the two cases were similar.

Oil Engines and Electricity Generation.

Mr. BECKER, on Monday, asked the Under-Secretary of State for the Colonies if, seeing that the use by the Rutenberg Co. in Palestine of oil engines for producing the energy to develop electric current was a breach of their monopoly agreement, he would inquire into this matter, and, if necessary, cancel the concessions?

Mr. ORMSBY-GORE: I am not aware that any breach of agreement has taken place. I do not think it possible or necessary to take the action suggested in the last part of the question.

Private Bills.

In the House of Lords on July 18th a Royal Commission gave the Royal Assent to a number of Acts, including the BRADFORD CORPORATION (Trolley Vehicles) Order (1922) Confirmation Act, the OAKHAM Gas and Electricity Act, and the STALYBRIDGE, HYDE, MOSSLEY and DUKINFIELD Tramways and Electricity Board Act.

Subject to a decision on a minor point regarding finance, the Unopposed Bills Committee of the House of Commons, on July 18th, passed for third reading the bill promoted by the SHROPSHIRE, WORCESTERSHIRE AND STAFFORDSHIRE ELECTRIC POWER COMPANY. The principal object of the Bill is to construct certain internal works for the development of the undertaking, whose area of supply is practically the whole of the three counties. Under the Act of 1918, the company is constructing a generating station at Stourport, and the works include a short railway to connect with the Shropshire and Worcester Canal and a cable airway from the G.W. station to the generating station so that coal can be conveyed in either way.

TRADE FIRES.—The premises of EBONESTOS INSULATORS, LTD., Rollins Street, Deptford, were gutted by fire on July 19th. An outbreak of fire last Friday in the basement of the offices of the METROPOLITAN-VICKERS ELECTRICAL CO., Daimler House, Paradise Street, Birmingham, was subdued before much damage could be done. A number of packing cases in the basement were burned, and a certain amount of damage was caused to electrical equipment. Business is being continued without interruption.

The Post Office Estimates.

Intensive Development of Automatic Telephony.

Progressive development of automatic telephony was foreshadowed by Sir L. WORTHINGTON-EVANS in presenting the Post Office estimates to the House of Commons on Tuesday. Orders for two large exchanges for Central London were to be placed immediately, and in future all new exchanges required in the London area would be of the automatic type, it being hoped to place within the next three years orders for the equipment of about 85 000 lines. It was estimated that in London alone facilities for inter communication without the intervention of an operator would have to be provided ultimately for 1 000 000 subscribers, and an agreement had been reached with three of the leading telephone manufacturing companies whereby patents owned by them would be pooled for this purpose. He referred to the automatic exchanges recently opened at Fleetwood and Southampton and stated that a large number of similar schemes in other provincial towns were in progress.

Sir Laming said the net increase in telephone subscribers during the year was 51 000, the highest increase recorded in any one year. Of 390 new rural exchanges authorised 166 had been completed.

Anticipated Surplus on Telephones.

Reviewing the financial side, Sir Laming said the actual surplus was £5 511 000, as against an estimated £3 161 000. Dealing with the estimates for the coming year, he said there would probably be a drop in revenue of £2 000 000 through reductions in postal and telephone charges. A deficit of £1 350 000 was anticipated on telegraphs, and a net surplus of £4 750 000 on telephones. He mentioned that charges for interest and repayment of telephone capital were £610 000 more, as the result of large and continuing capital expenditure on the telephone system.

Empire Wireless Policy.

Dealing with the question of Empire wireless, Sir Laming said two applications had been received, one from the Marconi Co. for a general licence for the British Empire as well as foreign countries, and the other from the Eastern Telegraph Co. tor a licence to erect stations for a service between India and Great Britain. If the Government of India granted a licence for a station, the arrangements for the communicating station in Great Britain would be discussed with the company.

The Postmaster-General then outlined the proposed conditions of agreement with the Marconi Co., the effect of which was that the wireless telegraph services with the Empire were to be conducted through stations provided by the company and the Government respectively in agreed proportions, the company at the outset to provide two stations and the Government one, apart from the existing stations at Leafield and Carnarvon. The whole of the services were to be worked from the General Post Office by Government operators, and the Government would have power to admit other parties to the pooling arrangement, and the Government would also retain the right to license parties to conduct wireless services without admitting them to the pool.

Criticising "the grave reversal of policy" on wireless, Mr. HENRY NORMAN said that it had previously been decided that the Empire should have a State-owned wireless service, leaving the sphere of communication with foreign countries to private enterprise.

Replying to this and other points raised, Sir Laming said the Dominion Governments in Australia and South Africa had decided not to run their own wireless services, and when they changed their policy the British Government had to follow suit.

Organising Power Supply.

South-East Lancashire Board's First Meeting.

SIR JOHN SNELL presided at the first meeting of the South-east Lancashire Electricity Advisory Committee, held privately in Manchester on July 19th. After the meeting the Chairman was entertained to luncheon, Ald. DAGNALL, chairman of the Committee, presiding.

Work of the Commissioners.

Replying to the toast of the Electricity Commissioners, Sir John Snell expressed astonishment that an industry whose first law was passed so recently was in 1882, should be such a complex business as that of electricity supply was to-day. Dealing with the work of the Commissioners, Sir John said the Lancashire problem was fairly easy, but the problem which concerned North Wales was extremely complicated, and it alone had been exercising the almost constant attention of the Commissioners for two years. Altogether they had considered 1 500 separate applications for loans involving the expenditure of £40 000 000. He thought that, with the good-will of the undertakings' electrical engineers and administrators, the Commissioners would be able to bring about a revolution, or evolution, in the development of electricity supply in this country.

Proposing "The South-east Lancashire Electricity Advisory Board," Ald. T. E. HIGHAM said the district administered by the Board included one-tenth of the population and one-tenth of the rateable value of the United Kingdom, besides controlling one-tenth of the whole of the electrical plant in the kingdom.

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Municipal Electricity Accounts.

More Profitable Undertakings.

Further details are given below of the accounts of various municipal electricity undertakings for the year ended March 31st, 1922. In every case the undertaking more than paid its way, and in several cases large sums have been appropriated for rate relief.

Sheffield's Increased Working Efficiency.

With a profit of £173 915, the SHEFFIELD undertaking has allocated no less than £34 817 to the relief of rates, the remainder being split between the reserve fund, which gets £39 089, and the renewals and special expenditure fund, which receives £100 000. Consumers, however, have not been entirely forgotten, as charges were reduced during the year and further reductions operated from the March and June, 1923, readings. The average price was 1·47d. per kWh, which compares favourably with such cities as LEEDS and BIRMINGHAM, but is still above the averages for 1920 and 1919, which were 1·27d. and 0·99d. respectively. An interesting feature of the report is that although 123 000 000 kWh were sold, compared with 103 000 000 kWh in the previous year, coal consumption has been so reduced that the extra 20 000 000 kWh were generated with 349 tons less of coal; better quality coal has had something to do with this, but the chief cause would seem to be greater efficiency in working.

The year's working resulted in a surplus of £9 778 at GRIMSBY, the detailed figures showing an increase in the energy sold of slightly over 2 000 000 kWh with, on the whole, reduced costs. From the surplus, £5 219 is to be applied in liquidating expenditure on plant in excess of the loans taken for the purpose, £1 285 to capital account, and £3 274 to reserve. At CHESTER the net revenue account shows a net profit of £12 434, as compared with £803 last year, but owing to the method of arriving at the net cost of supplying the tramways and public lighting being one year after the actual expenditure in connection with such supplies, and owing to abnormal costs during 1921–22, the net profit is inflated to the extent of £2 944. The year's sales totalled 3 722 242 kWh, an increase of 182 682 kWh on the preceding year.

A Record Profit at Wolverhampton.

A record net profit of £34 042 is reported from WOLVERHAMPTON, but certain expenditure on items of a capital nature has been deducted, leaving a final surplus of £15 269. At a recent meeting of the Town Council an unsuccessful attempt was made to prevent the allocation of £10 000 from this sum towards the relief of the rates. It was pointed out that ratepayers had never contributed anything to the undertaking since its inception 27 years ago. The profits had been produced by the consumer, and the only claim the ratepayer might have on the profits was in the shape of a theoretical risk in case of losses on a year's trading; they might be considered as underwriters covering the risk, and a premium of £2 000 per annum would about cover it, although, from a sound business point of view, there was no risk at all for the ratepayers. The consumers had the real claim. The remainder of the surplus, £5 269, has been placed to reserve. Sales increased from 16 208 656 kWh to 26 940 142 kWh. The total net average price per kWh sold amounted to 1·514d. Two large reductions in the general percentage advances were made during the year, and a further reduction of 15 per cent. for all tariffs came into operation at the end of the March quarter.

Bradford's Contribution to the Rates.

BRADFORD, another prosperous undertaking, has to give £20 000 out of a surplus of £34 000 to rate relief. Income totalled £472 000, against £444 000, the increased revenue being derived from all classes of consumers with the exception of bulk supply users. A decrease of £60 000 has been effected in the expenditure, and the quantity of energy sold has increased from 53 250 000 kWh to 65 500 000 kWh. PORTSMOUTH, too, out of a profit of £23 973, has had to hand over £10 000 for rate relief, the remaining £13 973 going to reserve. Here, as at WOLVERHAMPTON, the view was unsuccessfully put forward that the consumer should have the benefit of the profit in reduced charges. A portion of the current year's estimated profit will go to consumers as from the September quarter readings, the maximum charge for ordinary lighting will be reduced to 5½d. per kWh, while for power the new charge will be 1½d. per kWh. For slot meter consumers the rate is reduced from 7½d. to 6d. per kWh.

Progress at Bolton and Oldham.

With a gross profit of £141 494, as compared with £103 070 for 1922, the BOLTON undertaking is able to show a disposable surplus of £20 403, which compares favourably with the £17 501 available last year. Equally satisfactory is the result of the year's working at OLDHAM, where a record profit of £23 148 was made, in spite of reduced charges to consumers. While distribution costs were increased by £4 000, due mainly to cable replacements, the cost of production was less than last year. Some idea of the growth of this undertaking is apparent from a comparison of the 1910 production with that of 1923, the respective figures being 6 000 000 kWh and 30 000 000 kWh sold.

Increased profits at LEEDS left a surplus of £37 698, as compared with a surplus of £26 891 secured during the previous year. The rapidly growing use of electricity for lighting in the district is evidenced by the reported increase of 20 per cent. in the number of consumers, while the sale of electricity for heating purposes also shows a satisfactory increase; a feature which is becoming prominent is the supply of electricity in bulk to other undertakings for re-sale.

Legal Intelligence.

B.T.-H. Electric Lamp Patent.

Company's Action for Infringement in Scottish Courts.

In the Scottish Courts on July 19th Lord BLACKBURN gave judgment in an action of interdict at the instance of the British Thomson-Houston Co. against Charlesworth Peebles and Co., electrical engineers, Glasgow, and for £10 000 as damages for the infringement by the defenders of a patent dated 1909 of which the pursuers are the grantees. The infringement on which the pursuers found is the importation and sale by the defenders of incandescent lamps containing a filament of tungsten made in the manner described in the patent.

Lord Blackburn sustained the validity of the patent, granted interdict and expenses, and, *quoad ultra*, continued the cause for proof on the question of damages, and granted leave to reclaim.

His Lordship, in giving judgment, examined at some length the claims made in the patent and described the method of manufacturing tungsten filaments. The defenders' case, as presented, resolved itself into a challenge of the validity of the patent, on the grounds of anticipation, want of subject matter, and insufficiency of description, and a denial that infringement had been proved. The conclusion he had come to was that the pursuers had succeeded in establishing the validity of the patent so far as related to Claims 1 to 4 which they made. With regard to Claim 5, which was for apparatus, had it not been qualified by the words "for manufacturing wires or filaments of tungsten ductile at ordinary temperature," he did not think he could have sustained it. But qualified and restricted as it was, it appeared to him to be unobjectionable. There remained only the question of infringement. It was maintained that the pursuers had failed to prove that the filaments complained of had been constructed in accordance with the directions in the patent. The evidence for the pursuers was confined to this, that they had proved that the filaments in the lamps sold by the defenders were fibrous, and they maintained that there was no other known process by which such a product could be obtained than that set out in their patent. The pursuers' evidence was certainly not more than sufficient to establish a prima facie case of infringement, and, had the lamps been manufactured in this country, that would not have been sufficient to entitle them to decree. But the lamps here complained of were manufactured abroad, and accordingly this prima facie evidence of infringement was sufficient to throw the onus on the defenders of proving that they were not manufactured in accordance with the process described in the patent. In his Lordship's opinion, the defenders had failed to discharge that onus.

Dispute Over Wireless.

Liverpool Firm's Successful Claim for Apparatus.

At Liverpool County Court on Monday, Judge DOWDALL gave judgment for £74 8s. 11d., with costs, in favour of B.N.B. Wireless, Ltd., Renshaw Street, Liverpool, who sued Dr. A. Dinsley, consulting chemist, Great Crosby, in respect of wireless apparatus supplied.

Counsel for the plaintiffs said the defendant admitted having received the goods, but had counter-claimed for services alleged to have been rendered to the plaintiffs. The defendant stated he had allowed the plaintiffs to use his transmission station as the research and testing department of their business, had tested their apparatus from time to time, and gave them expert advice. For such services he claimed £100, or as much as equalled the amount to which the plaintiffs were entitled on their claim.

His honour, in giving judgment, said that anything that the defendant had done for the plaintiffs had not been done with the idea that it would be paid for, except that it might be to his advantage when, if ever, he became a member of the company.

Sequel to Tramcar Collision.

Verdict for Huddersfield Corporation Tramways.

At Leeds Town Hall on Monday, before the Lord Chief Justice, Messrs. Wrigley and Tinker sought to recover damages for injury to a motor car sustained in a collision alleged to be due to the negligence of a tram driver in the employ of the defendants, the Corporation of Huddersfield.

The plaintiff alleged that the tramcar ran into the motor, and the defence was that the motor turned sharply in front of the tramcar, and so made the accident inevitable.

His lordship found for the defendants, with costs.

London Electric Railways.

Southern Co. Withdraws Opposition.

The Unopposed Bills Committee of the House of Lords on Tuesday considered the LONDON ELECTRIC RAILWAY BILL and passed it for third reading subject to any amendments that might be necessary as a result of the further consideration of the City and South London Bill in Committee on Wednesday. In regard to the latter Bill, a compromise was reached on Wednesday, when Mr. Macmillan, for the Southern Railway, said a tentative agreement had been reached whereby the promoters would carry out their extension through Balham and Tooting to Merton, and would cut out all references in the Bill to the Wimbledon and Sutton Railway.

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Electricity Supply.

Extensions and Developments.

SOUTHEND Town Council is laying additional mains at an estimated cost of £99.

SOUTHWARK GUARDIANS are to instal electric light in their Newington Institution.

PLYMOUTH Electricity Committee has approved cable extensions estimated to cost £2 090.

MANSFIELD Town Council has received sanction to a loan of £3 000 for electricity meters.

Electricity will be supplied to MENAI BRIDGE from the North Wales Power Co.'s station near Capel Curig.

FAVERSHAM Town Council has received sanction to borrow £399 for the purpose of the electricity undertaking.

NEWRY Urban Council has temporarily deferred the question of proceeding with a municipal electricity scheme.

To popularise the use of electricity WEST BROMWICH Electricity Committee proposes to spend part of its profit of £10 054 on propaganda.

CREWE Town Council has received sanction to a loan of £1 000 for the erection of an overhead cable from Sydney to Maw Green, and Bradfield Road.

WHITBY Urban Council has applied to the Electricity Commissioners for a loan of £100 for the purchase of electric cookers to be let out on hire.

LOWESTOFT Electricity Committee is applying to the Commissioners for consent to an extension of the generating station by the installation of one 300 kW set.

Sanction has been received by LEEDS Electricity Committee to borrow £175 000 for the extension of the Whitehall Road plant, and £40 000 for service cables.

HOYLAKE and WEST KIRBY Council is applying for permission to borrow £1 164 for an economiser, etc. Borrowing powers are also being sought for £2 000 for mains and services.

BRADFORD Electricity undertaking is to spend £34 000 on converting plant, feeder cables, etc. It has been decided to order a large turbo-generator set for the Valley Road Works.

ROTHESAY Town Council is making application to the Commissioners for sanction to borrow £4 000 for street lighting, £7 000 for private lighting and power, and, later on, £20 000 for the erection of a new generating station.

On the recommendation of the Electricity Committee, TRURO Town Council has adopted a scheme under which the Cornwall Electric Power Co. will supply electricity at 10d. per kWh for lighting and 5d. per kWh for power.

DARTFORD Electricity Committee is seeking sanction for a loan of £13 150 for the purchase of a 1 600 kW turbo alternator and necessary auxiliaries. Permission to borrow £3 750 for cable and switchgear is also to be sought.

PRESTON Electricity Committee recommends the approval of revised estimates for the erection and equipment of the Ribble power station to £409 510, and for transmission lines, sub-stations, mains, etc., to £74 826. Also that a site for a sub-station be purchased for £79.

Alterations in Charges, Proposed and Actual.

Conferences have been held between representatives of the BACUP and RAWTENSTALL Corporations regarding the terms for a supply of electricity to the former authority. Subject to acceptance by the Bacup Corporation, the charges for current for power purposes will be 1d. per kWh for the first 10 000 kWh per month, 0·95d. for the next 10 000 kWh, 0·9d. up to 50 000 kWh, and 0·85d. for the next 50 000 kWh, with all additional at 0·8d. per kWh. The scale of charges for lighting, heating, cooing and power purposes to consumers in Bacup will also be brought to the level of those obtaining in Rawtenstall as from April 1st. The proposed new scale will operate until June 30th next year.

Tapping New Areas.

ROMSEY Town Council is considering the question of obtaining a supply of electricity for the borough.

TRING Urban Council is considering an offer by the Aylesbury Town Council to supply electricity to Tring.

RUGELEY Urban Council has received a scheme from Mr. A. V. Fleming for the formation of a company to supply the town with electricity.

FEATHERSTONE Urban Council has sealed an agreement with the Electrical Distribution Co. of Yorkshire for the supply of electricity for public lighting.

Terms have now been arranged between the KEIGHLEY Electricity Committee and the Yorkshire Electric Power Co. for a supply of electricity to SKIPTON.

WESTBURY-ON-SEVERN Urban Council has approved the application of the West Gloucester Power Co for a special Order to enable it to supply electricity within the Council's area.

At a meeting of the NANTWICH Rural Council it was stated that if Crewe got a fringe order it would supply the townships of Copperhall, Shavington, Haslington and Willaston, and possibly Nantwich.

Inquiries and Orders.

FAVERSHAM Town Council has received an Order from the Ministry of Transport authorising a maximum price of 10d. per kWh.

BEDFORD Rural Council has decided to object to the application for Orders to supply electricity to parishes in the Council's area by Bedford Corporation and the Rushden and District Electric Supply Co.

ABERTILLERY Urban Council has applied to the Ministry of Transport for an Order to continue the charge of 9d. per kWh, with minimum payments of 11s. 3d. for each winter quarter, and 7s. 6d. for each summer quarter.

SOUTH MOLTON Corporation has applied to the Commissioners for a Special Order to supply electricity in the borough of South Molton.

DOVER Rural Council has decided to object to the application of Sir C. Bright and Partners for an Order to supply electricity to parishes in the district, including Ringwould and St. Margaret's. The latter parish already has a supply from Dover.

Tiverton Corporation has applied to the Electricity Commissioners for a Special Order authorising the generation and supply of electricity in the borough of TIVERTON. Objections to the Secretary, Electricity Commission, Whitehall, London, by September 14th.

Personal Items.

Mr. W. H. ONKEN, jun., editor of the "Electrical World," is paying a three months' visit to Europe.

Weymouth Town Council has increased the salary of the electrical engineer, Mr. G. NICHOLSON, from £500 to £600 per annum.

The salary of MR. P. G. CAMPLING, general manager of the Yarmouth Corporation Tramways, has been increased by £100.

Carlisle City Council has been recommended to increase the salary of the electrical engineer, Mr. C. W. SALT, from £930 to £1 000.

Mr. HENRY G. SMALL, sales engineer to the Electric Equipment Manufacturers, Pty., of South Melbourne, has commenced business on his own account at 60, Queen Street, Melbourne, under the style of Henry G. Small and Co.

Mr. SYDNEY EVERSHED has accepted the chairmanship of Evershed and Vignoles, Ltd., and he will in addition act as consultant to the company. Mr. E. B. VIGNOLES and Mr. A. VINES remain managing directors of the company.

WILL.—Mr. FREDERICK WILLIAM HARMER, formerly chairman and managing director of the Norwich Electricity Co., left (net personalty £93 394) £103 301.

OBITUARY.—We regret to announce the death in a London nursing home on Sunday last of Mr. REGINALD LAURENCE, aged 66 years, who was for 35 years chairman of Laurence, Scott and Co., Ltd., dynamo and motor manufacturers, Gothic Works, Norwich. Mr. Laurence took a great interest in public affairs and was High Sheriff of Norfolk in 1921. He is survived by his widow.

Business Items.

RICHSON AND CO. have opened new showrooms at 113, Oxford Street, London, W.1, where a wide selection of electric light fittings is on view.

MR. WILLIAM NICKSON, jun., is continuing the business of his father, the late Mr. William Nickson, electrical engineer, of 54, Everton Road, Birkdale (Lancs).

FRANCIS POLDEN AND CO., electrical and mechanical engineers and contractors, 56, Cannon Street, London, E.C.4, have acquired additional premises at that address for the display of electrical fittings, plant and accessories.

MR. A. W. MILLER, electrical engineer, of 39A, Queen Street, Aberystwyth, has taken over the electrical fittings and accessories stock of the Chiswick Electricity Supply Corporation, which has given up this branch of its business.

Institution Notes.

From August 1st the address of the INSTITUTION OF AUTOMOBILE ENGINEERS will be Watergate House, York Buildings, Adelphi, London, W.C.2.

Members of the West Midland District of the INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS visited Sutton Coldfield last Saturday, when the electricity works were inspected. Mr. T. BLOORE, the borough electrical engineer, read a paper giving the history and development of the local electricity undertaking.

It was mentioned at the annual meeting of the INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS that there was a net increase of 248 members during the year, and that it had been decided to reduce the subscriptions of all grades of membership. Mr. E. H. Shaughnessy was elected treasurer and Mr. R. V. Hansford has taken over the duties of secretary consequent on the resignation, after twelve years' service in that capacity, of Mr. T. Smerdon.

TOUCHING A LIVE WIRE at the Plymouth Corporation Electricity Works, JAMES HOSKINS, an employee, was instantly killed. A similar fate would, according to Reuter, have been shared by a workman at a railway station in Norway but for the fact that a short circuit had been caused some miles away by a crow pecking at the insulation.

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Electric Traction.

Tramway Extensions and Developments.

BIRKENHEAD Tramways Committee proposes to relay portions of its tramway track.

The reconstructed sleeper tramway track between Oakwood and Roundhay, LEEDS, was opened last Friday.

SOUTHPORT Tramways Committee recommends an extension of the track linking up Eastbourne Road terminus with Liverpool Road.

The question of linking up the London County Council tramways at Tooting Junction with the CROYDON tramways is under consideration, Col. Ashley stated in Parliament last week.

WANDSWORTH Council is opposing a proposal of the London County Council to seek powers to construct tramways from Wandsworth or Putney to Roehampton.

MANCHESTER Corporation Tramways are to construct a new line along Monton Street between Moss Lane East and Great Western Street. A siding is also to be laid in Platt Lane to accommodate about 40 cars.

Fares, Receipts and Passengers.

HALIFAX Tramways Committee has decided not to make the experiment of issuing tokens at the price of twelve for 10d.

DERBY tramway receipts for the week ended July 14th, were £2 389, an advance of £284 over the corresponding week of last year.

ASHTON-UNDER-LYNE Corporation Tramways Department has decided to increase the 1½d. fares to 2d., but books of tickets at eight for 1s. are to be introduced.

Receipts on tramways controlled by the "Underground" group for the week ended July 14th totalled £44 584, a decrease of £1 451 on the corresponding week last year.

Traffic receipts on the MADRAS electric tramways during the fortnight ended July 15th amounted to Rs.56 964, an increase of 11·9 per cent. over the corresponding period last year.

Electric Railway Items.

The formal opening of the first electrified portion of the AUSTRIAN STATE RAILWAYS between Innsbrück and Telfs, a distance of 17 miles, took place on Sunday.

For the week ended July 14th the traffic receipts of the MERSEY RAILWAY amounted to £4 227, bringing the total for the first 28 weeks of the year up to £127 394.

South-Eastern Electrification.

Orders placed for Motors and Control Gear.

The board of the South-Eastern and Chatham Construction and Power Co. has intimated to The English Electric Co. and the Metropolitan-Vickers Electrical Co. that their two tenders for motors and control gear respectively have been accepted.

These equipments are required for the electrification of the first section of the South-Eastern and Chatham division of the Southern Railway, and will cover the conversion to electrical operation of the suburban services within a 15-mile radius of Charing Cross. The equipments consist of no fewer than 508 traction motors each of 300 H.P. with the appropriate controlling apparatus.

The two contracts are possibly the largest for multiple unit equipments for main line railway electrification which have ever been placed. The work, which will give employment to many thousands of people, spread over a period of nearly two years, forms part of an expenditure of £5 500 000, which was the subject of a guarantee under the Trade Facilities Act.

Southern Railway.

The London Electric Supply Corporation gives notice of an application for a special order authorising it to supply electricity at a point within the company's area to be used for purposes incidental to the working or lighting of the systems of the Southern Railway in London, Surrey, Kent, Middlesex, West Sussex, etc.

Wireless News.

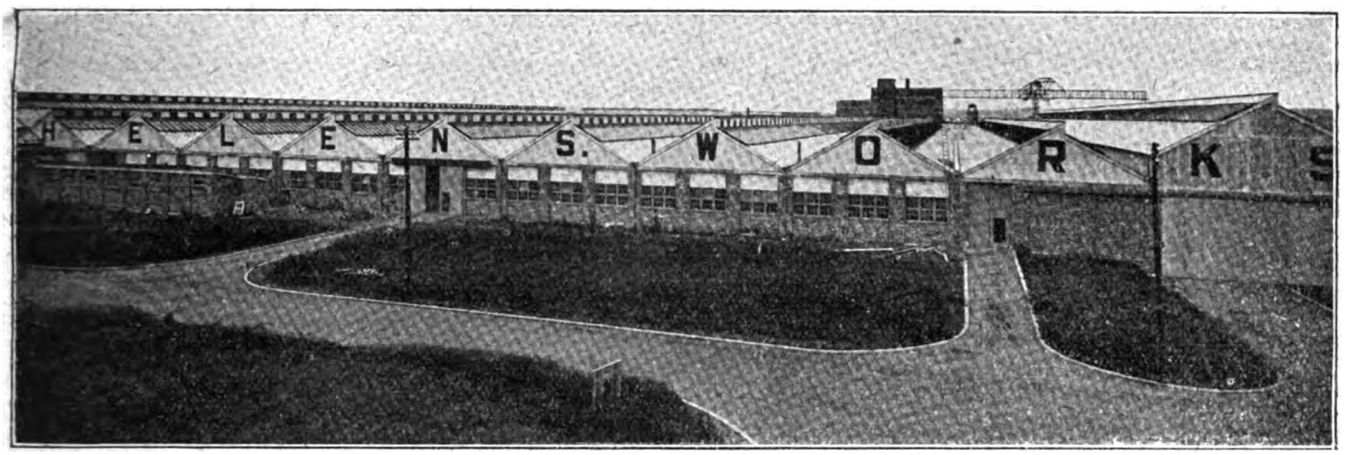
Cheap Wireless Rates Promised.

On Monday the Postmaster-General informed a deputation from the Empire Press Union that he hoped an agreement with the Marconi Co. for an Imperial wireless telegraphy service would be concluded and signed within a month. The Government expected to have the high-power station at Rugby erected a little over twelve months hence. This would enable an Imperial wireless service to be carried out in conjunction with the Marconi Co.

The Postmaster-General added that CHARGES FOR WIRELESS MESSAGES would be lower than the cable rates. He agreed that it was most essential to secure a cheaper news service throughout the Empire. The basis of the licence to the Marconi Co. was that there should be a joining of private enterprise with such a minimum of control as was necessary by the Government Department.

Broadcasting Co.'s New Stations.

Lord GAINFORD announced at a luncheon last week that the Broadcasting Company would, within a few weeks, complete the eight stations which they had arranged to construct. With the completion of the eight stations 31 700 000 people would be brought within a thirty-miles receiving radius. Subject to permission from the Post Office, they intended TO CONSTRUCT A NUMBER OF RELAY STATIONS in certain areas where industrial populations, by distance or through "screening," were not receiving the results of the existing transmitting stations. If they were able to construct eleven relay stations, they would be in a position to secure the broadcast programmes for 75 per cent. of the total population of Great Britain.



A PORTION OF THE WORKS AT SLOUGH TO WHICH THE ST. HELENS CABLE AND RUBBER CO. HAVE REMOVED THIS WEEK.

The Broadcasting Committee's Report.

In the House of Commons, on Tuesday, Sir L. WORTHINGTON-EVANS said he could make no statement of policy until he received the report of the Broadcasting Committee; this was expected to be ready at any moment. The total number of licences issued was 165 012, of which 52 264 were experimental receiving licences, 111 905 were broadcast receiving licences, the remaining 843 being transmitting licences.

It is rumoured that the Committee does not favour the proposal to grant new 10s. licences to owners of home-made receiving sets. It is expected, however, that the Committee will be able to make a unanimous report, in spite of recent differences of opinion.

[Other wireless news in Parliament is in page 100.]

Wireless News in Brief.

The BRITISH BROADCASTING CO. announces that its Aberdeen broadcasting station will be opened in August.

According to an "African World" cable, the CAPE TOWN Fire Brigade has installed wireless apparatus on its engines.

Bermondsey Guardians have decided TO INSTALL A WIRELESS RECEIVING SET at the Ladywell Institution at a cost of £54.

New Cable and Rubber Works.

Warrington Firm Moves to Slough.

During the week there has been more than usual activity at Warrington and at Slough, owing to the transference of the works of the ST. HELENS CABLE AND RUBBER CO. from the former to the last-named place. The staff has been transferred, and although the whole of the plant has not yet been removed, the company has a sufficient quantity of new plant put down at Slough, in addition to a certain amount removed from Warrington, to enable it to commence manufacturing in the new works early in August. The plant remaining at Warrington will gradually shut down and be removed to Slough as opportunity offers, and the company is taking every precaution to prevent difficulties arising in regard to delay in the delivery of orders. From to-morrow (Saturday) all communications should be addressed to the Slough Works, which are illustrated above. The new telephone number is Slough 333 (3 lines), and the telegraphic address, "St. Helens, Slough."

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Tenders Invited and Accepted.

GREAT BRITAIN.

COLCHESTER GUARDIANS.—Electric light wiring and fitting of the master's quarters and the casual ward at the Institution. Particulars from the Clerk.

KILMARNOCK TOWN COUNCIL.—Electric light wiring and fitting of 30 houses. Particulars from Mr. T. C. Stewart, surveyor, 61, Portland Street.

SOUTHEND-ON-SEA TOWN COUNCIL, July 30th.—Electric light wiring and fitting of the Leigh Council offices. Particulars from the Borough Engineer, Mr. R. H. Dyer.

GRAYS URBAN DISTRICT COUNCIL, July 31st.—Two 350 kW converting plants, two 400 kVA static transformers, and switchgear. Specifications from the Engineer, Electricity Works, Maidstone Road, Grays.

LEEDS CORPORATION, July 31st.—Steam turbine, three-phase alternator and exciter (about 10 000 kW capacity) running at a speed not exceeding 3 000 revs. per min., and auxiliaries for surface condensing plant. Specifications from the Manager, Electricity Department, 1, Whitehall Road, Leeds.

BRISTOL CORPORATION, August 1st.—Self-cleaning water screening plant for Feeder Road generating station. Specification, etc., from Mr. H. Faraday Proctor, Electricity Department, The Exchange, Bristol.

STOCKTON-ON-TEES CORPORATION, August 4th.—Purchase of two triple-expansion d.c. 500 V generating sets, 300 and 400 kW, and one 500 kW d.c., 500 V turbo-generator, with condenser and pipes, etc. Particulars from Mr. S. G. Marston, Corporation Electricity Works, Stockton-on-Tees.

BIRTLEY PARISH COUNCIL, August 9th.—Electric lighting of streets. Specification from Mr. R. Hobson, clerk to the Council.

WARRINGTON TOWN COUNCIL, August 11th.—Three electrically-driven centrifugal pumps. Particulars from the waterworks engineer, Mr. James Gray.

BASFORD GUARDIANS, August 13th.—Electric light, wiring and fitting of the Institution at Bulwell. Specifications from Mr. W. C. C Hawtayne, 9, Queen Street Place, London, E.C.4.

LONDON COUNTY COUNCIL, August 13th.—Pipework and de-aerating plant for the Greenwich power station. Specification from the General Manager, London County Council Tramways, Victoria Embankment. London, W.C.2.

LEEDS CITY COUNCIL, September 3rd.—Three-phase switchgear. Specifications, etc., from Mr. C. Nelson Hefford, manager of the Electricity Department, 1, Whitehall Road, Leeds.

AUSTRALASIA.

SYDNEY, August 16th.—Submarine telephone and telegraph cable (Stores schedule N.S.W., No. 23) for Postmaster-General's Department.*

VICTORIAN ELECTRICITY COMMISSION, October 6th.—22 000 V insulators. Specification (No. 23/117) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

SOUTH AFRICA.

JOHANNESBURG COUNCIL, August 8th.—Field coils for traction motors.*

HASTINGS CORPORATION has accepted the tender of the Brush Electrical Engineering Co. for two Brush-Ljungstrom turbo sets.

SLAITHWAITE URBAN COUNCIL has accepted the tender of T. W. Broadbent, Ltd., for an electrical installation at the Town Hall.

The tender of the Hamworthy Engineering Co. for an electrical installation at the Corfe Mullen pumping station, at £655 10s., has been accepted by POOLE CORPORATION.

SOUTHEND CORPORATION is recommended to accept the offers of Electricars, Ltd., for an electric tower wagon, at £995, and Edison Accumulators, Ltd., for a battery at £600.

The tender of the Brush Electrical Engineering Co. for a 1 600 kW two-phase 50-cycle turbo-alternator and auxiliaries, at £13 150, has been accepted by DARTFORD URBAN DISTRICT COUNCIL.

The tenders of the Peel-Conner Telephone Works for telephone instruments, £330 12s. 6d., and the Pulsometer Engineering Co. for electric pumping plant for the Ferens boating lake extension, £334, have been accepted by HULL CORPORATION.

LONDON COUNTY COUNCIL has accepted the following tenders :—Rail Welding Co. for two electrically driven grinding machines, £576·12s. ; Equipment and Engineering Co. (lowest tender received) for two electric welding equipments, £560 18s. 4d. (eight tenders received, the highest being £810 18s.) ; Rail Welding Co. (lowest tender) for electrically welding 700 rail joints in tramway track in Whipp's Cross Road and Leytonstone High Road at 12s. 6d. per joint. Three other tenders were received, the highest being £1 8s. per joint, for the Thermit process.

The following tenders have been accepted by HALIFAX CORPORATION in connection with the electrification of the condensing plant for No. 1 6,000 kW turbo-alternator at the electricity works ; Worthington-Simpson, Ltd., circulating pump, valves and pipework, £1 031 ; Hick, Hargreaves and Co., ejector plant, £540 ; J. H. Holmes and Co., 230 H.P., 60 H.P. and 8 H.P. motors, including bedplate, £729 5s. 6d. ; Hackbridge Electric Construction Co., 250 kVA 3-phase transformer, £285.

* Particulars from the Department of Overseas Trade.

London's Electricity Supply.

Proposed Joint Authority and Power Combine.

At the LONDON COUNTY COUNCIL meeting on Tuesday, the report of a special committee recommending the establishment of a Joint Electricity Authority for the Greater London area was adjourned for a week.

The committee's recommendations include the establishment of a Joint Electricity Authority and, provided, that a satisfactory sliding scale of prices and dividends can be agreed, the London companies will be empowered to amalgamate, and to have an extension of tenure to 1971. The undertakings would then be transferred to the Joint Electricity Authority on the following terms :—(*a*) Assets in use when the Joint Electricity Authority is constituted to be transferred free of cost to the Joint Electricity Authority. (*b*) Assets subsequently provided by the companies to be transferred on payment of capital expenditure less depreciation (to be provided by sinking fund).

Companies would have financial and administrative independence subject only to the control of the Joint Electricity Authority in regard to technical development (in accordance with the agreed scheme) ; the disposal of surplus energy over and above that required for the united needs of the companies concerned ; capital expenditure by the companies which will ultimately be repayable by the Joint Electricity Authority (i.e., expenditure not entirely covered by sinking fund before 1971) ; and maintenance of the assets to be transferred ultimately to the Joint Authority. The companies would have a right of appeal to the Commissioners in regard to matters arising under any of the foregoing heads.

Companies' Representation on Joint Authority.

It is also recommended that the London companies should provide sinking funds to liquidate by 1971 the value of the physical assets in use at the date when the Joint Authority is constituted, as determined on the basis of capital properly expended by the individual companies less depreciation ; and to provide for the depreciation of assets representing future expenditure. The committee points out that in view of the large measure of autonomy to be given the London companies, their representation on the Authority should be very small.

The report recommends that the Special Committee on London Electricity Supply be authorised to confer with the Electricity Commissioners, the London electricity supply companies and the Conference of Local Authorities owning electricity undertakings in Greater London, with a view to the formulation of a scheme providing for the establishment of the Joint Electricity Authority.

It is added that the question of the position of the Barking supply in relation to any settlement that might be come to was mentioned at a discussion with the companies' representatives. Failing any agreement with the companies, the right of a Joint Electricity Authority in whatever form it may be set up to purchase the Barking station under the terms of the County of London Company's Act, 1921, will remain.

Forty Years Ago.

"The Electrician," July 28th, 1883.

EXETER.—A committee of the Town Council has been formed to report on the best means to be adopted for lighting by electricity the new lunatic asylum.

* * *

YORK.—It is said that the exhibition at York, held during the Royal Agricultural Show week, owes much of its success to the electric light. This work was carried out by Messrs. Crompton & Co.

* * *

ELECTRIC LIGHT AT THE HOUSE OF COMMONS.—The experimental lighting of the dining room and library of the House of Commons by electricity has, it is said, been so successful that the system is to be adopted for a permanency.

* * *

THE COMMITTEE ON THE PROVISIONAL ORDERS.—The evidence taken before this committee is lengthy and interesting, but we are compelled to leave the consideration of it for another issue, preferring to deal with it as a whole rather than in parts.

* * *

"GORDON'S PHYSICAL TREATISE ON ELECTRICITY."—We understand that the new edition of this work will be ready next month. The work has been revised throughout and considerably enlarged by the addition of new matter and illustrations. Full accounts will be found in it of the experiments of Bjerkness, Stroh, and Tribe. The publishers are Messrs. Sampson Low & Co.

* * *

TELEPHONY AND MORALITY.—A curious case has recently come before the American Courts. A telephone company stopped communication with a subscriber because the language used mainly consisted of expletives, and was unfitted to reach the ears of many who might accidentally overhear it, such as the young women employed in the exchanges. The company was upheld by the Court.

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Company Meetings.

Eastern Telegraph Co.

Increased Capacity of the System.

Presiding at the ninety-second ordinary general meeting of the Eastern Telegraph Co., Ltd., held on Tuesday, at Electra House, Moorgate, London, E.C., Sir JOHN DENISON-PENDER (the chairman) said the gross revenue for the year amounted to £3 489 071, against for the preceding year £4 124 976, or a decrease of £635 905. The receipts from messages showed a reduction of about £611 000 when compared with the preceding year, which might be attributed solely to the reduced traffic transmitted consequent upon the depression in trade which prevailed generally during the past year. Interest and dividends on the investments produced about £25 000 less in 1922 owing to the realisation of some securities, the cash being required for the payment of instalments on new cables. As a partial set-off against the reduced revenue he was able to record a reduction in working expenses of £244 000, and, after making provision for taxation, interest on loan and on debenture stock, and for the dividend on the 3½ per cent. preference stock, they had an available balance of £847 249. Not only had they been able again to maintain the dividend raised to 10 per cent. on the ordinary stock, but they had been able to place £400 000 to the credit of the general reserve fund, and to carry forward a balance of £515 257.

Successful Financial Policy.

It could not too often be emphasised that the success of this and its associated companies in the past had been largely due to the policy of building up the reserve funds, thus enabling them to lay additional cables as and when considered expedient. Since the Armistice this company had, in conjunction with the Eastern Extension Co., laid an entirely new cable of large capacity to the Far East, in addition to which they had carried out extensive renewals to many of the main line sections.

The company's expenses this year had exceeded the normal annual ratio of increases over pre-war days by no less than a sum £1 000 000, apart altogether from taxation. It was on these grounds that the necessity for economy became imperative. Out of every £100 received to-day their expenses were approaching £17 more than they were in 1913.

The falling-off in income, due to trade depression, was reflected pretty generally in all countries served by these companies, and while the reduction in the number of messages was not so marked, the messages themselves on the average were shorter.

Current Year's Prospects.

In the current year there had been no improvement in trade as shown by the traffics up to the present, but better trade returns could not be anticipated until the present chaotic condition of European affairs resumed a more normal aspect. It was, however, to be hoped that the economies which were being effected would in a measure meet the considerable decrease in income they must anticipate this year.

Owing to the excellent margin of capacity for traffic which they now had in the Mediterranean, they were shortly reducing the number of ships in those waters, by not replacing at present those they were putting out of commission owing to their age, with a consequent reduction in working expenses.

Cable Renewals and Pre-War Rates.

Continuing, Sir John said they had strengthened their system during the year at a cost of over £1 000 000 by completing the laying of a new line between Malta and Colombo, connecting them with the extensions made by other associated companies. The length of cable expended during the year for new cables and renewal of old ones reached the very large figure of about 4 500 miles. This increase in capacity would accelerate the dispatch of messages. All this expenditure had been made without any increase in rates. There had been a marked improvement in the transmission times, and when further instrument adjustments on these cables were effected, it was anticipated that the company's times in transmission would be even better than those before the war. The installation of new and improved apparatus was being developed rapidly.

With regard to recent suggestions for a readjustment of capital, the directors felt it was inadvisable to recommend or make alterations.

Cable and Wireless Communication.

Sir John said in regard to wireless that he did not state at a recent meeting that wireless was pushing the cable companies hard. He had never predicted what wireless was going to do, but it was significant in this connection that Italy, the home of wireless telegraphy, was at the moment floating a company with a capital of the equivalent of £2 000 000 for the purpose of laying cables between Italy and North and Italy and South America. After dealing with American and German cable developments, Sir John said he did not think the Governments concerned would consent to the risking of vast sums of capital in cable enterprise unless they were confident that cable systems of communication all over the civilised world must continue. At the same time the board held the opinion that they should be associated with all classes of telegraphic communication, and with this object they were associated with applications for wireless licences for full-powered stations in Great Britain, India, and China.

The Chairman then referred to changes in the directorate involving the appointment of Mr. J. C. Denison-Pender as joint managing director, and of Mr. A. K. Hardie as a member of the board. He then moved :—" That the printed report and accounts of the directors for the year ended December 31st, 1922, submitted to this meeting, be and the same are hereby received and adopted. That the dividend of 3½ per cent., less income-tax, paid in respect of the preference stock of the company, and the dividend of 10 per cent., free of income-tax, paid in respect of the ordinary stock of the company for the year ended December 31st, 1922, be approved."

The resolution was carried unanimously as were resolutions altering the remuneration of directors, and re-electing the retiring directors and the auditors.

The proceedings terminated after a vote of thanks to the chairman, directors and staff, which the chairman briefly acknowledged.

Eastern Extension Australasia and China Telegraph Co.

At the annual meeting on Wednesday, the chairman of the company, Sir J. Denison-Pender, said: The report and accounts for the year 1922 are, I consider, quite satisfactory, although on the result of the year's working, as compared with that of 1921, there is a net decrease of £402 297. Message and other receipts have again fallen. Working expenses are about 203 per cent. in excess of the year 1913, but having now been relieved of many items of expenditure rendered necessary during the past few years, they should before long assume a more proportional standard to receipts.

You will observe a net increase in general expenses at stations, amounting to £47 498, which is mainly accounted for by the very considerable increase in income tax, due to the introduction in the Netherlands Indies of a revised system of taxation, against which, I may say, strong objection has been raised by all mercantile firms trading in that country. Also noticeable is the increase in home taxation of £46 413, as shown in the revenue account, which you may perhaps consider requires some explanation in view of the welcome reductions in the rates of income and corporation profits taxes. It is due to the fact that under the three years' average system in the computation of the income tax for 1922, one lean year was dropped and one fat year had to be substituted, thus increasing the taxable amount by about £204 000. The 1921 accounts also were credited with £56 993 on account of the old excess profits duty adjustments, which augmented the 1921 figures and, of course, tells against a favourable comparison with those of 1922 now before you.

A Substantial Carry-forward.

The balance we have to deal with is £724 803, plus the carry forward from 1921 of £307 880, making a total of £1 032 683. From this sum, £250 000 has been placed to the general reserve fund; £400 000 paid in dividends; and the balance, £382 683, has been carried forward. Your directors considered it advisable to carry forward this substantial amount, in view of the fact that returns for the early months of the current year show a further considerable fall in traffic receipts, which, considering the state of trade all over the world, is not surprising.

You are no doubt aware of the condition of affairs at present ruling in China, where, owing to the existence of several militarist parties, who are all striving to force their domination on the country, chaos reigns, and it will, I fear, be some years before any improvement in the situation will take place. Needless to say, trade suffers. H.M. Minister at Peking, under direction of the Foreign Office, is supporting our cause in that country.

On the last occasion on which I had the pleasure of addressing you, I mentioned the proposed laying of a cable between Colombo and Penang. This, I am pleased to say, was successfully accomplished in March last, and the cable has been working well since that date. Owing to increased shipping activities at the port of Penang, and the area of the harbour there becoming congested with our many shore-ends, it became necessary to make an alteration in order to secure our cables from such interruptions as had recently occurred through ships anchoring in the vicinity of our cables. With the assistance kindly rendered by the Colonial Office, and the Government of the Straits Settlements, a suitable landing place, six miles distant from the harbour, was secured, to which six cable shore-ends have been removed, leaving only five in the harbour.

Duplicating the Singapore-Batavia Cable.

In order to improve our communication between Singapore and Java, your directors decided to duplicate the Singapore-Batavia cable. This work will be completed when the company obtains the necessary permission from the Netherlands Indian Government to land the second cable. In the unlikely event, however, of such permission being refused—for the cable in question will further facilitate telegraphic communication to and from the Dutch Indies—the company will substitute the new cable for the existing Singapore-Batavia section. The latter having been laid for many years, this part of our system must be strengthened. I am pleased to state that the Great Northern Telegraph Co.'s route between Europe and the Far East has worked satisfactorily since February, 1922, thus helping to lessen any congestion of traffic on our lines and enabling us at such a time to reduce delay in transmission.

At our last meeting I spoke strongly on the subject of the Postal Department's advertisement of their " Pacific " route on public correspondence passing through their hands, and I am now pleased

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to tell you that our representations in the matter have had the desired effect, and this form of advertisement has now ceased.

Referring to my promise to you to look into the question of the rearrangement of the shares of this company, I have to inform you that your directors and auditors have carefully considered the matter and have come to the decision that any alteration at the present moment would, in the best interests of your company, be inadvisable.

You will remember my reference to the late Mr. F. E. Hesse, whose death took place shortly before our last annual meeting. Mr. Wolfe was appointed to take over his duties and, after a year's personal experience, I can testify to the ability and energy with which Mr. Wolfe carries on the work. He has also the benefit of having served many years abroad at our Far Eastern stations, which is of material value when any local questions arise. Mr. Elwes, a younger man brought up in the Associated Companies, also having served abroad for some years, has been appointed assistant secretary. Thus, I consider our head office staff has been further strengthened.

On the proposition of the Chairman the report and accounts for the year ended December 31st, 1922, were adopted; and the dividend of 10 per cent., free of income tax, paid for that year, approved.

Companies' Reports, Dividends, etc.

MATHER AND PLATT.—The directors announce an interim dividend of 5 per cent. actual on the ordinary shares, free of tax.

EDISON SWAN ELECTRIC CO.—Notice is given that the petition for the confirmation of the reduction of the capital from £1 198 307 to £432 565 will be heard before Mr. Justice Lawrence on July 31st.

PETTERS, LTD.—After providing for depreciation, doubtful debts, and after adjustment of taxation reserve, the accounts for the year ended March 31st, show a profit of £10 035 (against a loss for the preceding year of £15 188). This is added to the balance of £10 918 brought forward, giving an undivided balance of £20 953. No dividend is proposed. It is stated that notwithstanding bad conditions, the sales have been maintained. To meet losses incurred by Vickers-Petters, Ltd., the directors have transferred £30 000 from the reserve, reducing it to £30 000.

WARD AND GOLDSTONE, LTD.—The report for the year ended March 31st last states that the net profit was £22 881 after providing for all charges except income tax and corporation profits tax, which absorb £6 453 leaving £16 428. This, with the balance brought in, £7 808, makes £24 236, which interim dividends already paid reduce to £18 591. The directors propose to place £2 000 to reduce preliminary expenses account, £4 500 to reserve, to pay a final dividend on the ordinary shares at the rate of 7 per cent. per annum for the last half-year, £1 444, leaving £10 647 to carry forward.

FELLOWS MAGNETO CO.—For 1922 the net profit was £1 025, compared with a loss of £49 009 in the previous year. The directors do not recommend the payment of any dividend this year. The report states that the improved position has been attained almost entirely on the sale of magnetos. Business in wireless apparatus did not commence until towards the end of July, 1922. Consequently the beneficial results accruing from this branch of the business are not very considerable in the accounts under review. Sales of wireless apparatus in the current year have been quite satisfactory. The directors feel that the position is not on the whole unsatisfactory, and that, given normal times, a return to former prosperity may reasonably be looked for. The annual meeting was to be held yesterday (Thursday) at the Institute of Chartered Accountants, London.

Stock Exchange Quotations.

The STOCK EXCHANGE COMMITTEE has ordered the following securities to be quoted in the Official List: 2 148 828, £1 fully paid, ordinary shares of Babcock and Wilcox; £650 300 5½ per cent. secured and guaranteed redeemable notes (registered) of the Central Electric Supply Company; and $297 000 capital stock of the Kaministiquia Power Company.

Supply and Lighting.

SMITHFIELD MARKETS ELECTRIC SUPPLY CO.—On the ordinary shares the company will pay on August 15th an interim dividend of 3 per cent.

METROPOLITAN ELECTRIC SUPPLY CO.—Payable on August 10th, an interim dividend has been declared at the rate of 6 per cent. per annum on the ordinary shares in respect of the half-year ended June 30th. This compares with 5 per cent. for the same period last year.

LAUNCESTON AND DISTRICT ELECTRIC SUPPLY CO.—On the working for the year ended December 31st last a gross profit was made of £1 702 and a net profit of £1 327, which with £527 brought forward makes £1 854. As the company would be restricted to a dividend of three-quarters of 1¼ per cent. it has been decided to place that amount to reserve against future dividends. The directors recommend that £350 be placed to depreciation, £300 to reserve, £500 to pay off debentures and that £704 be carried forward.

Cable, Telegraph and Telephone Companies.

EASTERN EXTENSION AUSTRALASIA AND CHINA TELEGRAPH CO.—The interest on the 4 per cent. mortgage debenture stock for the half-year ended July 31st, will be paid by warrant on August 1st.

CHILI TELEPHONE CO.—An increase in the gross revenue from £167 911 to £189 254 is recorded in the report to March 31st last and the profit was £35 570, against £46 016. The available balance, with £3 274 brought forward, is £38 844. The proposed final dividend is 3s. per share, free of tax, making 6 per cent., free of tax, for the year (the same), a sum of £6 000 (against £5 000) is placed to reserve for renewal of plant, and £3 144 is carried forward. For the preceding year a sum of £24 547 was placed to general reserve.

Traction Companies' Results.§

BRAZILIAN TRACTION, LIGHT AND POWER CO.—Holders registered on July 31st will receive on September 12th, a quarterly dividend of 1 per cent. on the ordinary capital stock.

DUBLIN UNITED TRAMWAYS.—A dividend has been declared at the rate of 6 per cent. per annum, less tax, on the preference shares and an interim dividend at the rate of 4 per cent. per annum, less tax, on the ordinary shares for the half-year.

CORDOBA LIGHT, POWER AND TRACTION CO.—Resolutions were passed at the annual meeting last week approving, *inter alia*, the agreement (referred to in our issue of July 13th) with the Argentine Tramways and Power Co., the increase in the capital to £2 200 000,, and the changing of the name of the company to "The Argentine Light and Power Company, Ltd."

HONG KONG TRAMWAYS CO.—A circular to shareholders on the London register states that resolutions will be proposed at extraordinary meetings in October next that the company be wound up voluntarily and authorising the liquidator to distribute the assets. It will be recalled that the undertaking was assigned in January, 1922, to a new company incorporated under the Hong Kong Companies' Ordinance in exchange for shares of that company.

New Companies.

COUNTY ELECTRICAL AND WIRELESS STORES, LTD.—Private company. Cap., £1 000 in £1 shares. Business indicated by title. Reg. office: 1, Broad Street Place, London, E.C.2.

CARTER AND MITCHELL, LTD.—Private. Cap., £2 000 in £1 shares. Electricians, electrical and mechanical engineers, etc. Reg. office: 24, Alsop Street, Upper Baker Street, London, N.W.1.

WORTEX MANUFACTURING CO., LTD.—Private. Cap., £2 000 in £1 shares. Manufacturers, importers and exporters of, and wholesale and retail dealers in, electrical apparatus, etc. Reg. office: 62, Oxford Street, London, W.1.

O. SICHEL AND CO. LTD.—Private. Cap., £12 000 in £1 shares. Manufacturers of and dealers in electrical, optical and scientific instruments, etc. Solicitors: H. Oppenheimer, Nathan and Vandyk, 1, Finsbury Square, London, E.C.2.

R. EGERTON-GREEN, LTD.—Private. Cap., £1 000 in 900 7½ per cent. cumulative preference shares of £1 each and 2 000 ordinary shares of 1s. each. Manufacturing electrical engineers, etc. Reg. office: 22, Dyott Street, New Oxford Street, London, W.C.1.

GENERAL RADIO CO., LTD.—Private. Cap., £30 000 in £1 shares. Electrical engineers, wireless telegraph manufacturers, and dealers in apparatus and accessories connected with electricity, wireless telegraphy, etc. Reg. office: 105, Great Portland Street, London, W.

CAMBRIAN ELECTRICITY SUPPLY CORPORATION, LTD.—Cap., £10 000 in 9 500 8 per cent. cumulative preference shares of £1 and 10 000 founders' shares of 1s. each. To supply electric light and power in all its branches, etc. Reg. office: 43, Cannon Street, London, E.C.4.

LACY INDUCTION COIL CO., LTD.—Private. Cap., £26 725 in 25 500 ordinary shares of £1 each and 24 500 founders' shares of 1s. each. To acquire a patent granted to Howard Lacy for improvements in electro-magnets, and to carry on the business of electrical engineers, etc. Reg. office: 48A, Gillingham Street, Pimlico, London, S.W.1.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER (Special Lacquer Issue).—"Chinese Furnishing Schemes"; "The Decoration of Furniture: Lacquering."

THE CHEMICAL AGE (Annual Colonial Issue).—"Explosive Tendencies of Pulverised Coal," by Hartland Seymour; "Further Notes on the Handling of Compressed Gases."

THE EUROPEAN COMMERCIAL.—"Standardisation in Bills of Lading"; "Holland's Internal Transport Problems"; "The Effect of Currency Depreciation on Germany's Foreign Trade."

THE FRUIT GROWER.—"The Bullfinch Pest"; "Wider Fruit Tree Planting"; "Wart Disease of Potato Order."

GARDEN ILLUSTRATED.—"Summer Treatment of Pot Strawberries"; "Early Flowering Magnolias"; "The Flower Garden for Beginners."

THE GAS WORLD.—"The Fairweather Recording Gas Calorimeter"; "Preparation of Gas Meter Leathers"; "Proposed Amalgamation of Gas Companies."

THE HARDWARE TRADE JOURNAL.—"The Facts About Anthracite Stove Explosions; Colliery Owners' Statement"; "Electric Pocket Lamps and Novelties"; "Fanlight Opening Gearing."

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

AIREY, George, trading as GEORGE AIREY AND CO., 4A, Commercial Street, Harrogate, electrical engineer. £14 10s. 11d. June 7th.

BETTERIDGE BROS., The Castle Stores (nr. Town Hall), Weston-super-Mare, electricians. £11 4s. 8d. June 6th.

GOMPERTZ, Mr. G., 199, Laygate, South Shields, electrical engineer. £11 9s. 4d. June 5th.

NEWBURY AND THOMAS, 66, Westminster Bridge Road, S.E., electrical engineers. £14 15s. 10d. June 11th.

ROWLANDS POWELL RADIO CO., 44, Stuart Street Docks, Cardiff, electricians. £11 7s. 4d. June 14th.

STOODLEY, Mr. P. W., trading as P. W. STOODLEY AND CO., 60 and 61, London Road, Camberley, electrician and power engineer. £12 8s. June 9th.

Receiverships.

ELECTRICITY HOUSE, LTD., Wolverhampton. D. E. Campbell, of 79, Lichfield Street, Wolverhampton, was appointed receiver on June 29th, under powers contained in debenture dated June 28th, 1923.

MITCHELLS ELECTRICAL AND WIRELESS, LTD. E. S. Thorn, A.C.A., of 68, Coleman Street, E.C.4, was appointed receiver on July 6th, 1923, under powers contained in debenture dated December 11th, 1923.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

WIRELESS AGENCIES, LTD., manufacturers, exporters and merchants of electrical and radio accessories. lately trading at 162, Shaftesbury Avenue, London, W.C. Ranking liabilities of £1 655, all due to unsecured creditors, and net assets estimated to realise £463, a deficiency as regarded the creditors of £1 192, were shown in the statement of affairs presented at the statutory meeting of creditors in this voluntary winding-up, held at the offices of Mr. W. H. Cork, accountant and auditor, 19, Eastcheap, E.C. Mr. Cork said the case was a somewhat unsatisfactory one, and that there were matters that required investigation. The company was registered in January of the present year with a capital of £1 000, of which £500 had been issued, mostly for cash. A considerable amount of business was done in the early stages of the company's existence. On March 31st there was a bank overdraft of £350, which was subsequently increased to £500. The overdraft had been guaranteed by two directors and had since been discharged. In addition, two of the shareholders, who were creditors for £600, had had their loans repaid during May and June, while three accounts guaranteed by directors or shareholders had also been paid during June. The company was interested in another concern called the Radolion Manufacturing Co., Ltd., which produced the goods which were sold by Wireless Agencies, Ltd. The majority of the goods produced, however, were unsatisfactory and had to be sent back for repair. During the discussion which took place the opinion was expressed by creditors that the matter called for a close investigation, and eventually it was decided to confirm the voluntary liquidation of the company with Mr. Cork as liquidator, while a committee of the principal creditors was also appointed. The following are creditors:—Burton, C. F. and H., Walsall, £47; Bacon Elworthy and Co., London, £52; Chrystophone Manufacturing Co., Ltd., Tonbridge, £88; Graham, Alfred, and Co., London, £225; Garland, S. T., London, £234; Goodyear Tyre and Rubber Co., London, £181; Houghton Butcher Manufacturing Co., Ltd., London, £159; Lithanode Electric Storage Co., London, £43; Mullard Radio Valve Co., Ltd., London, £146; Radio Structa Manufacturing Co., London, £168; Radio Instruments, Ltd., London, £80; Siemens Bros. and Co., Ltd., London, £135; Wilkins, H. F., London, £39.

WHITESIDE, BLOOMFIELD AND CO., LTD., 10, Lower John Street, London, W., dealers in accessories and wireless goods manufacturers. The voluntary winding-up of this company was confirmed at the statutory meeting of creditors held on Tuesday at the offices of Poppleton, Appleby and Hawkins, 4, Charterhouse Square, E.C., when a statement of affairs was presented which showed liabilities of £912 and net assets estimated to realise £459, or a deficiency of £453. It was reported that the turnover had totalled £2 704, with a net loss on the trading of £513. It was proposed to close down the business as it could not be carried on profitably or sold as a going concern. The following are creditors:—Cables and Electrical Supplies, £116; Castle, T. L., £70; Ebonite Parts Supplies, £17; Fuller's United Electrical Works, Ltd., £85; Jeffries and Co., £242; Power Equipment Co., Ltd., £17; Standard Insulator Co., £13; Thames Valley Rubber Co., Ltd., £37; Young, T. W., Ltd., £32.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Bankruptcy Information.

THE ARC ELECTRICAL CO., Palatine Buildings, Victoria Street, Manchester. Receiving order, July 18th. Creditor's petition.

WHITEHOUSE, John Henry, 61, Martin Street, Morriston, in the county borough of Swansea, electrical engineer. Receiving order, July 20th. Debtor's petition.

Application for Debtor's Discharge.

MAULLIN, Horace John Albert, carrying on business at 124, Devonshire Street, Birmingham, as THE WILTON ENGINEERING CO., electrical engineer. Hearing, September 13th, 10.30 a.m., Court House, Corporation Street, Birmingham.

Partnership Dissolved.

MONKS AND KINDER (William MONKS and John Francis Neot KINDER), electrical engineers, 28 and 30, High Street, Chorley, in the county of Lancaster, as from July 16th, 1923, so far as concerns J. F. N. Kinder, who retires from the firm.

Bankruptcy Proceedings.

McDOWELL, Henry Frank, Harrogate.—Statement of affairs shows liabilities of £13 728, and no assets. For ten years prior to September last debtor was managing director of an incandescent electric lamp company in Leeds. From September to June 1st this year he was endeavouring to form a company, and since the latter date has been employed as a district representative of a London electric lamp company. He alleges that his position has been brought about entirely by the losses he sustained in connection with the promotion of companies, and that apart from such liabilities he does not owe any debts.

WRIGHT, Charles, and WRIGHT, Herbert Thomas. electrical engineers, 251, Fulham Road, Chelsea, S.W. At the statutory meeting of creditors last week a statement of the debtors' affairs was submitted, in which they had returned their joint liabilities at £3 061 (of which £2 429 were expected to rank), and estimated net assets at £423 after deduction of £191 in payment of preferential claims. The meeting passed a resolution for the appointment of Mr. William Strachan (Martin Farlow and Co.), I.A., 50, Gresham Street, E.C., as trustee to administer the estate in bankruptcy.

Prices of Metals, Chemicals, etc.

TUESDAY, July 24.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£69 10 0	£1 10 0	—
Electro Wirebars	,,	£73 0 0	—	—
H.C. Wire, basis	per lb.	10 1/16d.	—	—
Sheet	,,	10½d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2 1/16d.	—	—
Brass 60/40—				
Rod, basis	,,	7½d.	—	—
Sheet, basis	,,	10d.	—	—
Wire, basis	,,	10½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 15 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 10 0	—	—
Lead Pig—				
English	,,	£25 15 0	10s. 0d.	—
Foreign or Colonial	,,	£24 10 0	10s. 0d.	—
Tin—				
Ingot	,,	£186 12 6	£7 12 6	—
Wire, basis	per lb.	2s. 5⅜d.	1⅛d.	—
Aluminium Ingots	per ton	£120 0 0	—	—
Spelter	,,	£30 5 9	£1 12 6	—
Mercury	per bottle	£10 5 0	—	2s. 6d.

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2¾d.
,, (Roll-Brimstone)—,, £8 5s. *Sulphuric Acid* (Pyrites, 168°) per ton, £7 10s.
Copper Sulphate.. ,, £36
Boric Acid (Crystals). ,, £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2d.; plantation 1st latex, 1s. 2½d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd. and the rubber prices by W. T. Henley's Telegraph Works Co.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

195 051 MARCONI'S WIRELESS TELEGRAPH CO. Loop antennæ. (14/3/22.)
172 969 A. DELLA-RICCIA. D.c. rotary transformers with arbitrarily variable subdivision of pressure. (16/12/20.)
197 361 J. E. LEA. Indicating or/and recording electrically rates of flow of liquids. (13/1/22.)
197 362 J. E. LEA. Indicating or/and recording of mechanical movements electrically. (13/1/22.)
197 364 BRITISH THOMSON-HOUSTON CO. and F. H. CLOUGH. Protective devices for enclosed electrical apparatus. (31/10/22.)
174 940 H. LAHR. Leading-in wires for incandescent lamps. (2/2/21.)
197 366 RADIO COMMUNICATION CO., N. LEA and J. REE. Electric signalling systems. (4/2/22.)
197 383 G. BOUDOU. Electrically-heated hair-waving appliances. (7/2/22.)
197 384 S. GEORGE (J. H. GEORGE). Rotary contact devices for timing and distributing sparking for electric ignition. (8/2/22.)
197 420 H. G. BARTHOLOMEW and M. L. D. MCFARLANE. Telautography. (10/2/22.)
197 405 T. H. KINMAN. Receiving arrangements for electromagnetic waves. (11/2/22.)
197 406 J. F. GILL and J. N. CHAVIARA. Electro-dynamic power-transmitting mechanisms. (11/2/22.)
197 410 METROPOLITAN-VICKERS ELECTRICAL CO., L. MILLER and A. B. FIELD. A.c. machines. (13/2/22.)
197 420 A. REYROLLE AND CO. and W. M. THORNTON. Lightning or surge arresters for conductors. (15/2/22.)
197 424 J. REID. Sand-pipe control arrangement for electric cars. (16/2/22.)
197 435 G. R. JUDGE. Loud-sounding telephones. (20/2/22.)
197 445 M. Y. L. DUFOUR. Automatic commutators or switches. (24/2/22.)
197 454 BRITISH THOMSON-HOUSTON CO. (CIE FRANÇAISE THOMSON-HOUSTON). Electric control systems. (2/3/22.)
179 513 HART MFG. CO. Reciprocating rotary electric switches. (3/5/21.)
197 462 EURAL PATENTS, LTD., and H. J. WALLER. Electrical contact-makers for use with steering-wheels of vehicles. (2/12/22.) (Patent of Addition not granted.)
197 464 J. HIGGINSON. Interrupters for use in electric ignition systems. (8/3/22.)
197 468 ELECTRICAL IMPROVEMENTS, LTD., L. C. GRANT and R. W. GREGORY. Protective devices for d.c. circuits. (11/3/22.)
197 469 GENERAL ELECTRIC CO., LTD., and J. J. GRACIE. Incandescent lamps or the like. (11/3/22.)
197 477 BRITISH THOMSON-HOUSTON CO., H. W. TAYLOR and K. R. HOPKIRK. Windings of a.c. machines. (18/3/22.)
177 776 WIRELESS SPECIALTY APPARATUS CO. Electrical condensers. (30/3/21.)
177 525 AKT.-GES. BROWN, BOVERI ET CIE. Apparatus for feeding polyphase mercury-vapour rectifiers. (24/3/21.)
197 484 ELECTRICARS, LTD., and J. P. KEMP. Electrically-propelled coke trucks. (24/3/22.)
197 486 COVENTRY AUTOMATIC TELEPHONES, LTD. (A. H. ADAMS). Terminal banks for automatic telephone switches. (28/3/22.)
197 487 WESTERN ELECTRIC CO. Telephone exchange systems. (28/3/22.)
197 490 CALLENDER'S CABLE AND CONSTRUCTION CO. and A. E. WILSON. Insulators. (31/3/22.)
177 806 AUTOMATIC TELEPHONE MFG. CO. Telephone systems. (1/4/21.)
197 492 E. Y. ROBINSON. Antenna systems for wireless communication. (1/4/22.)
197 501 A. MELOTTE. Brush-holders for electric motors. (11/4/22.)
197 502 M. J. RAILING, C. C. GARRARD and W. WILSON. Charging of accumulators. (11/4/22.)
197 503 AUTOMATIC TELEPHONE MFG. CO., LTD., and H. H. HARRISON. Transmission of telephone numbers, etc. (12/4/22.)
197 504 GENERAL ELECTRIC CO., LTD., and G. C. MARRIS. Telephone repeater circuits. (12/4/22.) (Cognate Application, 35 189/22.)
178 857 LANDIS AND GYR AKT.-GES. Instrument transformer with variable-current ranges. (21/4/21.)
182 769 BRITISH THOMSON-HOUSTON CO. Electric relays. (5/7/21.)
197 542 V. R. RICHARDS. Apparatus for forming depolarising element of primary cells. (15/5/22.)
197 546 H. A. GILL (VIGILANT AUTOMATIC FIRE ALARM CO.). Thermostat for electric fire-alarm systems. (18/5/22.) (Addition to 177 567.)
197 548 O. LUCAS and H. W. F. IRELAND. Electric horns. (19/5/22.)
184 776 WESTERN ELECTRIC CO. Loaded signalling-conductors. (16/8/21.)
182 778 SOC. INTERNATIONALE M.D.M. Electro-magnetic control-devices for signalling apparatus. (4/7/21.)
197 553 A. M. E. BEAVAN. Electric radiators and cookers. (30/5/22.)
197 556 DUBILIER CONDENSER CO. (1921), and W. H. GOODMAN. Electric condensers. (1/6/22.)
197 561 L. N. REDDIE (OFFICINE MECCANICHE ITALIANE). Electrical measuring instruments. (9/6/22.)
197 562 TELEGRAPHIE-GES. SYSTEM STILLE and DR. C. STILLE. Telephone relays. (10/6/22.)
197 570 G. B. R. PIMM. Posts for supporting electric conductors, etc. (21/6/22.)
197 572 E. MALLETT and R. MARX. Variable inductances and auto-transformers. (22/6/22.)
197 578 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electric systems of connections for railway train units. (28/6/22.)
183 445 SCINTILLA. Spring-controlled electromagnet armatures for electrical vibration regulators. (20/7/21.)
197 587 SIR P. DAWSON and F. W. FAWDRY. Device for use in supporting overhead conductor wires for electric railways, etc. (26/7/22.)
197 590 O. LUCAS. Electric switches. (29/7/22.)
197 599 PRITCHETT AND GOLD AND E. P. S. CO., H. M. GENESE and G. N. R. MINCHIN. Storage batteries. (31/8/22.)
187 947 J. THUM. Field-magnet frames for electrical machines. (22/10/21.)
197 609 S. G. BROWN. Electrical transmission of sound. (5/5/22.) (Divided Application on 188 709.)
197 620 SWITCHGEAR AND COWANS and E. D. RODWAY. Electric fuses. (10/11/22.)
197 626 S. D. WHITE and C. W. SAUNDERS. Locking device for securing electric lamps to holders. (1/1/23.)
195 355 BRITISH THOMSON-HOUSTON CO. Electric switches. (25/3/22.)
197 630 COVENTRY AUTOMATIC TELEPHONES, LTD. (F. R. MCBERTY). Machine switching telephone exchange system. (9/12/21.) (Divided Application on 196 018.)
197 711 SIEMENS BROS. AND CO., J. E. COLLYER and R. BARKER. Prepayment devices for telephone systems. (22/12/21.)
175 291 F. H. L. HOLWECK. Impermeable electrical apparatus, such as incandescent lamps, vacuum apparatus, etc. (11/2/21.)
197 722 F. CREEDY. A.C. commutator machines. (13/2/22.)
197 753 METROPOLITAN-VICKERS ELECTRICAL CO., J. F. PERRY and A. STUBBS. Electrically operated mining plant. (24/2/22.)
197 758 WESTERN ELECTRIC CO. Carrier wave transmission systems. (27/2/22.)
197 759 R. A. MACAULAY. Electric switches. (26/4/22.)
197 774 BRITISH THOMSON-HOUSTON CO (GENERAL ELECTRIC CO., N.Y.). Oil-cooled electron discharge devices. (6/3/22.)
197 782 P. D'AIGNEAUX. Means for converting direct current into a high-frequency alternating current. (8/3/22.)
197 797 WESTERN ELECTRIC CO. and L. POLINKOWSKY. Telephone systems. (24/3/22.)
179 188 AUTOMATIC TELEPHONE MFG. CO.. Telephone systems. (28/4/21.) (Addition to 165 031.)
197 836 E. S. PRIDHAM and P. L. JENSEN. Telephone receivers, etc. (29/5/22.)
196 878 SOC. ANON. LE CARBONE. Dry batteries. (1/5/22.)
197 853 W. R. BULLIMORE. Thermionic valves. (22/6/22.)
197 854 C. F. ELWELL and B. E. G. MITTELL. Inter-valve and telephone transformers for use in wireless receiving apparatus. (24/6/22.)
182 468 E. WEISSBERG. A.C. motors. (1/7/21.)
197 857 LODGE-COTTRELL, LTD. (E. ANDERSON). Electrical precipitation of suspended particles from gaseous fluids. (30/6/22.)
197 864 WARD LEONARD ELECTRIC CO. and A. E. WALLER. Electric resistance device. (7/7/22.)
197 867 J. B. MCDOWELL. Electric switch. (11/7/22.)
197 870 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electrical machines. (12/7/22.)
183 480 LANDIS AND GYR AKT.-GES. Multiple range current transformer. (22/7/21.
184 194 BRITISH THOMSON-HOUSTON CO. Circuit breakers. (4/8/21.)
185 751 LANDIS AND GYR AKT.-GES. Time switches. (7/9/21.)
186 061 L. J. DABOS. Electric alarms. (14/9/21.)
187 584 C. GROSS. Negative electrodes for accumulators. (17/10/21.)
197 887 G. BREWER (F. KRUPP AKT.-GES.). Electrolytic separation of pure chromium in thick layers. (28/9/22.)
197 888 A. B. HARJE. Electric clock. (4/10/22.)
187 625 E. DICK. Dynamos for lighting of vehicles. (21/10/21.)
197 891 WESTERN ELECTRIC CO. Telephone systems. (29/11/22.)
192 709 E. MARRE. Multiple contact panels for luminous signboards. (4/2/22.)
194 273 FORGES ET ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE JEUMONT. Device for rupturing electric arcs. (28/2/22.)

APPLICATIONS FOR PATENTS.

July 9th.

17 710 C. W. CLARABUT. Thermionic valves.
17 718 SCHOTT AND GEN. Electrolytic electricity meters. (7/8/22, Germany.)
17 727 WESTERN ELECTRIC CO. Coating cores.
17 732 E. B. WEDMORE and W. B. WHITNEY. Circuit breakers, etc.
17 735 F. X. MAZO and A. J. B. TAULEIGNE. Batteries.
17 738 H. G. C. FAIRWEATHER (ARENDT AND MORTON). Self-charging electric vehicles.
17 741 W. B. MEDLAM and U. A. OSCHWALD. Radio receiving circuits.
17 746 M. A. RENISON. Radio communication apparatus.
17 748 J. REZELMAN. Short circuited rotors for asynchronous motors.
17 777 AKT.-GES. BROWN, BOVERI ET CIE. Air compressors. (23/12/22, Germany.)
17 781 BRITISH LIGHTING AND IGNITION CO. and E. O. TURNER. Control of voltage in electrical systems.
17 788 CONNECTICUT TELEPHONE AND ELECTRIC CO. Vacuum tube and system. (5/8/22, U.S.)
17 791 E. A. GRAHAM. Loud-speaking telephone apparatus.

July 10th.

17 804 OFFICE EQUIPMENT CO. and H. W. THOMPSON. Telephone receiver holder.
17 809 A. E. DAVIES, W. E. BOX and H. H. THOMPSON. Controlling highly induced currents.
17 815 J. B. TUCKER. Connections between electric conduits and their boxes.
17 835 H. J. NORBALLE. Electric switches.
17 846 H. G. DETHERIDGE. Illuminated electric signs.
17 862 J. STONE AND CO. and J. F. B. VIDAL. Electric lamp fittings.
17 872 BRITISH THOMSON-HOUSTON CO., A. P. YOUNG and L. GRIFFITHS. Electric indicating devices for motor vehicles, etc.
17 877 J. P. BUDGE. Electric signs for exhibiting reading matter.

July 11th.

17 907 L. F. A. BOURN. Electric switches.
17 908 L. E. A. BOURN. Local distribution of signals from wireless receiving apparatus.
17 918 C. E. VAWTER. Variable high resistance. (12/7/22, U.S.)
17 965 J. E. WALLER. Electric ignition apparatus.
17 971 A. E. BOWYER-LOWE. Reaction coils for wireless receiving sets.
17 976 C. S. FRANKLIN. Generating high frequency oscillations.
17 988 C. W. GAYDER. Wireless telephony.
17 990 J. DAVIS AND SON (Derby) and I. S. MACKENZIE. Secondary cells for miners' lamps.
17 997 GRIFFITHS, GILBART, LLOYD AND CO. Chains for electroliers, etc.
17 998 W. H. BROWN. Wireless telephony.
17 999 A. ABELL. Secondary cell for miners' lamps.
17 999 AKTIESELSKAB ELEKTRISK BUREAU. Automatic telephone systems. (18/7/22, Norway.)
18 001 and 18 002 E. A. GRAHAM. Loud-speaking telephones.
18 004 SOC. DES MOTEURS SALMSON (SYSTEME CANTON-UNNE). Circuit breakers for magnetos.
18 006 SOC. INDUSTRIELLE DES PROCEDES W. A. LOTH. Acoustic signalling. (11/7/22, France.)
18 009 GENERAL ELECTRIC CO., LTD. Preparation of ductile wire of tungsten, etc. (23/12/22, Germany.)

July 12th.

18 014 RADIO COMMUNICATION CO. and N. LEA. Thermionic valves, etc.
18 024 J. E. BOXALL. Electric circuit terminals or connections.
18 036 J. C. ADAMS. Combined switch and plug.
18 045 L. H. PADDLE. Regenerative circuits for wireless apparatus, etc.
18 062 J. A. SMITH. Electrical machines. (28/7/22, U.S.)
18 066 N. WISE. Incandescent lamps, thermionic valves, etc.
18 069 AUTOMATIC TELEPHONE MANUFACTURING CO. and C. GILLINGS. Telephone systems.
18 089 STERLING TELEPHONE, ETC., CO., and F. R. GRIFFITHS. Head telephone receivers.
18 100 EASTERN TELEGRAPH CO., H. V. HIGGITT and W. C. HUBBLE. Reception of electric signals.
18 115 FELTEN AND GUILLEAUME CARLSWERK AKT.-GES. Movable coil boxes for cables. (12/7/22, Germany.)

July 13th.

18 122 G. B. BURNSIDE. Wireless receivers.
18 124 SMITH AND ANSELL and P. J. ROBINSON. Electric lanterns.
18 128 J. H. COLLIE. Lampholder adapters, etc.
18 131 WESTERN ELECTRIC CO. Coating cores.
18 140 W. H. GARDNER. Electric switches.
18 147 RANSOMES AND RAPIER and P. D. IONIDES. Electric cranes.
18 185 BRITISH POWER RAILWAY SIGNAL CO. and E. C. IRVING. Railway signalling.
18 189 J. R. QUAIN. Trembler coils.
18 194 M. LATOUR. Feeding reactance coils having ferro-magnetic circuits. (13/7/22, France.)

July 14th.

18 198 W. T. THORNE. Automatic tram axle spring brake, etc.
18 199 F. WHITTLE, E. V. DAVIES and G. SMITH. Lift, etc., arrester.
18 219 H. W. LUNDIN. Joint for electrical conductors.
18 230 J. H. AND S. E. HALL and H. H. RATCLIFF. Coil holder for wireless purposes.
18 248 AUTOMATIC TELEPHONE MANUFACTURING CO. and A. E. HUDD. Electro-magnetic mechanism.
18 251 F. FIRTH. Electric conduit fittings.
18 257 R. L. AND T. E. BEAUMONT. Wireless telephony.

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THE ELECTRICIAN

VOL. XCI.—No. 2359. FRIDAY, AUGUST 3, 1923. SIXPENCE

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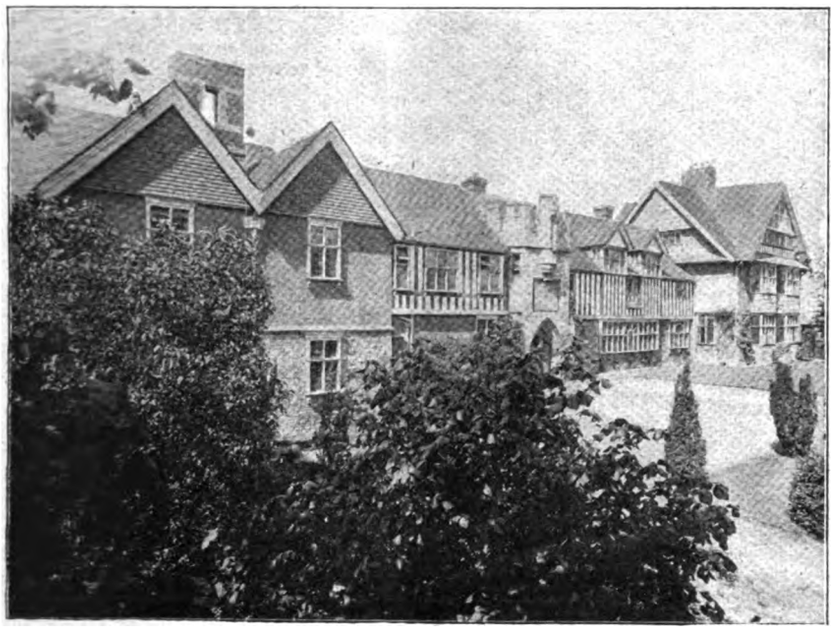
Some recent "KALEECO" installations.



THE illustrations show the entrance and one of the cloisters of St. Agnes Home, House of Charity, Knowle, Bristol, which has recently been wired throughout with "Kaleeco" by Messrs. J. M. Vaughan, 8 and 9, Triangle South, Bristol.
These buildings have taken approximately 1¼ miles of "Kaleeco" Wire, with roughly 5,000 Fixing Clips, Saddles, etc.
The walls are of Portland Stone, Brick, Pennant Stone and Glazed Tile.
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June 1st, 1923.

J. M. VAUGHAN, ESQ.,
8 & 9 TRIANGLE SOUTH, BRISTOL.

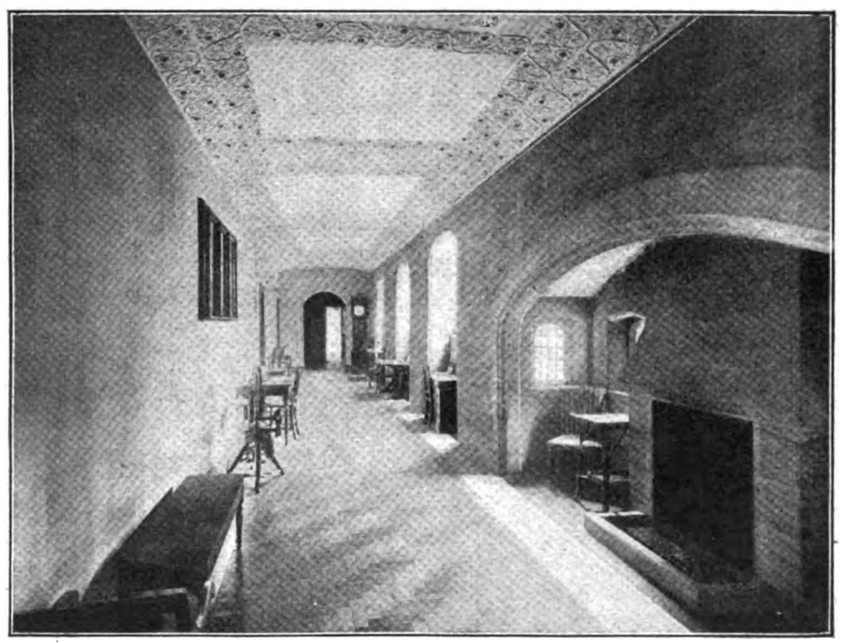
Dear Sir,

I have received the set of very beautiful photos of our Home and Chapel with much appreciation of your kind thought.

They show in an admirable way not only the buildings themselves, but the very neat and unobtrusive way in which the electric installation has been carried out, which I am sure will be much admired.

I should like once more to express to you and to your foreman our gratitude for the trouble and patience which was shown over the whole work, and I quite hope it may not be long before we are able to send for you to carry on the installation over the whole buildings.

Believe me with grateful thanks,
Yours truly,
(*Signed*) MOTHER SUPERIOR,
Sister of Charity.



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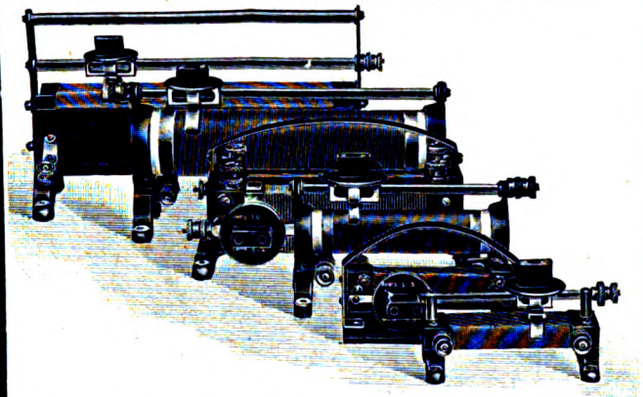

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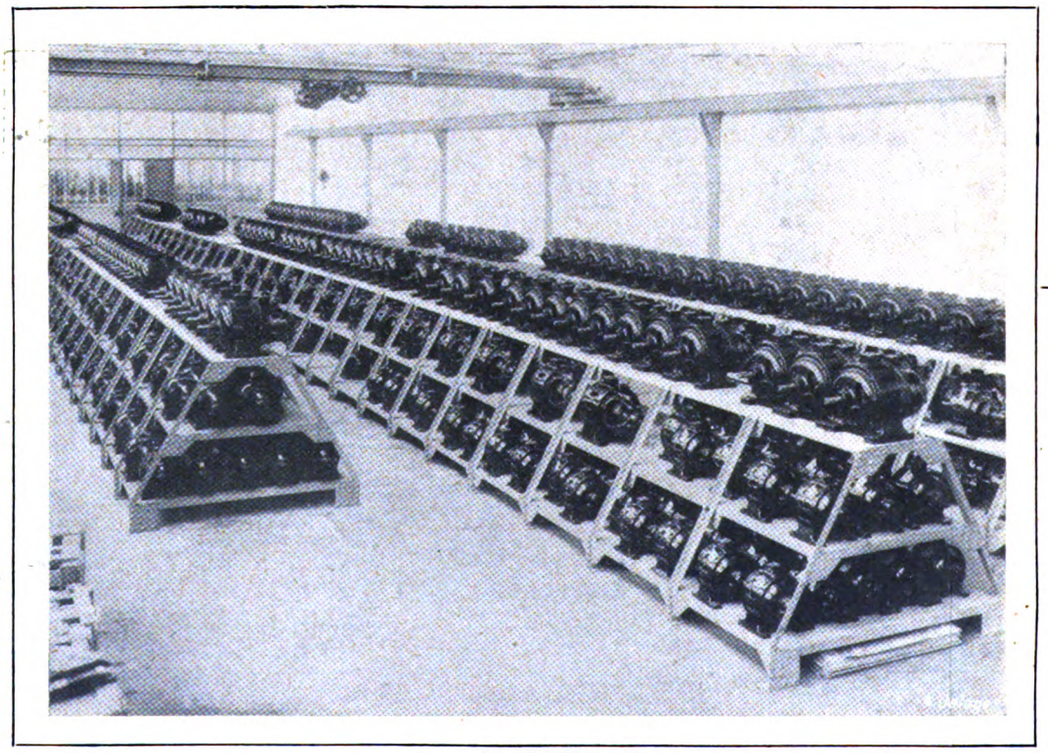

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THE ELECTRICIAN

ESTABLISHED 1861.

THE OLDEST WEEKLY ILLUSTRATED JOURNAL OF

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Notes of the Week.

Commissioners' Action *Ultra Vires.*

THE judgment of the Court of Appeal on the scheme for London propounded by the Electricity Commissioners has complicated rather than assisted matters; and has still further delayed a solution of what becomes every day a more and more difficult problem. In legal phraseology their lordships allowed the appeal from an order of the Divisional Court discharging a rule *nisi* for prohibition which had been obtained against the Commissioners. The rule is therefore made absolute. The appeal against the order refusing to make the rule *nisi* for a *certiorari* absolute was dismissed. The effect of this judgment, if the matter is carried no further, is that the Commissioners' scheme for a Joint Authority for London with two compulsorily appointed Committees, one representing the joint authorities and one for the companies, is *ultra vires*; and some other solution for bringing these two antagonistic bodies into working agreement must therefore be found. One way would be, as Lord Justice BANKES suggested, to have two authorities, but the London County Council object to this and others object to one. Though we also should much prefer one authority we should still more prefer to see London's electricity supply taken out of the present atmosphere of uncertainty, and it may be that two authorities would bring that end about. At least it would be a beginning and closer working might come at a later date when partisanship had cooled a little.

Reasons for the Decision.

THE reasons which influenced their lordships in coming to their decision are interesting. Section 6 (2) of the Electricity (Supply) Act of 1919 empowers the Commissioners to formulate schemes containing provisions which enable a joint authority to delegate their powers to Committees. The scheme propounded for London in effect sets up two authorities, each with a separate district and independent powers. In the view of the Court that is not authorised by the Act of 1919. But if it did so in fact it would be in order. By statute the powers of delegation are to be exercised by the Authority. In the London scheme they have been exercised by the Commissioners. The Commissioners have powers of veto over such delegation but must not order it. In other words, they may only act judicially and not ministerially. For that reason Lord Justice BANKES thought there was abundant precedent for taking action at that stage, a point which had been questioned in the Court below and which his Lordship described as the important part of the appeal. This certainly puts the matter very clearly and we presume the judgment will not be tested further. The reorganisation of London's electricity supply has therefore come back to the starting point except for the very tentative suggestions of the companies to which we referred last week and which have received the blessing of the London County Council. It may be that this will develop into a real solution, especially if those concerned would pay rather more attention to public than to private interests.

Summer and Unemployment.

SUMMER has come and we see that Colonel BUCKLEY, Parliamentary Secretary to the Department of Overseas Trade, is prophesying another great wave of unemployment owing to political conditions. There may not at first sight seem much connection between these two events, but we have noticed in the years since the war that as sure as the days begin to shorten talk about unemployment begins, and that as sure as they lengthen it dies down into nothing. Unfortunately, political conditions or not, unemployment is always with us, the amount following a seasonal curve, and each year the matter is therefore discussed more or less sensibly and each year nothing much is done. This being so, whether Colonel BUCKLEY is right or not, it is essential

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that this distressing and highly important problem should be tackled without delay and that everyone concerned should bring their intellects to bear on finding some solution. Some useful suggestions have, in fact, been made. Last winter Mr. BONAR LAW propounded alternative schemes for unemployment insurance by industries, but though there was a great deal of talk about them they have not got out of the paper stage. It is time these schemes were examined, and if found practicable put into force. For it is not even now generally realised how great the effect of unemployment and the fear of unemployment have on trade stoppages.

Railway Electrification and Unemployment.

THAT the need for action has occurred to others besides ourselves is evidenced by several letters and speeches that have been published during the last few days. On behalf of the Industrial Group in the House of Commons, a letter has been sent to the Prime Minister expressing "the grave apprehension with which the Group regards the present volume of unemployment and the prospects of the coming winter," and advising that, owing to the conditions in Europe, more attention should be paid to developing the resources of the British Isles. The useful suggestion is made that greater energy should be shown in carrying out the railway electrification schemes that were suggested in 1922. To do this would mean the expenditure of some £50 000 000, would be extremely remunerative to the railway companies, would employ a large number of skilled workers in their own trades, would relieve the housing problem and generally benefit industry by bringing down goods rates. All these reasons we heartily endorse, and we hope that due heed will be given to them. In a further interim report, the Federation of British Industries consider a number of questions bearing on the important problem of increasing our inter-Imperial trade. That increase would in its turn help to reduce unemployment, and it is to be hoped that the points mentioned will be reviewed at the forthcoming Imperial Economic Conference and settled without delay.

Universal Co-operation Needed.

THE subject of unemployment naturally made its appearance in the debate in the House of Commons on the Board of Trade Estimates on Thursday of last week. Sir ALFRED MOND was frankly pessimistic about the future. Matters, he said, were going to be worse owing to the occupation of the Ruhr, and the protracted negotiations were gradually ruining trade. The failure of the Government to assist Russia was having a bad effect on British trade, and industrial relations with China were also suffering. More money ought to be spent on Empire development, and in this country we were suffering from over-taxation and too rapid deflation. He concluded, however, on a more cheerful note, and ought to have gained still further encouragement from Sir PHILIP LLOYD-GREAME'S reply. The Government, the latter said, was prepared to give assistance to local authorities and public companies if they would put in hand revenue-producing works for the relief of unemployment. But they could do nothing unless the country co-operated. This, we think, is the right note. To overcome unemployment and to improve trade are problems for industry, not for the Government. The best assistance the latter can give is to remove certain political difficulties and then not to interfere.

Sir Alfred Mond and the Commissioners.

OUR appreciation of Sir ALFRED MOND'S remarks on the present industrial conditions does not extend to what he said about electricity supply. He thought there would be a good deal more business for the electrical industry if only, instead of so many inquiries being held, more decisions were come to and people were allowed to place orders. There were too few Electricity Commissioners and the chairman ought not to be a technical man. This is the well-known disease of "expertophobia" breaking out once more. The delay in the determination of the electricity districts has not been caused by the engineers, but by politicians, imperial and local, lawyers and all that body of the population who talk rather than act. In almost every case a technical scheme has been agreed upon without difficulty, but in almost every case hitches have occurred about boundaries, representation and other time-consuming devices, which will never make electricity one penny the cheaper or increase its use by one kilowatthour. Sir ALFRED MOND had better take Sir JOHN SNELL'S place himself and see whether he could hurry things up, though before he does so he had better make himself better acquainted with tidal power problems than he seems to be.

Present Position of the Relativity Theory.

THE theory of relativity is a closed book to the majority of electrical engineers. Its concepts and its applications seem so remote from anything that they come across in practical life that they may be forgiven for neglecting its closer study. Nevertheless, such examination may be regarded as a whetstone for the ideas and facts with which they may have to deal every day and a short summary of the work of such investigators as EINSTEIN himself, EDDINGTON, WHITEHEAD, LARMOR and WEYL is one that they cannot afford to disregard. Such a summary is provided by the article by Mr. G. W. DE TUNZELMAN which we publish on another page of this issue. As he points out, and as we know only too well ourselves, the flood of literature on relativity is not diminishing, and his article is therefore an exposition of the present position of the general theory. Dealing with the subject in the broadest way, it appears that there are two schools of thought which differ as to whether an ether of events is necessary or not. EDDINGTON thinks that it is and LEIGH PAGE has pointed out that without such an ether the existence of the electron would be a miracle.

Whitehead's Work.

IT has, indeed, aroused much criticism not only from EDDINGTON, but from LE ROUX, who has pointed out that from the mathematical standpoint the theory fails because it allows for no interaction between a particle and other moving bodies and because the postulated determination of the gravitational orbit of a body by the action principle involves self-contradiction. LARMOR also takes the view that "this destructive criticism of a purely spatial scheme seems to be fundamental and complete." Mr. DE TUNZELMAN in summarising WHITEHEAD'S criticisms of the theory quotes the view that the worst homage which we can pay to genius is to accept uncritically foundations of truth which we owe to it. This is a conclusion which is likely to receive general acceptance. In fact, from the purely critical point of view WHITEHEAD'S work is deserving of the closest study, as in his analysis of natural phenomena he has succeeded in eliminating many of the complications hung about the philosophical study of science by the older philosophers from the times of ancient Greece onwards. All his results were obtained without any departure from the initial simplicity of MINKOWSKI'S Euclidean methods, and therefore indicate that in these philosophical regions as elsewhere there is a chance that the true idea may be lost amid a superabundant foliage of unnecessary detail.

"B.E.X." and the Electrical Industry.

IT is not going too far to say that the success or failure of the British Empire Exhibition next year depends on the Press not only of this country but of British Dominions overseas and of foreign powers. Success will come from the way in which potential exhibitors and the visiting public are educated within the next few months in the advantages and possibilities of this great scheme. It will come from a realisation that the Exhibition is a unique opportunity of advertising the British Empire by the best possible means—that of showing what it can do in every sphere of human activity. This being so, the PRINCE OF WALES is to be congratulated on inviting those who control our great

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newspapers (in passing we may express a regret that those who control the technical and trade Press were not included in the invitation) to "inspire them with an enthusiastic interest in a project of the highest Imperial importance." There was, he said, no obstacle to success. Manufacturers and traders had responded generously to an appeal for funds and if the Exhibition achieved success it might well mark a new era in Imperial trade and point the way to new paths by which to repair the ravages of the Great War. We hope these words will be taken to heart by all concerned, and especially by the electrical industry. Properly organised the electrical exhibit should show the people of this country not only what electricity can do to improve conditions in the home, the factory and the street, but the ways and means by which these improvements are carried out. Not less important than the actual exhibition of the equipment is the way it is shown so that it will be intelligible to all.

The Organisation of Electrical Exhibitions.

THE fact that Wembley is to take up a great deal of thought and attention next year should not cause electrical manufacturers and electricity supply undertakings to forget the real usefulness of organising local electrical exhibitions. As our columns bear witness, these displays were a great success last winter and we are glad to hear that dates are already being booked up for similar shows during the coming months. To those who are ignorant how to set about organising such an exhibition we cannot do better than suggest they should study a pamphlet which has been issued by the Electrical Development Association on the subject. The information given therein has been based on experience and can be followed with confidence. Another useful hint is to start work on the project at the earliest possible date and as soon as the date has been fixed to let all the interested parties, including especially the local Press, know it. As with Wembley, so with the smallest exhibition in the smallest market town, an early announcement of when it is to be held and of what is to be seen there and a little judicious talk about its aims and objects are all ways of achieving success.

Electricity Supply Progress.

The annual report of the Minister of Transport for the year ended March 31st, 1923, on the work done under the Electricity (Supply) Acts is but the dry bones of the Electricity Commissioners' report, which, if precedent is anything to go by, need not be expected for three months or more. It will be remembered that recent legislation made the Minister of Transport the representative of the Commissioners in Parliament and laid upon him certain confirmatory and discretionary powers. This report, which is published for the information of Parliament and the general public, shows how those powers are exercised.

The range of duties indicated by the document is quite large, but we do not think that the work carried out under each heading is quite so copious as it has been in former years. This is probably due to the fact that the stream of applications and other matter which was dammed up by the war has now reached normal flow, and this diminution of the torrent will, we hope, give both the Commissioners and the Minister time to proceed with reorganisation.

District Organisation.

One of the Minister of Transport's principal duties in connection with electricity supply is the consideration and confirmation of orders. During the year under review, two orders under Section 7 of the Electricity (Supply) Act, 1919, dealing respectively with the South-West Midlands and the South-East Lancashire Districts, were received for confirmation. At the date to which the report was made this confirmation had not been carried out, but it has, of course, since been effected, and the orders have been approved by Parliament. At the date of the report work had in addition been done in eleven other districts with varying results, while in two districts, South Wales and the West of Scotland, the areas have been delimited but no scheme has been submitted.

Special Order Progress.

The Act of 1919 gives the Commissioners powers to make special orders, and during the year thirty-four such orders were approved, giving powers of various sorts to the undertakings that had applied. These mainly refer to the smaller undertakings, though an exception is Liverpool, with its order for the purchase of the undertakings of the Bootle Corporation and the Liverpool and District Lighting Co. It is interesting to find that a number of these orders give powers to supply in rural places which heretofore have been without the benefits of electricity. We hope that this form of enterprise will be largely extended. Two orders for bulk supply were confirmed, for the supply of Rushden and Wellingborough from Northampton, and for supply of the area served by the British Insulated and Helsby Cables from Liverpool.

Price Revisions.

The question of revising prices (which in this case means making them higher than before) has, we are sorry to see, been absorbing a portion of the activities of certain undertakings. During the year in question the Minister made 35 orders revising charging powers, though in one case an inquiry was held before confirmation. We might inform consumers that the Minister has, on application from them, power to revise the charges after every three years, and it is as well for electrical development that a downward tendency in them should become marked at the earliest possible date. Most of the undertakings affected are small, but even a small undertaking should be able with enterprise to build up a domestic load.

Overhead Wires and Wayleaves.

In connection with the supply of electricity in the less populous places, we are glad to see the increasing number of applications for consent to the erection of overhead wires. During the year there were 91 such cases, and in each of these cases the Commissioners had to be satisfied that certain requirements regarding strength, height above ground and other factors have been complied with. Wayleaves are another matter which have to be dealt with when disputes arise. During the year under review six applications were dealt with, consent being given in four of the cases and refused in one. The sixth case was withdrawn. The small number of cases seems to indicate either that our engineers are becoming more tactful or landowners are becoming more amenable.

The Work of the Commissioners.

The report concludes with a forecast of the matters that will be subsequently dealt with more fully by the Commissioners themselves. During the year consent was given to the establishment of 28 generating stations (10 statutory and 18 non-statutory), to the establishment of 22 main transmission lines, and to 74 extensions of existing generating stations. This sufficiently indicates the progress that has been made in the electricity supply industry during the year. But if a further confirmation were necessary it would be given by the statement that 408 applications for loan were made and were sanctioned in 350 cases of an aggregate total amount of £7 782 089. In addition to matters relating to orders and bulk supply which we have already mentioned, the Commissioners made 59 orders permitting various undertakers to supply electricity to specific premises outside their areas of supply, and have approved the use of special systems of supply in the case of 22 undertakings.

It will be agreed that this represents an amount of very useful work whose carrying out is necessary to the development of the electricity supply industry along the right lines. Incidentally we notice that the net expenses of the Commissioners during the year were £44 000, and we may be permitted to wonder whether Sir ALFRED MOND or any other collection of business men would be able to do so much accurate, painstaking and often uninteresting work so efficiently for such a sum.

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The Present Position of the General Relativity Theory.

By G. W. DE TUNZELMAN, B.Sc.

The position of the general relativity theory and its relation to the development of physical theory in the autumn of 1920, were briefly discussed in a leading article on Physical Theory and Relativity in THE ELECTRICIAN of October 1st of that year. Reviews of Whitehead's "Concept of Nature" and Eddington's "Space, Time and Gravitation" (the latter being, in my opinion, still incomparably the best popular introduction to Einstein's Gravitation Theory) appeared in the same issue, while a review of Whitehead's "Enquiry Concerning the Principles of Natural Knowledge," had already appeared in the issue of April 16th, 1920. The opinions expressed in the article and in these reviews as to the fundamental importance of Whitehead's books, have been amply confirmed by his recently published "Principle of Relativity with Applications to Physical Science," as we shall presently see. It will be no exaggeration to describe these volumes as epoch-making.

Flood of Relativity Literature not Diminishing.

The flood of scientific relativity literature is certainly not diminishing, and Asia is now taking a hand in the shape of contributions by Indian students to British scientific journals, and by Japanese students to their own mathematical and physical journals, which are published, some entirely in English, others in English, French, or German, as the individual writer may prefer. Of recent formal treatises expounding Einstein's theory which are known to me, there are two of outstanding merit—Weyl's "Space—Time—Matter," translated from the fourth German edition (1922), and Eddington's "Mathematical Theory of Relativity" (1923). The former consists of a course of lectures at the Zurich Technical High School. About half the book—viz., some 160 pages—is devoted to the geometry and to the setting-up of the tensor calculus, which is not difficult when thus systematically expounded. Moreover, even Maxwell's electrodynamic theory and the analytic geometry required in developing the general theory, are developed in their main essentials, so that it is admirably suited, as the author intended, to serve as a text-book for students as well as for making physicists better acquainted with the powerful tensor calculus. The development of the dynamics of both fixed and moving electromagnetic fields is notably clear and simple. Really difficult mathematics are encountered only in the concluding sections of the volume.

An Ether of Events.

Eddington's volume is by no means a book for students, using that term in its limited superficial sense. It is addressed to the physicist, and a chapter of 32 quarto pages is devoted to setting up the tensor calculus, which is outside the mathematical equipment of the majority of physicists. The book can be dipped into anywhere, thanks to its arrangement and the adequacy of the index. It is a deductive exposition of Einstein's theory, but a critical one, bringing out every available point in support of the theory, as a leading counsel before the judge, but also exposing its weaknesses, as the counsel closeted with his solicitor. It is, therefore, a delightful book to read. Eddington differs from Einstein and his followers in believing ether to be necessary—an ether of events. A striking instance of the difficulties involved in the denial of an ether is found in an excellent little volume, "An Introduction to Electrodynamics," by the very able relativist Leigh Page, the object of which is to present a logical development of electromagnetic theory founded upon the relativity principle. On p. 51 the author, in deriving the dynamical equation of an electron finds himself driven to the introduction of such a very unsatisfactory concept as the "reaction on the electron of its own field." But this may, perhaps, be regarded as a small matter, in view of the fact that, in the absence of an ether, the existence of the electron would be a *miracle*. The extremely "bizarre" results, as Silberstein expressed it some time ago, arrived at by some of Einstein's more enthusiastic followers, especially among the Germans and the Dutch, originated mainly in their attempts to remove the dense veil of mystery in which his theory envelopes motions of rotation.

Electromagnetic Relativity.

The original relativity principle embodied in the Minkowski space-time is now known as either restricted, special, or electromagnetic relativity. The results of recent observations show that the statement that the tracks of light rays and freely moving particles in this space-time are straight lines must be modified either by the limitation—in the absence of a gravitation field, or by qualifying the light rays also as freely moving. When this is done, the formulation may be regarded as being as firmly established as any conclusion in physics. The formulation in Whitehead's first book, of the ultimate facts of nature as events connected by their spatio-temporal relations, and the fact that these relations are in the main reducible to the property of events of extending over other events, provides a very simple and natural explanation of the homogeneity of time with space. As exemplified in the space-time, it may be regarded as arising from the common share in the quality, more fundamental than either space or time, of extension, which is a quality belonging exclusively to events. In Whitehead's analysis the quantity c, introduced into electromagnetic relativity as the velocity of light in vacuo, or rather in an ether of events and in the absence of matter, emerges from the symmetrical properties of relative velocity as an absolute constant, the meaning of which is seen to be comparability of space-units and time units, and which is found to be equal, within the limits of experimental error, to the velocity of light.

Nothing Magical About Space-Time.

It may be well again to emphasise the fact that there is nothing magical about the Minkowski space-time. It is simply a mathematical method of combining a length defined in terms of three rectangular co-ordinates with the corresponding time, the length and time respectively being those noted by any observer moving without acceleration. These lengths and times respectively vary with the relative motion of different observers, but they combine together into a four-fold continuum in the algebraical expressions defining the interval between two adjacent points just as if the time were a fourth co-ordinate at right angles to each of the space co-ordinates and, analytically, just as in elementary co-ordinate geometry, by making the additional co-ordinate imaginary. The four co-ordinates may then be taken as x, y, z and $ct\sqrt{-1}$, the factor c making the time measure comparable with the space measures. Then the square of the infinitesimal interval between two adjacent points will be given by the sum of the squares of the differences of the co-ordinates of adjacent points, just as in two or three dimensions—viz.,

$$ds^2 = dx^2 + dy^2 + dz^2 - c^2dt^2,$$

and this remains of the same form after any Lorentz transformation. Although we cannot picture relations in a fourfold, we can actually draw a plane section through any pair of axes. A little book (1923) containing "Four Lectures on Relativity and Space," by Steinmetz, contains very simple explanations of the various mathematical spaces included in the general geometry of Riemann, together with a little pocket of stereoscopic photographic cards illustrating the bending of space by means of distorted surfaces which, seen stereoscopically, and that can be done without a stereoscope, appear like solids.

The Work of Einstein.

Einstein's aim is the realisation of Riemann's ideal of —in Riemann's words—"finding the ground of the measure

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relations of the universe" (represented as a geometric fourfold) "in binding forces which act upon it. If these forces vanish, the fourfold becomes Euclidean, and all the laws of physics will become absorbed into a geometric scheme in which there will be no fields of force. These will appear only on the use of a faulty measure system." Then (Eddington, "Math. Theory"): "A field of force represents the discrepancy between the natural geometry of a co-ordinate system and the abstract geometry arbitrarily ascribed to it. A field of force thus arises from an attitude of mind. If we don't take our co-ordinate system to be something different from that which it really is, there is no field of force."

Criticisms of Einstein's Theory.

Eddington's view is that the equivalence principle "offers a suggestion for trial, which may be expected to succeed sometimes, and fail sometimes." Larmor, who was one of the original founders of the relativity theory, points out that, as regards the overt effect, the absorption of gravitation locally into a moving scheme of space and time, is feasible, but that its complete absorption would require—(1) that the local partial schemes of space and time should cohere into a continuous whole; (2) that bodies and light rays are essentially projectiles flying across empty space, which it is a hard saying in face of the developed science of optics and electrics. Weyl states definitely that the general relativity theory provides no inter-connection of the fourfold "world" as a whole. The French mathematician, J. Le Roux, in several papers presented to the French Academy, has subjected the theory to detailed mathematical criticism—(1) In that there is no interaction between a particle and other moving bodies, according to Einstein's formulation; (2) In that the postulated determination of the gravitational orbit of a body by the action principle involves self-contradiction, as he has worked out in special examples. Larmor points out that it is "the slowness of the motions of the celestial bodies compared with the velocity of adjustment by waves across the medium, that permits an analysis attributing to each body a statical field of force, and so renders practical discussion of inter-related orbits feasible." He adds: "This destructive criticism of a purely spatial scheme seems to be fundamental and complete." Turning to the section, Action, in Eddington's "Mathematical Theory," we find that Eddington shows that the Action can be stationary, in Einstein's theory, only in empty space—that is to say, when it does not exist. But he attributes the breakdown to the precise formulation of the law of atomicity of matter not having yet been achieved in Einstein's theory.

Sir J. Larmor's Views.

Sir Joseph Larmor concludes his paper with the statement:—

> If things stand as here claimed it is not involved that the beautiful mathematical theory of general relativity so-called becomes derelict. But an inference does lie that the metaphysic which would absorb gravitation, and even electric fields, into a physical space and time belonging to the masses, and which postulates that space is otherwise mere emptiness and nullity, has been founded on a faulty analysis inconsistent with itself. It is when the theory tries to come into contact with the ordinary material world, with fields of activity produced by atoms, that misfit seems to arise as regards its metaphysical postulations. But the elegant mathematical analysis of fields would still provide an effective method of exploring the inner connections of a field of gravitation with the other primary physical agencies; and if, as is here claimed, closer scrutiny compels a reversion to the view that space is a *plenum*, is an æther in the historical and ultimate British sense held ever since Maxwell and even long ago by MacCullagh, not a crude material substance, but a coherent scheme of local physical relations, then further mathematical and observational development may have gained rather than lost in interest.

Whitehead's Criticisms of Einstein's Theory.

(1) In dealing with nature our meanings must directly relate to the immediate facts of observation. We must first analyse the most general characteristics of things observed, and then the rare casual contingent occurrences. There can be no true physical science which looks first to mathematics for the provision of a conceptual model. (2) Cognisance of nature is twofold—e.g., there is a red patch, and the redness exhibits to you something that is red (*cognisance by adjective*). Further you are cognisant of it as having a spacio-temporal position—that is to say, a certain type of relatedness to the rest of nature, which is thereby involved in the particular experience (*cognisance by relatedness*). But the analysis of the adjectives of appearance attached to the events within any limited field of nature carries with it no certain knowledge of the adjectives attached to the same or other events (*contingency of appearance*). On the other hand, the essential relatedness of any perceived field of events to all other events requires that this relatedness of all events should conform to the ascertained disclosure derived from the limited field. For we can know that distant events are spacio-temporally connected with the events immediately perceived only by knowing what these relations are. They must, therefore, possess a systematic uniformity in order that we may know of nature as extending beyond isolated cases subjected to the direct examination of individual perception (*uniform significance of events*). Thus, the constitutive character of nature is expressed by the contingency of appearance and the uniform significance of events. This doctrine leads to the rejection of Einstein's interpretation of his formulæ as expressing a casual heterogeneity of spacio-temporal warping, depending upon contingent adjectives. (3) In obtaining his law of gravitation by identifying the potential mass impetus of a kinematic element with a spacio-temporal measurement, Einstein leaves the whole antecedent theory of measurement in confusion when confronted with the actual conditions of perceptual knowledge. The potential impetus shares in the contingency of appearance, so that measurement on his theory lacks systematic uniformity, and requires a knowledge of the actual contingent physical field before it is possible—e.g., we could not say how far the image of a luminous object lies behind a mirror without knowing what is actually behind the mirror. (4) He obtains a solution of the gravitational equations for a single point singularity under the assumption that the gravitational field is permanent for the co-ordinates adopted, so that none of the g's are functions of the time in the system of co-ordinates adopted. This would rule out any application of this solution to cases like that of the moon's motion, where the sun and earth clearly cannot both produce gravitational fields permanent for the same system of co-ordinates. (5) Einstein's theory, in explaining gravitation, has made rotation an entire mystery. The section of Whitehead's "Principle of Relativity" containing these criticisms concludes thus: "My whole course of thought presupposes the magnificent stroke of genius by which Einstein and Minkowski assimilated time and space. It also presupposes the general method of seeking tensor or invariant relations as general expressions for the laws of the physical field, a method due to Einstein. But the worst homage we can pay to genius is to accept uncritically formulations of truth which we owe to it."

Whitehead's Achievements.

We have seen that the velocity c emerged from Whitehead's kinematic as a critical velocity, an absolute constant, connected only observationally with the velocity of light. In this kinematic the track of a physical object such as a mass particle or an electron is determined by the stationary property of the impetus realised by the pervasion of the track by the object. This impetus depends partly on the intrinsic character of the object—e.g., its mass or its electric charge, and partly on the intrinsic potential impetus of the track arising from the physical character of the events of the region due to the presence of other objects in the past. This character is gravitational and electrical. Its dependence on antecedent objects is expressed by the formula here adopted for the gravitational law which also directly expresses the principle that the flux of time is essential to the concrete reality of nature.

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It gives this expression by conceiving the attracting body as pervading an element of its track.

So far as matters stand at present, both Einstein's and Whitehead's formulæ give the motion of Mercury's perihelion. Whitehead's formula gives a possible shift of the spectral lines, dependent on the structure of the molecule and on the interplay of the gravitational and electromagnetic fields, and lastly, assuming a well-known modification of Maxwell's equations giving such interplay, the famous eclipse results follow. The shift above mentioned was predicted by Einstein as a consequence of change in the apparent mass due to the gravitational potential. Whitehead's formula ascribes it partly to this cause and partly to the change in the electric cohesive forces of the molecules, due to the gravitational field. The formulæ are practically identical for observational purposes. The limb effect, which has been observed in the case of light from the sun, and the doubling or trebling of spectral lines, observed in the spectra of some nebulæ, have hitherto been unexplained.

Molecules Separated into Three Groups.

Whitehead's investigation shows reason for believing that the molecules will separate into three groups, sending to a distant observer light of changing relative intensities, passing from the centre of the disc of the emitting body (sun or nebula) to the edge. One of these groups has the shift before mentioned, while the two remaining groups have shifts differing from it and from each other. Under circumstances such that all or two of the groups send separately observable light, the trebling and doubling effects are explained to the extent of demonstrating the existence of causes for the multiplication of lines other than those due to the motions of the matter of the nebulæ.

In a steady electromagnetic field the electromagnetic equations predict two novel magnetic forces, due to the gravitational field. These forces are extremely minute—(1) A steady electric force at a point on the earth's surface (F in electrostatic units) should be accompanied by the horizontal magnetic force

$$1{\cdot}2 \times 10^{-9} \times F \sin \alpha \text{ (gausses)},$$

perpendicular to its direction and to the vertical, where α is the angle between these directions. (2) A steady current (I in electromagnetic measure) in a straight wire, making an angle β with the vertical should produce at a point distant R from the wire the magnetic force in a direction parallel to the wire.

$$\tfrac{1}{2} \times 10^{-9} \times \cos \varphi \sin 2\beta \times \frac{2I}{R} \text{ (gausses)},$$

where φ is the angle between the vertical plane through the wire and the plane through the wire and the point.

The temperature of an attracting body should augment its gravitational field by an amount which is probably outside the limits of our observational powers.

Einstein's assumption that a ray of light follows the path $ds^2 = 0$ is proved as an approximation due to the shortness of the waves. The bending of the light rays in a gravitation field, to the extent predicted by Einstein then follows.

It is also shown that the earth's gravitational field will produce no modification of the interference fringes in any experiment of the Michelson-Morley type, in which rays of light, originating from the same source at P are sent along alternative paths from P to Q. The null result of the Michelson-Morley experiment is, therefore, fully explained.

General Requirements of Gravitational Law Satisfied.

In addition to Whitehead's set of integral formulæ, from which the above mentioned results follow, Einstein's and two other sets of tensor differential equations are found to satisfy all the general requirements of a gravitation law. These are—(1) to have no arbitrary reference to any one particular time-system; (2) to give the Newtonian term of the inverse square law, and (3) to yield the small corrections which cannot be deduced as effects of the main Newtonian law. The possibility of such other laws arises from the fact that on Whitehead's theory there is a relevant fact of nature which is absent on Einstein's theory—viz., the whole bundle of alternative time stratifications arising from the uniform significance of events. It is purely a matter for experiment to decide which formula gives most completely the small corrections which are observed in nature. But Einstein's equations, as initial assumptions, have the disadvantages of being difficult to solve and not linear.

Fundamental Phenomena of Rotation Accounted for.

Finally, the theory of space and time here set forth, with its fundamental insistence on the bundle of time-systems with their permanent spaces, provides the necessary dynamical axes, and thus accounts for the fundamental phenomena of rotation.

It was by the introduction of gravitation into the Euclidean, or "flat" Minkowski four-fold, by transforming it into the more general, and therefore less definite, Riemannian four-fold, of which the Euclidean four-fold is only a special case, that Einstein laid himself open to the foregoing fundamental destructive mathematical criticism. But even the Riemannian four-fold was not sufficiently undetermined to allow of the further introduction of electromagnetic fields, and further indetermination was introduced with this object by two alternative theories of Weyl and a third by Eddington, either of which involved a considerable increase in the already formidable analysis of Einstein.

Whitehead, by means of his far more fundamental analysis of natural phenomena, undertaken with the object of eliminating from the foundations of physical science the numerous false and mutually inconsistent concepts which had been introduced by various philosophers from John Locke to the sages of ancient Greece, was enabled to dispense with these complications. All his results were obtained without any departure from the initial simplicity of Minkowski's Euclidean four-fold, with an interval the square of which is equal to the sum of the four squares of the differences of the co-ordinates of two adjacent points.

Some Recent High Voltage D.C. Generators.

According to the "Elektrotechnische Zeitschrift" the Allgemeine Elektrizitäts Gesellschaft have recently manufactured a high tension direct current machine for the experimental station of the Gesellschaft für drahtlose Telegraphie at Geltow.

This machine has a continuous capacity of 30 kW at 1 100 revs. per min. and 4 000 V. It is a 4-pole auxiliary pole machine without any compensation windings. The armature has two separate windings and two commutators, the latter being connected in series. Both armature windings are held in slots which are highly insulated in order to cut down surging as much as possible.

The commutator segments are separated by very thick mica sheets. Two small carbon brushes collect the current, and are staggered so that if any tendency to arc arises the distance between the opposite polarities is the maximum possible.

Another interesting point is the wide insulating sparking surface between the commutator segments and the commutator core. The machine is separately excited from a 220 V circuit by the alteration of which the voltage can be reduced to a 2 000 V. Driving is effected by a 220 V direct current motor.

At the recent summer meeting of the American Institute of Electrical Engineers, Mr. S. R. Bergman described the principles underlying the successful design and manufacture of a high-voltage direct-current generator. He attributed the success of the design to its being based on or built around commutation. A distributed field winding as well as a distributed armature winding made possible successful commutation, even though the voltage between bars was high. The principal mechanical problem was to build the commutator. The principal use of such a machine was to provide the plate voltage for large vacuum tubes.

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Efficient Steam Generation.

Progress in America as Indicated by the N.E.L.A. Report.

By DAVID BROWNLIE, B.Sc. (Hons.) Lond., F.C.S., A.M.I.Min.E., A.I.Mech.E., Mem.Am.Soc.M.E.

The American National Electric Light Association held their forty-sixth annual convention in New York from June 4th to 8th last, and although the full report of the proceedings is not yet available in this country, the abstract of the "Prime Movers Committee" section is, as usual, of great interest to all power station engineers, as it is a record of progress during the past year—chiefly in America—in connection with steam and power generation.

Rapid Increase in Steam Pressures.

In the first place, the rapid increase in steam pressures is commented upon, and we are of course already fairly well acquainted in Great Britain with the various striking developments that are taking place in this direction throughout the world. Quite a number of plants in America will be operating in the near future between 400 to 550 lb. pressure, with temperatures for the superheated steam of 650 to 750 deg. F. It is interesting to note, however, that many American engineers are of the opinion that pressures in the neighbourhood of 500 lb. and over are somewhat in the nature of a leap in the dark, and that it would be far better to go more slowly, although it is recognised by almost everyone that pressures such as 250 lb. are now rapidly becoming obsolete in power stations of any size. The modern power station designer is certainly at the present time in a very unenviable position, in view of the fact that no one knows what will be regarded as the standard steam pressure even within the next twelve months, whilst the struggle between mechanical stoking and pulverised fuel firing is further complicating the issue.

An Investigation into Pressure Drop.

In connection with steam pressures, some attention is given in the report to the considerable difference in the pressure drop between the boiler junction valve and the turbine stop valve, and it is felt in America that some investigation on this point is desirable, especially in connection with the design of steam apparatus and fittings, which seem to be responsible for most of the trouble. It is stated, for example, that in some cases a comparatively slight alteration in this direction has resulted in the pressure drop being reduced more than 50 per cent.

High Pressures, Temperatures and Complications.

As every one knows—just as much by experience in Great Britain as in America—the adoption of high steam pressures and temperatures has resulted in all kinds of complications in the design of what may be termed "boiler plant accessories," and one instance of this is in connection with boiler and pipe coverings. As will be generally agreed, the most efficient pipe covering for all-round use is 85 per cent. magnesia—that is, 85 per cent. hydrated magnesium carbonate mixed with 15 per cent. asbestos to provide "body." Thus a standard high-class job for normal pressures up to, say, 200 lb. pressure, is 2 in. 85 per cent. magnesia followed by ½ in. hard setting composition, whose primary function is to bind the magnesia on to the pipes. The trouble is, however, that the increasing temperatures have brought us within the actual range of decomposition of the magnesia by heat—that is to say, the stage at which hydrated magnesium carbonate begins to calcine, driving off moisture, and at the same time decomposing and giving free CO_2. When this happens, the material entirely loses its granular structure, and is practically no longer any use as an efficient non-conductor of heat. The temperature, however, at which this action begins to take place is a matter of opinion, and it has generally been regarded that 85 per cent. magnesia is suitable for temperatures up to, say, 650 deg. F. According, however, to a recent report of the National Physical Laboratory, this is not the case, and it is stated that magnesia begins to decompose slightly at temperatures even below 500 deg. F., whilst it is fairly rapid in the neighbourhood of 600 deg. F. Further data is undoubtedly required upon this question. At any rate, the N.E.L.A. report shows that with the modern high pressures and temperatures of superheat, the general practice in America—as in Great Britain—is to adopt the principle of having ½ in. of some material next to the pipes which is indestructible by heat. This material, although not primarily intended as a non-conductor, takes the first shock of the heat, and thus enables the covering of 2 to 3 in. of 85 per cent. magnesia to exercise its function as a non-conductor of heat without decomposition—that is to say, the modern composite covering consists roughly of ½ in. non-destructible material, 2 to 3 in. of 85 per cent. magnesia, and then ½ in. of hard setting composition.

Size of Power Stations.

With regard to the size of power stations, the Report points out that several very large stations have now been constructed in Europe, including the Gennevilliers Station in Paris of 200 000 kW, and the two enormous German power stations at Golpa and Goldenburg, which are of 150 000 and 300 000 kW respectively. Whilst on this subject of power stations, it may be stated that at the present time the biggest plant projected in America is 500 000 kW. This is the Crawford Avenue Station of the Commonwealth Edison Co. of Chicago, of which at the moment 160 000 kW is under construction, the steam pressure being 550 lb. (gauge) and the temperature 720 deg. F., whilst the boilers are comparatively small—namely, 14 500 sq. ft. heating surface each.

The new Trenton Channel of the Detroit Edison Co., with which the readers of THE ELECTRICIAN are already familiar, is to be eventually 300 000 kW, 100 000 kW being under construction at present, the steam pressure being 415 lb. and the temperature 700 deg. F. As is well-known, the "Lopulco" system of pulverised fuel is being adopted, and the boilers are 29 000 sq. ft. "Stirling" type. Another huge plant in America will be the Hudson Avenue plant of the Brooklyn Edison Co., which is to be eventually 400 000 kW, and of which at the present time 100 000 kW is under construction, with a steam pressure of 265 lb. and a temperature of 611 deg. F. The Cahokia Station, on the Mississippi, of the Union Electric Light and Power Co., of St. Louis, will be 240 000 kW, 60 000 kW being under construction, and pulverised fuel is also being adopted on this plant, the pressure being 300 lb. and the steam temperature 690 deg. F. Another high-pressure station in America is the Waukegan plant at Illinois, to work at 400 lb. at the boiler and 700 deg. F., which will be eventually 250 000 kW, 20 000 kW being under construction.

America is naturally, of course, the home of large installations, because of the enormous demand, and it is for the same reason that such large individual units—both as regards boilers and turbines—can be adopted and kept going at normal output.

Mechanical Ash-Handling Problems.

Some interesting data is given in the Report with regard to the troublesome question of mechanical ash handling. As is well known by bitter experience to most power-station engineers, mechanical ash-handling is probably the least satisfactory of all the operations in the average power station. The Report states that of the data collected from 41 large representative American stations, the material is dumped direct into railway cars in the case of 15 plants, whilst only 7 adopt direct conveying. The general method is either the use of locomotive cranes or bridge cranes, using apparently telphers. There are to-day, in general, three ways which can be stated to be satisfactory for ash conveying:—

1. Building the station sufficiently high up above the ground so as to make the ground level the ash level, and shunting the railway wagons direct under the ash hoppers.
2. The use of telphers operating grabs, or alternatively locomotive cranes with grabs, used in conjunction with small cars run under the ash hoppers.
3. The water sluice method, either on the principle of a continuous sluice of water on an incline, an intermittent flushing sluice, or the use of a stationary sluice of water with a drag conveyor under the water level.

The method of building stations high up has now quite a number of advocates in Great Britain, and it is undoubtedly a very convenient one, except that it is apt to be costly in the way of extra foundations and building, whilst a minor trouble is the necessity of some sort of sidings to provide a continuous service of wagons.

The telpher or locomotive grab is generally an extremely satisfactory method, although the whole question of ash conveying seems to be somewhat in the melting-pot again, due to the perfection of the water-sluice method, which has many advantages, the ash and clinker falling direct into the water from the ash hoppers, being quenched and conveyed on the spot

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without dust or smell. It will be generally acknowledged that for large stations many methods formerly favoured, such as the use of tray conveyors, bucket elevators and suction methods, are no longer practical propositions, especially in view of the increasing weight of material that has to be handled.

No Air Heating.

A considerable amount of attention is naturally given in the Report to the exciting struggle between mechanical stoking and pulverised fuel, although so far as can be judged from the abstracts, this section seems to be very disappointing. As regards mechanical stoking, it is a very remarkable fact that, according to the Report, no large power station in the United States has yet adopted the efficient principle of air heating, although the reason for this does not seem to be very clear.

Attention is also given to the somewhat troublesome question of the arches over chain grate, travelling grate and similar types of stokers, and much difference of opinion seems to still exist in America with regard to the shape and sise of these. The use of the suspended firebrick arch, in connection with which—as is well-known—the "Detrick" type has now been brought over to Great Britain, continues to grow, and numerous methods have been devised of air cooling and water cooling the side walls of the combustion chamber, whilst there is some tendency to adopt this principle also even in the case of the arches.

With regard to pulverised fuel, the Report does not seem to be at all full, and the statement is made that the application of pulverised fuel firing is in a state of flux, and much experimental work remains to be done. This seems to be hardly fair, to say the least of it, in view of the very large number of installations that are now running in America, some of them of enormous size. It is mentioned in the report that one of the objections to pulverised fuel is the fact that it causes a reduction in the temperature of superheat, and one case is given in which a certain boiler plant was obtaining 225 deg. F. superheat with mechanical stokers, and when pulverised fuel was adopted, the temperature was only 125 deg. F. This, however, does not seem to be a very logical objection to pulverised fuel. What happens of course is that this method of firing enormously increases the efficiency of the boiler itself and leaves less heat available for the super heater and the economiser. It would sound very strange if anyone was to invent a boiler that would give 100 per cent efficiency, and someone else was to come along and raise the objection that there was no heat left for the superheater and economiser (!) If pulverised fuel is going to raise the efficiency of the boiler itself, the remedy, of course, as the Report suggests, is to adopt the radiant heat principle of superheating, or even—if necessary—externally fired superheaters.

Degassing Boiler Feed-Water.

Considerable attention is also given in the Report to the necessity of "degassing" boiler feed-water, a consequence of the adoption of very large boilers, since of course evaporations like 250 000 lbs. and over per hour soon begin to corrode the boiler, due to the small quantity of dissolved air present in the water. It is pointed out, for example, that water which leaves the main condensors with practically no oxygen soon contains 0·75 — 1·40 cub. cm. of oxygen per litre, even when the water is as hot as 180 deg. F., by the time it is ready to go into the boilers. This action is particularly severe on the steel tube economisers which are now being largely adopted in America. As is well-known, the principle in use is to pass the water through lower oxides of iron or very finely divided iron, which de-aerates the water, that is to say, absorbs all the oxygen.

Chimney Practice.

A very interesting section is that dealing with chimneys, and the four standard types in American power stations are steel, radial or common brick, reinforced concrete, and a combination of tiles and reinforced concrete. As is well-known, one of the chief troubles with the steel chimney is corrosion, and the bitumastic or similar paints which are used are not by any means satisfactory. We understand, however, that in Great Britain a new paint has been produced, manufactured from coal tar, which consists essentially in depositing a colloidal film of carbon on the steel plates, which is claimed to have remarkable resistance to corrosion.

The American practice with steel chimneys is to line the chimney inside with firebrick right up to the top, and grout in the space between the outer plates and the lining with cement, which is stated to protect the steel very considerably. The top of the chimney is fitted with a cast iron casing to avoid the possibility of rain water getting down between the lining and the casing. The ordinary brick chimney is now becoming entirely obsolete in America for large stations, and when bricks are used, these are all of the radial pattern. As regards the use of concrete, a typical American idea, the general opinion is that concrete has not been in use long enough for chimneys to decide definitely as to its suitability, and many American engineers are not altogether convinced on the matter.

Methods of Control.

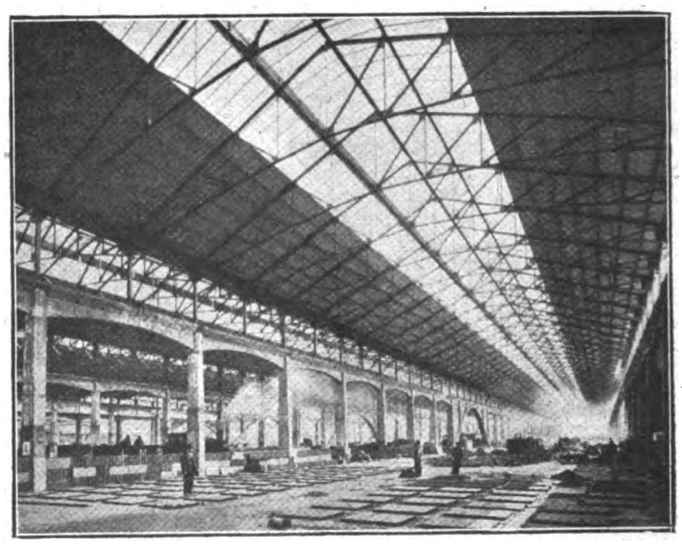
Another striking principle which is being more and more adopted in American power stations is what may be termed "ultra-scientific" methods of control, a subject in which it seems to be almost hopeless to get most power station engineers in Great Britain to take any interest. The advance of pulverised fuel, especially on very large boiler plants, has rendered possible the entire control of power station boiler installations merely from a switchboard. That is to say, the operator sits in a small room far removed from the boilers, and has a board in front of him on which is arranged a complete battery of switches and instruments, and he is able in this way to control entirely the working of the boiler plant by manipulating the switches according to the indications, adding, for example, more or less pulverised fuel automatically with the varying air supplies, maintaining the steam pressure with the maximum CO_2 and with suitable temperatures at every point of the plant, etc., etc.

Certainly it is a cheerful sign that there is no standing still in the science of steam generation, and it is beginning to be realised very fully in America that this question of steam generation is a separate science in itself, which is developing a group of men who are essentially chemical engineers specialising in the efficient generation of steam

British Empire Exhibition.

Forthcoming World Power Conference.

As few exhibitions are ever ready until after the official opening date, the accompanying illustration of the Machinery Hall at the British Empire Exhibition, Wembley, is of particular interest as showing the remarkable progress that has been made nine months before the exhibition is due to commence.



THE MACHINERY HALL, WHICH IS RAPIDLY NEARING COMPLETION.

As previously announced, the first World Power Conference is to be held at the Exhibition under the presidency of the Earl of Derby, when it is expected that the development of water power will be one of the principal subjects for discussion.

The Council of the British Electrical and Allied Manufacturers' Association, in arranging the final programme, has the co-operation of the Admiralty, the War Office, the Air Ministry, the Department of Scientific and Industrial Research, the National Physical Laboratory, the Institution of Electrical Engineers, the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Society of Chemical Industry, the Federation of British Industries, the Cable Makers' Association, the British Engineers' Association, the British Empire Producers' Organisation, the Industrial Fatigue Research Board, and other bodies.

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An Interesting Modern Condensing Plant.

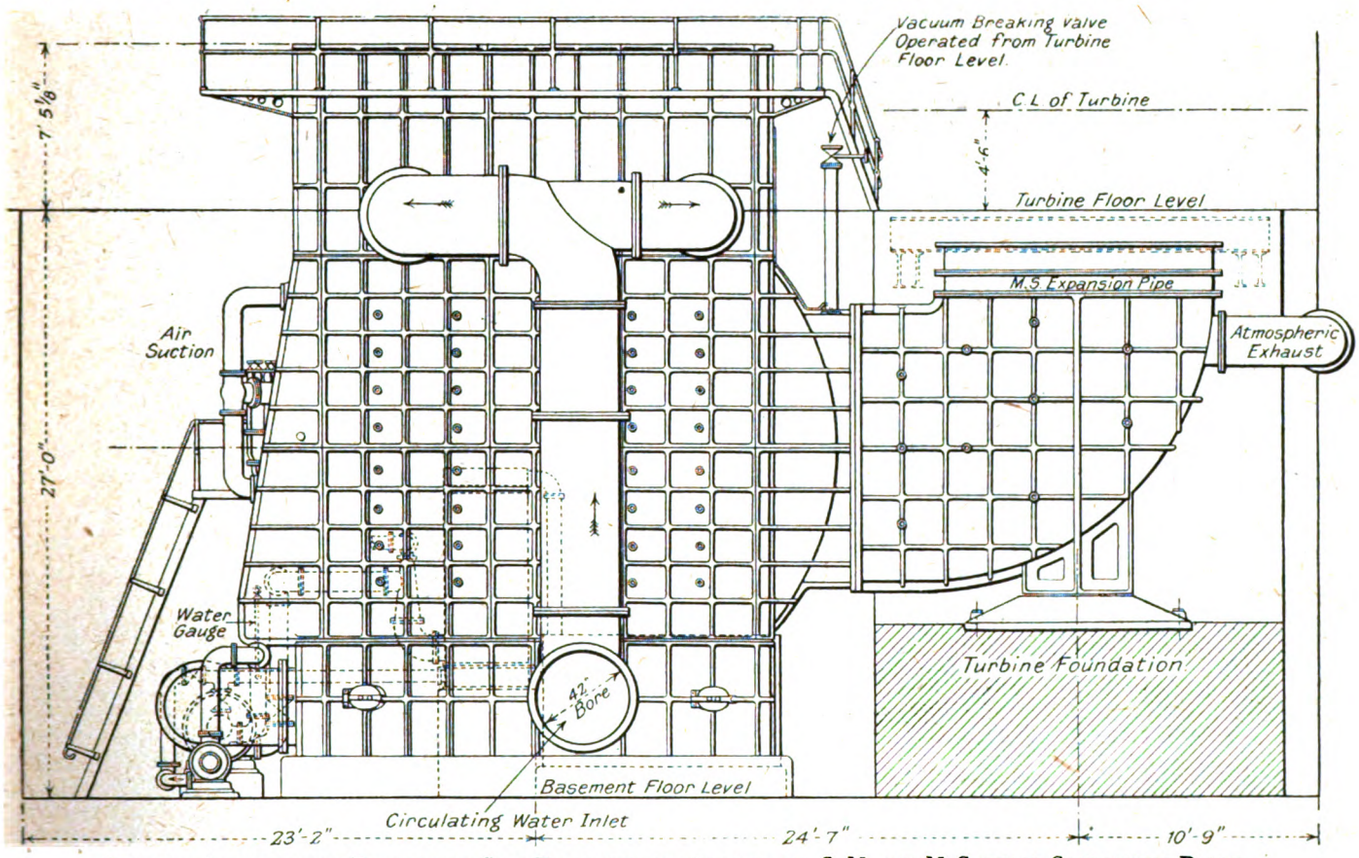
The efficiency of the generating station not only depends on the boiler house equipment and the turbo-alternators, but upon the design and construction of the condensing equipment. The conditions which make for successful condensation are by now well understood, but their carrying out in practice is sometimes made more difficult by site limitations and plant arrangements. The surface condensing plant recently manufactured by COLE, MARCHENT and MORLEY to work in conjunction with a 12 000 kW turbo-alternator at Leeds is therefore interesting both from the points of view of design and construction.

The condenser is constructed to meet special conditions, is arranged vertically, and designed to deal with 220 000 lb. of steam per hour, while maintaining a vacuum of 28·5 in. with the barometer at 30 in., with cooling water at a temperature of about 65 deg. F.

Details of Plant.

The main features of the condenser are as follows: At the top is a deep open box having three connections on one side for the circulating water inlet, outlet connections and weir with a grid box on the other side for an overflow pipe. Gates or dividing plates are fitted in this box to enable the circulating water to flow twice through the tubes when required. For single flow these gates may be raised and suitable gear for the purpose is provided which is operated from a platform surrounding the top of the condenser.

The centre portion of the condenser, forming the actual condensing chamber, is arranged with the exhaust steam inlet at one end and the air outlet branches at the other, two of which are supplied, one at the top and one below the centre division of this section, a further branch being arranged at the bottom for connecting to the extraction pump.



GENERAL ARRANGEMENT DRAWING OF SIDE ELEVATION OF 46 000 SQ. FT. C. M. AND M. SURFACE CONDENSING PLANT.

The capacity, principal dimensions and weights of the equipment are as follows:

Area of cooling surface	46 000 sq. ft.
Water circulating through the tubes	Once, and, if required, twice
Quantity of circulating water required	2 400 000 galls. per hour
Overall size of shell, including the top and bottom circulating water boxes	28 ft. from back to front 34 ft. high 11 ft. from side to side
Overall size of plant including exhaust connections and pipework	58 ft. from back to front 35 ft. 6 in. high 46 ft. from side to side
Dimensions of exhaust opening	12 ft. high by 6 ft. wide
Circulating water outlet	42 in. diameter
Weight of condenser with pipework, tube plates, tubes, pumps, etc.	Approximately 220 tons
Weight of tubes and tube plates	60 tons

It is interesting to note that there are approximately 31 miles of tubes, and that the circulating water equals about twice that of the total Bradford town supply.

To avoid the necessity of deep foundations or an excessively high engine-house, the exhaust inlet has been arranged on one side and the connection to the turbine exhaust outlet is made by a curved adapting pipe with a copper expansion pipe immediately below the turbine exhaust. This arrangement means that the turbine and condenser are side by side, and, in fact, the top of the circulating water inlet box is at approximately the same level as the top of the turbine.

A feature of the condenser is the method of staying. There are 48 lateral stays, each 1½ in. in diameter. These are contained in a cast-iron tube, which is a fit between the two sides of the condenser. Four cross girders arranged laterally act as stays to the condenser shell, and support the tube plates both at the top and bottom. In addition to the lateral stays there are vertical stays which tie the top and bottom tube plates together, the supporting plate in the centre being secured to these stays by means of collars.

The tube plates are of brass, the top one being $\frac{15}{16}$ in. thick and the bottom one 1 $\frac{3}{16}$ in. Each plate is built up of six sections, and above the top plate a guard plate 1¼ in. thick is fitted, having special bell-mouthed openings exactly coinciding with the holes in the tube plate. This is a special provision to meet the conditions of leaves, fibre, etc., being present in the circulating water.

The tubes are 1 in. internal diameter of solid drawn brass and 18 S.W.G. thick, expanded into the top plate and fastened in the bottom plate by cotton tape packings and screwed ferrules.

The base of the condenser forms a water box and settling chamber, having a branch at one side for the circulating water inlet for use when it is desired to convert the condenser into a two-flow. At one end circulating water outlet branches are provided, and in addition there is another branch so that sludge and dirt can be flushed out as required.

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As will be seen from the illustration the condenser is built up of cast-iron plates, each being ribbed to withstand external pressure.

Air Extraction.

Air extraction is carried out by three sets of C. M. and M.-Delas steam jet air extractors of the intermediate condenser type, two of which are sufficient to deal with the air to be extracted, the third acting as a spare, and these are arranged at the end of the condenser opposite the exhaust branch with a special platform and ladder to ensure easy access to them.

There are two extraction pumps of the multi-impeller centrifugal type, one of which, together with a multi-stage rotary boiler feed pump is driven by an auxiliary turbine developing 102 B.H.P. at a speed of 2 500 revs. per min., and the other direct coupled to its own electric motor.

The main feed tank or hotwell is approximately 10 ft. by 10 ft. by 6 ft. and the boiler feed supply tank 6 ft. by 5 ft. by 6 ft. Both are built up of cast-iron plates. In connection with these two tanks there is a 6 ft. Venturi meter with integrating and recording mechanism, having a range of 3 000 to 25 000 gallons per hour with bye-pass and valves to enable it to be isolated when required.

Pipework and Valves.

The circulating water is pumped from the River Aire through a 42 ft. diameter inlet pipe up to the top box of the condenser, and after passing through the tubes to the lower box it drains back into the river by gravity. Reference to the drawing will give the reader a better idea of the general arrangement of this pipework than can be done by a description.

Surface Feed Water Heater.

A feature of the C. M. and M.-Delas steam jet air extraction principle is that about 85 per cent. of the heat in the steam operating the jets is recovered by heating the water for boiler feed purposes. With the plant in question both the auxiliary turbine exhaust and the exhaust from the C. M. and M.-Delas air extractors pass through a feed water heater which is of the surface type having a cast-iron casing with ¾ in. diameter 18 S.W.G. solid drawn brass tubes, and is situated in a convenient position on the side of the condenser, near the auxiliary turbine and air extractors.

The Electrochemical Effects Produced by Superimposing Alternating Currents upon Direct Currents.*

By W. R. COOPER, M.A., B.Sc., F.Inst.P.

Some curious effects have been observed when alternating currents are superimposed upon direct currents during electrolysis. Certain electrolytic reactions can be carried out at a lower voltage, with consequently modified products, by this means. Electrolytic corrosion of electrodes, according to S. G. Brown, is much more marked than by direct current alone.

More recently H. M. Goodwin and M. Knobel have discussed the effects of alternating currents on hydrogen overvoltage. Certain observations made by the author, and here described, may lead to a clearer appreciation of the subject.

A general distinction may be drawn between low frequency and high frequency currents, and a further classification may be introduced depending upon the relative magnitudes of the alternating and direct currents. Three cases may be distinguished :

Three Cases.

Case 1. The amplitude of the alternating current is smaller than the value of the direct current. The resultant effect is the production of a fluctuating unidirectional current, or a direct current with a ripple upon it.

Case 2. If the amplitude of the alternating current is equal to the value of the direct current the resultant current falls to zero at each cycle.

Case 3. If the amplitude of the alternating current exceeds the value of the direct current there will be a reverse current once every cycle.

* Abstract of a Paper read before the Faraday Society.

In the original paper the arrangements for enabling an alternating current to be superimposed upon direct currents are described. When electrodes of approximately equal size and the same material were used no evidence of rectification could be detected, and this could not explain the phenomenon. It also seemed desirable to see whether any appreciable electro-deposition or electrolytic corrosion, as recorded by S. G. Brown, could be observed. Experiments were made on electrodes of copper sheet in a $CuSO_4$ solution, rendered acid by the addition of 5 per cent. of H_2SO_4. It would appear that no great difference is caused by superimposing low frequency a.c. under these conditions.

Details of Experiments.

Numerous experiments with platinum wire electrodes in dilute H_2SO_4 were also tried. With regard to the three cases specified at the commencement of the paper it was found that a superimposed alternating current gave an increase irrespective of the relative values. The case where the amplitude of the alternating current is smaller than the direct current value is the most interesting and the least explicable, as in this case there is presumably no actual reversal of current. The percentage increase may, however, be much more with a small direct current than with a larger one. Although for a given direct current the increase becomes greater as the alternating current is made greater the rate of increase soon falls off. A case is quoted in which an alternating current of 0·039 A gave initially an increase of 0·041 A (or 55 per cent.) and 0·08 A gave an increase of 0·55 A (or 73 per cent.). The fact that the increase does not pass off at once when the alternating current is switched off is also interesting. The comparatively slow return to the original value (e.g., a fall from about 13 to 2·5 mA in about 1 minute) presumably indicates a disturbance of the state of polarisation and will be less marked the smaller the electrodes, or the larger the current. A current of as much as 0·1 A took 2 min. to become normal.

The greatest sensitiveness is obtained when the voltage applied to the electrolytic cell is below that of decomposition. Thus whereas with 0·25 applied volts the increase was 0·3 mA, with 3·25 V it was 18·6 mA. The electrodes were examined under the microscope. At times the whole of the hydrogen was absorbed by the cathode, although the oxygen was given off freely at the anode. In one case the current could be taken well over 1½ mA before hydrogen was noticeable ; but the application of high frequency current at once caused an evolution of gas. A feature is the large size of the hydrogen bubbles. The oxygen bubbles appear to get away more easily.

When high frequency currents were used it was found, with an applied d.c. voltage below the decomposition voltage, that the effect was much less than that of low frequency, but the appearance under the microscope was the same.

A Curious Phenomenon.

Further, a very curious and apparently new phenomenon was observed. If the applied voltage is reduced until only one or two minute bubbles form upon the wire electrode, or even if the applied voltage is cut entirely out of the circuit, and a small high frequency current is passed momentarily (for example, by allowing merely a spark or two to pass across the gap), a large hemispherical bubble forms over the electrode. The most curous feature is that this bubble starts its formation, not from the electrode but from the body of the electrolyte. The formation appeared to start about 3 mm. below the electrode in the electrolyte. It travels very fast and takes up its position with unerring accuracy. Another curious point is the very large size of the bubble compared with those formed by electrolysis. The result is the same whether the wire is anode or cathode. As far as the author is aware, an electrolytic decomposition of this kind at a distance from the electrode has not been previously observed. It seems to be due to an electric discharge starting in the electrolyte. The discharge is audible, and in the dark it is luminous. The effect generally seems to be closely connected with the absorption properties of platinum.

The direct current responded very readily to a high frequency impulse whether the wire was anode or cathode. Experiments with a larger wire electrode, similar to those already described with low frequency currents, showed that the sensitiveness, expressed as the percentage increase of the direct current, was greater with the wire as anode. This is the arrangement that is usual in the electrolytic detector.

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Starting and Accelerating Peculiarities of Electric Rolling Stock.

By J. AUSTIN BAKER.

A tramcar may be considered as a symmetrical vehicle about its vertical and horizontal centre lines. This class of transportation unit is propelled by two or four motors of identical manufacture, whilst the control gear is of similar construction. From this it would logically follow that the tramcar would start and accelerate equally well when driven from either of the two ends. This condition of affairs does not exist, as all traffic men will agree, for the starting and accelerating characteristics of a tramcar differ when driven from No. 1 and No. 2 ends respectively.

This peculiar state of affairs is due to the fact that one motor of two in series is always electrically No. 1 and close to the line, whilst No. 2 motor is arranged for the negative field lead to be earthed. No doubt the theory of design and test bed practice would go to prove that no matter what series of connections are made each of the two motors in series takes up 50 per cent. of the total load imposed upon the two motors.

Operation of the Two Motors.

As a result of a series of experiments on tramcars, and following a number of road observations, it has been definitely established that No. 1 motor, when at the leading end of the car, inclines to race, and if this slip is not corrected the motor will race to its voltage limit and consume little current, whilst the second motor, deprived of its reasonable share of the line pressure, will just have sufficient energy to keep moving.

The "racing" of No. 1 motor usually occurs on grades, curves and greasy rails, although the trouble is ever present, as is well known to tramway engineers and traffic men. When No. 1 motor is leading and racing the car body on springs is inclined to lag behind the motor, and momentarily the actual weight is thrown backwards towards the second motor, and, as previously explained, this motor is doing little work in propelling the car. It will now be clear that No. 1 motor is trying to "pull" the car.

Effect of Rear Motor.

If the tramcar is travelling on the return journey and No. 2 controller is being used, it will be understood that No. 1 motor is at the rear of the car, whilst in this case No. 2 motor is in front. Arranged in this manner, it will be realised that, motionless, the car weight is equally divided over the two motors, and if, at the moment of starting No. 1, the rear motor "lifts" the car body and "pushes" the weight forward, not only is No. 1 motor fully loaded, but, as the car body is an elastic structure, the weight is thrown forward on to the front motor.

Now since No. 1 or the rear motor does not slip it follows that both Nos. 1 and 2 motors have a similar line pressure about their respective terminals, and each of the two motors is taking a similar current. From this it follows that the correct procedure is to arrange for the "lift" and "push," as opposed to "pull," so far as traction work is concerned.

A further peculiarity has been noticed, and a considerable amount of examination and research was needed to establish the cause of commutator trouble. When No. 1 motor is leading and "pulling" the car, No. 2 motor is doing little useful work, but when the transition from "series" to "parallel" is made No. 2 motor is momentarily "short-circuited" and then thrown across the line, both motors being in "parallel." From being a comparatively idle unit No. 2 motor becomes momentarily dead, and is then suddenly energised to its full capacity, less a little resistance, and is thus compelled to take up its load at once.

Impulse and Reaction.

The electrical impulse is a heavy one, whilst the mechanical reaction of a 14-ton car is equally large: it follows that a brush "flash-over" is to be expected, and this means a gradually blackening commutator, followed by flat spots, ridges, rapid brush wear, poor commutation and feeble rheostatic braking, and after a few months of such treatment No. 2 armature is sent to the shops for the commutator to be turned up to a true diameter.

Needless to say, there is no commutator trouble when No. 1 motor is at the rear of the car and No. 2 motor is leading, for this commutator defect is only noticeable when No. 1 motor is pulling. The system of series-parallel wiring has been in use since the earliest days of electric traction, and it is the universal practice for any two traction motors in series to be arranged so that No. 1 "pulls" in one direction and "pushes" in the other direction. The experiments, however, taught that the best results were obtained from the "push" system as opposed to the poor results of the "pull" principle.

Further Experiments.

Some further experimenting brought about a change in the control and motor circuits such that several tramcars were rearranged to ensure that, which of the two ways the car was running, No. 1 motor was always in the rear, the earth being on the leading motor. These experimental cars with the "push" type of wiring have been running for seven months with satisfactory and economical results.

There is no wheel slip, sand is not needed to assist adhesion, each motor is well within its load capacity, the driving wheel tyres at No. 1 and No. 2 ends are wearing down evenly, the current consumption—especially on grades, curves and greasy rails—is lowered, round trip timing is reduced owing to quick, smooth and uniform acceleration, whilst nothing in the shape of dirty commutators has been seen and motor defects have dropped to a large extent, and the re-wired cars are popular with the motormen who handle them.

Although the peculiarities of tramcars formed the basis of the experiments, the same characteristics have been observed on electric railway rolling stock, and are, no doubt, inherent in unequally loaded motors in series.

To make so simple and yet so drastic a change from the conventional is to court criticism and controversy. At the same time, the experimental cars are in full day service, and by their "pushing" advantages help to silence the sceptics and convert the waverers. The author has to thank his colleagues, Messrs. Edwards and Etheridge, for their valuable help during the experiments and for the evolution of an entirely new traction motor wiring system.

Cold and Hot Electron Discharges.*

By W. SCHOTTKY.

This Paper is an attempt to state the theory of electron discharge in a simple manner, without complicated mathematical formulæ. Much use is made of a simple mechanical analogy, in which a shallow saucer, with a plane horizontal bottom and curved sides, contains a number of small balls, which are moving about on the surface with different velocities, and run up the sides reaching the upper edges if their velocity is sufficiently great.

The analogy with the electrons, which pass out from the surface of a cathode with an average velocity which depends on the temperature, and which are able to escape from the surface if their velocity is sufficiently great, is, of course, by no means exact; but by supposing that a force can press down the edge of the saucer, and so enable more of the balls to escape, the author visualises the action of a field acting towards the cathode, which "overcomes" the field in the opposite direction caused by the mirror images of the outside electrons in the conducting surface, and makes it easier for the electrons to pass beyond the surface layer.

The edge of the "saucer" may terminate in a plane table, on to which the electrons run and move outward without any acceleration due to gravitational force; or the table may slope downwards in all directions from the edge of the saucer, and the balls which represent the electrons will be accelerated "towards the anode" (the edge of the table) as if by an electric field. In some cases the rim of the saucer may be bent right down by the outside field, so that all electrons which pass out from the surface are free to escape, whatever their temperature speed.

Increase of Thermal Saturation Current.

The author uses these ideas to explain the increase of the thermal saturation current by strong fields; cold electron discharge, in which connection he dwells on the probable effect of sub-microscopic points. F. Rother's experiments on discharge with minute distances between the electrodes are dealt with, and the possibility of positively charged metallic ions being driven out from the anode is mentioned; these may pile up on the cathode and make its surface irregular. Crystal detectors are next dealt with, where the relations between two "saucers" with edges of different shape and height come into play, and the bottoms of the saucers may be alternately on high and low levels with regard to each other. The mechanical analogy gives a satisfactory picture of the observed facts as to current flow through such contacts when the potential is varied, current voltage curves being obtained which agree with the measurements of Huizinga, 1922.

*Abstract from "Zeits. f. Physik," 14.2, pp. 63-106, 1923.)

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Atomic Projectiles and Their Properties.

(*Continued from page 61*).

Collision Rules.

In the fifth lecture of the series before the Royal Institution, Prof. Rutherford repeated that the collision rules were independent of any assumption as to the nature of the forces, but the frequency of the collisions was dependent upon those forces. Actual collisions with a nucleus were rare; none might be found on a hundred photographs; but their probability increased as the α particle was losing speed u, proportionally to u^4. The attracting and repelling electric forces depended upon the charges, and they had been deduced from scattering tests. Moseley had originally supposed that the number of nuclear positive charges on an atom was equal to the atomic number N; but the frequency η of the radiations from the atoms varied with $(N-\alpha)^2$, not with N^2, where α had the value 1 for K radiations, value 7·4 for L radiations, and so on. The α was due to the disturbing influences of the inner electrons in the nucleus. The value of N varied by one unit as we passed from one elementary atom to the next in the periodic table; the α would then constitute a correction, if N represented the nuclear charge. But it was most important definitely to prove that N really represented that charge, and that proof had been given by Chadwick with the aid of an apparatus similar to that of Fig. 24 (later used by Chadwick and E. S. Bieler). The α particles from *RaC* fell from *R* through stops (not marked) on the ring screen *A* of the substance to be examined, the central window in *A* being kept closed: particles widely-scattered by *A* left the box through the hole *O* and fell on the fluorescent screen *S*, the scintillations being counted by the aid of the miscroscope; there would be perhaps 50 scintillations per minute. The window was then

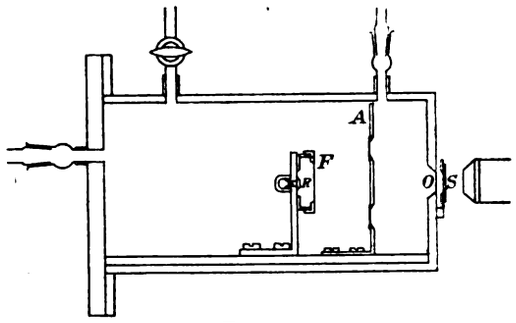

FIG. 24.

opened to count the total number of particles emitted, so that the fraction of particles scattered through definite angles could be deduced. The difficulty arose then that the particles followed one another so quickly, perhaps 1 000 per min., that counting became impossible. A rotating disc was therefore introduced between the hole *O* and the microscope; this disc had a radial slit of such width that only one particle in 1 000 would be able to pass. From these experiments Chadwick deduced the following nuclear charges, which agreed closely with the figures in brackets, the atomic numbers: Cu 29·3 (29); Ag 46·3 (47); Pt 77·4 (78).

Confirmation of Modern Theory.

That very satisfactory confirmation of the modern theory implied that the inverse square law held for the collisions observed, and further that the scattering varied as u^4, as above mentioned, at any rate for a zone lying between 10^{-10} cm. and 5×10^{-12} cm. from the nucleus, making the *a* allowance for the inner *K* electrons. Whether it would still hold right up to the surface—supposing we could speak of a nucleus of definite shape—only experiments with very light atoms (of low atomic weight) could decide, the small positive charges of which would not turn the α projectile aside as the heavy atoms in Fig. 21 did. When an α particle hit a helium atom normally we had the case of the two equal billiard balls: the striking ball would stop, the struck ball would go on with the original velocity of the striker; but we could not distinguish the one from the other. When an α particle of mass 4 struck a hydrogen atom of mass 1, the latter should, by the laws of mechanics, go on with 1·6 times the speed of the α, and since the hydrogen carried only 1 charge, the α particle 2 charges, the hydrogen atom should travel 4 times as far as the α, which would itself continue its motion. This was first observed by Marsden; in Fig. 25 the α particle could only be deflected from its path by a maximum of 14 deg., the hydrogen shot off upward. The hydrogen atom would also produce scintillations, but fainter than those of α particles.

From calculations based upon similar experiments Blackett had estimated the mass of the hydrogen atom to be 1·024 (instead of 1·008). In obtaining his first trails of hydrogen particles in a Wilson apparatus, Chadwick fired α particles

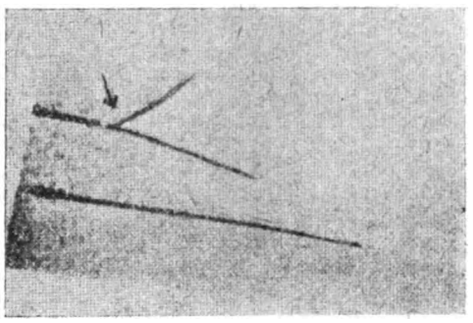

FIG. 25.

through a block of paraffin (consisting of carbon and hydrogen). In Fig. 26, the shot out hydrogen collided with a nitrogen atom in a Wilson apparatus; the hydrogen bounded back, whilst the recoil of the heavy nitrogen atom was indicated by a spur. In these and in similar experiments, made with the aid of the apparatus in Fig. 24, Sir Ernest, J. Chadwick, and E. S. Bieler found that the number of hydrogen atoms liberated from compounds by bombarding α particles was 20 and even 100 times greater than they had expected, and further, that the frequency of the collision decreased (instead of increasing) as the α lost speed. The rules they had deduced for collisions with heavy particles therefore broke down. That was partly due to the fact mentioned that with lighter atoms actual collisions became more probable. But there was the further circumstance that the nuclear forces had been assumed to be mere point charges. Retaining that assumption only for the hydrogen nucleus, C. G. Darwin had calculated the conditions of scattering for the two extreme cases, that the α particle itself resembled either a flat disc or plate, or a solid sphere, both the plate and sphere to be perfectly elastic so that particles would rebound. The result of the elaborate calculations was that the helium nucleus might be something intermediate between the plate and the sphere, i.e., an oblate spheroid of the shape of Fig. 27, with axes equal to 8 and to 4×10^{-13} cm. For convenience sake, the hydrogen nucleus was supposed to be the projectile, and the α particle the target. Assuming perfectly elastic collision—which was again an artificial assumption—the law of inverse squares should hold

FIG. 26.

outside that spheroid. But the α particle could not merely act as an elastic reflector, and once the hydrogen entered the nucleus of the spheroid, gigantic forces would come into play. The whole system might become distorted. Possibly, moreover, the α particle was not really symmetrical, a new law of force might have to be reckoned with, and the relative rotations would set up magnetic forces. In any case, we had to introduce other conceptions than those of the Newtonian inverse square law for the astronomy of these minute systems and distances.

The Nucleus of an Atom.

Applying in the sixth postponed lecture these arguments to the attack of the nucleus of an atom by α ray bombard-

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ment, Sir Ernest said that if the nucleus of radium *C*, which might, he supposed, be a sphere, fired out an α ray, that particle would start with a certain velocity, and if the converse case were taken and some particle was imagined shot from outside to arrive at the sphere with that velocity, the particle would reach the actual structure, but would not much disturb it. A heavy atom of an atomic number of about 80 might be approached within 4×10^{-13} cm., assuming the inverse square law to hold outside the nucleus, and would then be reflected. In the case of a lighter atom like oxygen (atomic number 8), the α particle might come ten times closer, that is, within 4×10^{-13} cm., and might carry enough energy to disintegrate the structure in a head-on collision. Another idea had further guided him in the experiments he had described. There was evidence that the helium nucleus of mass 4 was one of the constituents which built up the nuclei of other elements; the mass of the oxygen atom, for instance, was $16 = 4 \times He$. That would not apply to nitrogen, e.g., where mass $14 = 3 \times 4 + 2$, the 2 would represent something else, probably hydrogen nuclei (called protons) of mass 1. In such considerations, it must be remembered that the positive

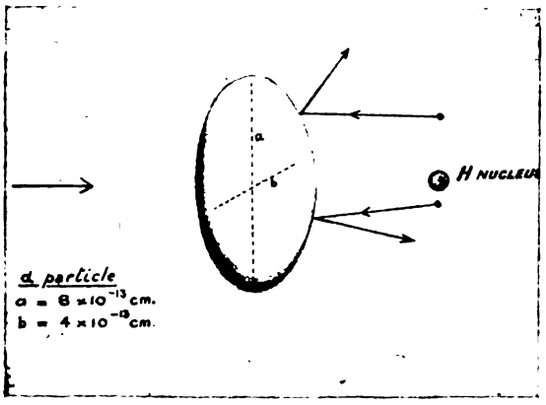

FIG. 27.

charge on the nucleus was the resultant charge due to the positive and to the negative matter; in the case of helium itself the mass was 4, but the resultant charge (equal to the atomic number) was only 2.

Peculiar Effect with Shooting Rays.

When shooting α rays some years ago he had noticed a peculiar effect: Particles appeared which travelled at high speed and had a long range and were able to make a screen of zinc sulphide scintillate. At the time of this first disintegration of the nitrogen of the atmosphere the counting of the few faint scintillation flashes had been a very laborious process, and the progress since made had been due mainly to improvement of the technique, chiefly of the microscope. They wanted for this purpose microscopes different from any other, a magnification of about 50, a wide field, large aperture and very short focal length. Prof. Conradi had assisted him, and Mr. F. Twyman had constructed a peculiar-looking microscope resembling a telescope, the object piece of which

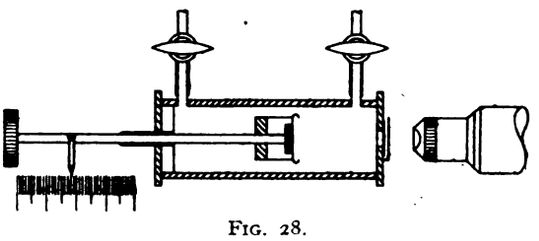

FIG. 28.

was mounted in a short lateral tube, at right angles to the main tube; that had been done so as to turn the light rays of the flashes at right angles in the telescope, and to keep the eye away from the radioactive source of the α rays. A similar larger microscope which they had constructed in the Cavendish Laboratory gave a field of nearly 8 mm. square, so that up to 150 flashes would be counted per minute; owing to the short focus the field was somewhat distorted, and the disc on which the *RaC* was coated was therefore curved.

A New Observing Apparatus.

In the later apparatus used (Fig. 28), a brass tube, 3 cm. diameter, the source was an invisible film of *RaC* on the disc *R* fixed to a rod which could be pushed in and out so as to approach the source at will to the hole at the other end of the tube, which was mostly closed by a window of silver. In front of this window was the fluorescent screen *S*, and, further out, the microscope; in the recess of about 1 mm. width between window and *S* absorbing screens of mica and

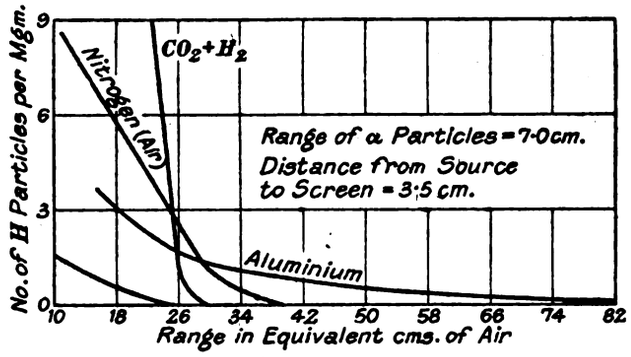

FIG. 29.

metal could be placed. Thin foils of the metals or films of other materials to be bombarded (coated on metal foil) were placed in front of *R*. When oxygen was directly bombarded in the apparatus, only very few particles were liberated by the α rays; but those particles had a range of 28 cm., whilst the α rays themselves had a range of 7 cm. only. When the oxygen was replaced by air, the number of particles greatly increased, and it was subsequently made quite clear that the few particles liberated from oxygen were due to traces of hydrogen, very difficult to suppress.

Results with Various Substances.

Fig. 29, show the results obtained with various substances. The abscissae mark the ranges of the liberated particles; the ordinates indicate the number of particles per milligramme of the radioactive material (*RaC*) per minute. Curve *A* illustrates the bombardment of nitrogen; the range of the particles liberated is 40 cm. In the mixture of carbon dioxide and hydrogen $CO_2 + H_2$ (curve *B*) there was a very strong evolution of particles of a range of about 20 cm., and the range limit was 29 cm.; thus the range of particles from nitrogen was not reached. On the other hand, aluminium (curve *D*) gave particles of a range of probably 90 cm. The short curve *C* was that of oxygen; the particles were probably due to a contamination with hydrogen, and this "natural effect" as Sir Ernest called it, had to be allowed for in the calculations. When foils of paraffin (or hydrocarbon, consisting of carbon and hydrogen) or films of hydrogen compounds were examined, the range limit was always 29 cm. as in oxygen containing water vapour. A great number of different substances, mostly of low atomic weight below 40, but also some more heavy atoms, having been examined in this way, it was found that the liberation of these particles of long-range was restricted to six elements: boron, nitrogen, fluorine, sodium, aluminium, and phosphorus, which alone appeared to be "active" in this sense.

(*To be concluded.*)

Electricity Supply in Greater London.

L.C.C. Committee's Report.

The latest return relating to electricity supply in the London and Home Counties Electricity District, issued by the London County Council and obtainable from P. S. King and Son, Great Smith Street, Westminster, price 5s., shows the various authorities under the Electricity Supply Acts, with the authorised areas of supply, together with an analysis of the accounts of each undertaking for the year ended December or March 31st, 1921, and miscellaneous statistics for the year ended March 31st, 1922, relating to capacity, output, charges, assessments, etc.

The return shows that of the 85 authorised distributors 43 are local authorities. The total sales for 1921 were 640 153 662 kWh, of which company undertakings sold 334 145 955 kWh. The total revenue of all authorities is given in the analysis of accounts for 1920–21 as £4 042 605, the total expenditure, excluding rates and taxes, being £2 853 390, or 2·19d. per kWh sold. The total revenue of company undertakings for the same period was £5 487 105, and the expenditure, excluding rates and taxes, was £2 971 871.

The "Charges" section of the return has been entirely reorganised and rewritten, as it had become increasingly difficult in recent years to express current tariffs in a form determined by the conditions of ten years or more ago.

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Controlling London's Trams.

Traffic Regulation Direct from Headquarters.

At a time when London's traffic problems are receiving so much attention, it is gratifying to find that the L.C.C. Tramways Department is actively engaged in minimising the possibilities of congestion. The latest step in this direction is a special system of telephones for the control of traffic which has recently been installed throughout the area north of the Thames. This area comprises approximately 23 square miles, extends from Hampstead to Poplar, and contains approximately 53 miles of route.

To run private telephone wires as ordinarily understood from all the termini, junctions and busy traffic centres in such an area to one central headquarters would be an undertaking

FIG. 1.—THE TRAFFIC CONTROL TELEPHONE AT FINSBURY PAVEMENT.

equal to the complete telephone installation of a small town, and the number of wires necessary would cost a considerable amount. The L.C.C. tramways, however, have adopted a system whereby one pair of wires may be used for a large number of telephones, which, while giving the facilities of an ordinary telephone service with the usual switchboard, has in addition certain distinct advantages.

The scheme is based on the WESTERN ELECTRIC Co.'s system of traffic control, and this company have been entrusted with the supply of the necessary apparatus and instruments. The Western Electric system of traffic control is already extensively used by many of the large railways in this country and abroad chiefly for the marshalling of goods traffic, and it has also been used on a small scale on tramways.

Features of the System.

As previously mentioned, the outstanding feature of the new telephone system is that a number of instruments may be used on one pair of wires running throughout the system. This is accomplished by a "selector" device which enables the controller to select and ring exclusively any one station out of as many as 78 stations, if necessary, all on the one pair of wires. The number of stations connected to a pair of wires will, of course, vary according to the particular conditions, and in the case of the London tramways only about 36 points are so connected. The headquarters for the control of the northern area is situated in the Council's car depot at Hackney, and apparatus is provided here for four controllers, although at present the traffic is being handled by one controller with occasional assistance. Fig. 2 shows the controller at work.

Selective Telephone Installations.

Along the track of all important junctions special selective telephones have been fitted in cast-iron boxes mounted on the familiar "feeder" pillars (see Fig. 1). At each of these junctions a "regulator" is stationed. The regulator is responsible for the regulation and spacing of the cars in the district, and by means of this telephone he is in frequent communication with the controller at Hackney. As the controller is continually receiving reports from all the regulators, he is fully advised of all delays, breakdowns, accidents, or other unusual events occurring anywhere over the system. The controller, by simply turning a particular key out of a number provided on his desk, can ring the bell of the telephone at any of the regulator or control points throughout the area, including various internal stations such as car depots and power supply sub-stations. He is thus able to authorise the necessary action, send the breakdown gang or bring assistance from other points; in fact, he is in complete control of the situation. When one considers the large number of minor incidents, such as the breakdown of heavy lorries on the track, which, if not quickly removed, cause congestion not only to trams but to other traffic, it will be realised of what value it is for officials to be concentrated on the scene of a breakdown.

Operation of the Control.

Briefly, the method of working the telephone control system is as follows:—At intervals of half a mile telephones are situated, and an official, driver or conductor going to any one of these telephones has only to open the door, lift out the receiver, and shout into the mouthpiece, "Control." This is conveyed through loud-speakers fitted in the control room to the controller, who by means of a telephone jack plugs on to the circuit from which the call is being received. The controller is also able whilst taking the message to ring another point, such as a breakdown gang, sub-station or regulator, to whom it may be necessary to give instructions; even while he is talking it is possible for him to ring a bell on the same circuit calling another man to the line.

Use of Inter-connecting Switches.

The system is divided up into eight circuits, which are at present linked in pairs, giving four separate keyboards, each of which can be operated by a single controller; alternatively the whole four can be worked by one controller. If officials at two different points wish to hold a conversation one line can be isolated from the other seven for the time being, and through the loud-speaker the controller is able to hear when the conversation ceases. The use of the inter-connecting switches has been much greater on this system than on any of the

FIG. 2.—CONTROLLER AT WORK AT THE HACKNEY DEPOT.

railway systems already installed, and it has been found, we understand, that the system of control of tramways is such that the Western Electric Co.'s telephone control system is particularly suitable for the work which has to be done.

Notice is given by the SECRETARY FOR MINES that an order has been made under Section 33 of the Coal Mines Act, 1911, approving the "Thor" pillarless electric hand lamp, S.P. type, the "Oldham" pillarless electric hand lamp, the "Wolf" nickel cadmium inspection lamp, No. 608, the "Ceag" deputy lamp, the "Oldham No. 3 hooded lamp (for officials), the "Laidler lamp, type L.C. No. 1, and the Cambrian lamp, No. 30.

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Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument

NOTES ON WIRELESS MATTERS.

To the Editor of THE ELECTRICIAN.

SIR,—In a recent issue of THE ELECTRICIAN Prof. Howe makes the statement that, because electromagnetic disturbances travel with the speed of light, therefore when an electron moves that a particular "surface represents the boundary beyond which it cannot yet be known that the electron has ceased to move . . ." Is not this a very violent assumption to make? According to my friend Dr. L. Silberstein the relativists do not assume that wave motion exceeding the speed of light cannot exist, but that moving matter cannot exceed the speed of light. Besides, has it not lately been forced upon physicists that revolving electrons cannot radiate, despite the accelerations?

Some time back I charged Prof. Lodge (1892) with the thought that a mere oscillation of charges upon a Hertzian oscillator could produce radiation. Since then, of course, he has naturally insisted that in a material system there must be both a capacity constant and a self-induction constant for oscillations to occur. That our ideas of these two constants needed revision Abraham was the first to indicate, and in a published paper I showed how they needed revision. A better proof is forthcoming. Yet why Prof. Howe thinks that Hertz's purely mathematical convenience is again substantiated I do not know; but I would advise strongly, first, that he re-read Dr. Abraham's paper on the subject (later illustrated by Dr. Hack), and secondly that he re-read Sommerfeld's paper on wave propagation in adjoining media. I for one cannot see what the electron theory has to do with Abraham's particular solution. Nor can I see that Sommerfeld's clear understanding of the physical and mathematical limitations of the Hertzian doublet theory is at all done away with.

The truth of the matter is that radiation cannot take place from a system without waves of exciting potential are set up which travel along the system with hypervelocity. The paper proving this is still in the hands of the Editor of THE ELECTRICIAN, and I shall be exceedingly pleased to have Prof. Howe's comments.

The only modification I find it necessary to make in Abraham's work is that, in the practical case, the progressive wave component of potential travels along towards a node at the free end of the antenna. It is not reflected towards the antenna centre as Abraham's particular solution for a subnormal state indicates. The energy of the progressive wave set up, along the elliptical oscillator, in the practical case is really dissipated by the time the progressive wave of potential reaches the end of the antenna. The full mathematical development will be submitted, as Heaviside once remarked, "as wanted."—I am, etc.,

A. PRESS.

Chevy Chase, Md., U.S.A.,
July 9th.

AUTOSYNCHRONOUS MOTORS.

To the Editor of THE ELECTRICIAN.

SIR,—I regret to note the somewhat pessimistic conclusions reached by Prof. Lindstrom in his article under the above title which has just appeared in your columns, particularly the third and fourth "concluding deductions," which seem to infer that while there is no risk of failure to obtain synchronism if the motor is started without load (presumably irrespective of flywheel capacity since the slip is then negligible), yet if started against load such a risk exists.

This is entirely contrary to the results obtained in practice. Machines of this type totalling some 50 000 H.P. have been built in this country during the past few years, many under the writer's own supervision, and no case is yet known where the inertia of the driven masses has been large enough to cause the slightest difficulty in synchronising against full load when normal excitation has been applied.

Research, both practical and theoretical, bears out the results obtained in practice, and shows the large margin of synchronising power which these machines possess.

The results of such research may be found in the Journal of the Institution of Electrical Engineers, Vol. 60, p. 165 and Vol. 62, p. 692, in two papers presented by the writer.

It may, however, be stated briefly that in a recent case of a compressor the total stored energy was only 4·3 per cent. of the amount which would have caused difficulty in synchronising against full load with unfavourable conditions of switching, while in the case of a mine fan the corresponding figure was 10·3 per cent.

It should also be pointed out that it is most unusual to allow for an overload capacity or pull-out torque of only 30 per cent. above full load, as indicated in Fig. 7 of the article mentioned. The minimum figure employed in practice is usually some 70 per cent. for constant horse-power work, while for special services a higher figure still is employed.

I disagree with the writer of the article where he states that it is impossible in practice to select the most suitable moment for changing over to synchronism.

At full induction speed, the slip is of the order of 1 per cent.; that is to say, on a 50 period machine, the secondary frequency is 0·5. A centre zero ammeter placed in the secondary circuit will take two seconds to make a complete oscillation, and it is quite simple to throw over the exciter switch at approximately the correct phase of the swing, thus ensuring synchronisation taking place at the best possible moment—that is to say, at the phase giving the least resultant disturbance on the line.

I suggest that the use of the term "Autosynchronous" is bad. Prof. Lindstrom states that this term is employed because the motor "automatically" pulls itself into step when excitation is applied. But this is also true of the salient pole synchronous motor with squirrel cage damper winding.

Since the motor partakes of the characteristics of both the synchronous motor and of the induction motor, I therefore suggest that the term "Synchronous Induction Motor," which is already widely used both in this country and on the Continent, should be standardised to describe this particular type of motor.—I am, etc.,

LAURENCE H. A. CARR.

Hale, Cheshire,
July 23rd.

CABLE PROBLEMS.

To the Editor of THE ELECTRICIAN.

SIR,—I was much interested in the leading article in your issue of the 13th inst., particularly in your remarks anent the recent contributions of Messrs. Wagner, Steinmetz, Hochstadter and others, and your comments that "it now appears likely that the process of breakdown in the cable is largely, if not entirely, due to the increasing conductivity of the insulation caused by temperature rise and is not the result of abrupt or disruptive puncture."

It was this aspect of the case that made me take up the line of defence which I did in my reply to the discussion, at the Institution, of my recent paper in the endeavour to demonstrate that, in order to provide equal safety with ordinary three-core cables, it was necessary to employ eight cables as against six cables with the system which I was proposing (see "Proceedings I.E.E.", Part No. 315, page 246, left-hand column).

The point I was making was that if, by the use of intersheaths and by separating the cores, we can double the voltage of transmission we can, for the same amount of copper, quarter the loss in the copper; which (*cæteris paribus*) means one quarter the temperature of the copper, and consequent increased safety for the insulation next to the copper.

If Messrs. Wagner, Steinmetz, and Hochstadter's deductions are correct, this should prove a great gain. Incidentally, moreover, it should prove that, so far as the actual losses which take place inside the insulation are concerned (these being obviously at a maximum where the dielectric stresses are the greatest), the maximum potential gradient should form the true criterion for eventual breakdown of the cable.—I am, etc.,

A. M. TAYLOR.

Birmingham,
July 21st.

Assistance for Professional Men.

The PROFESSIONAL CLASSES AID COUNCIL, which exists to relieve, or assist in relieving, distress among the professional and other highly educated classes and their dependants, has now issued its second annual report, which shows that in the course of the year 538 applications were made to the council, but some of these were unsatisfactory, and some did not come within the scope of its work. In all 262 cases were advised, 87 were assisted financially, and 50 families received educational assistance during the year. The income was £5 121, but as the year's working leaves a deficit of £2 212 the council would be grateful for assistance.

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Merchandise to Sell and Profit By.

***In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of* THE ELECTRICIAN.**

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

Honest Goods, Well Made.

A buyer must need ponder in these days when so many are soliciting custom: What is the best test to prove whether a particular manufacturer is offering reliable products? There is probably no definite answer. Only time can prove the reputation of the manufacturer, but surely it can be said that the WALSALL ELECTRICAL CO. have proved that they can offer the trade reliable electrical instruments? To follow this question with another: Is there any line of electrical apparatus where reliability is more

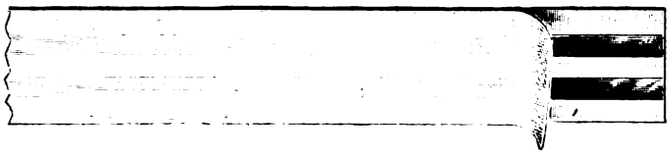
A RELIABLE RECEIVING SET.

important than in electrical instruments? If, therefore, the Walsall Co. can manufacture such apparatus to pass the most severe specifications, it can be safely assumed that the wireless apparatus which they manufacture is such that the retailer can offer it to the public with confidence. We illustrate the crystal set which this company manufacture. No pretension is made to any unique point of design. The claim is made, however, that the set is well and thoroughly made, and when such a claim is sincere and can be backed up, there is every prospect of a good market for such a product.

G.E.C. Invisible Bell Wire.

We fear that contractors have become hard-faced in their attitude to bell wire. It could well be described as the Cinderella of installation work. The latest development of the GENERAL ELECTRIC CO. will probably change all this, and if, as is argued, bell work is now a nuisance, in a very short while it will cease to be so.

This bell wire consists of twin copper strips 5 by 120 mils. laid parallel between two felt paper tapes § in. wide and stuck together

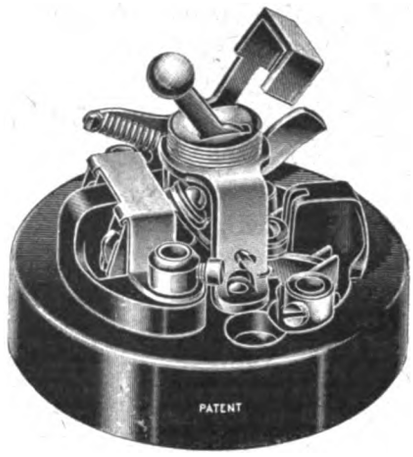


G.E.C. INVISIBLE BELL WIRE.

by special glue. This is supplied in coils of 100 yards and can be fixed on walls under wall paper or distemper, on the ceiling under whitewash, or on the floor under the carpet or oilcloth, when it is quite concealed. If run on the surface it can be coloured or painted to match its surroundings and is then invisible. G.E.C. invisible bell wire has a conductivity equal to round wire and the insulation is excellent.

A.P. Lundberg's Tumbler Switches.

We illustrate a "Twinob" switch manufactured by A. P. LUNDBERG AND SONS. This bald foreword does not give any indication of the importance to the trade of the new catalogue, No. S.41, recently published, from which this switch is taken. A close study of the list prompts the question as to whether it is possible to develop any further the art (for it has become an art with A. P. Lundberg) of tumbler switch design. We have a multitude of designs each with many variations, and it is doubtful if there is any need which is not catered for. The switch which we illustrate is one of 10 A capacity) and is designed for the control of a.c. single phase motors. The switch is at once a simple device for the non-technical user, because the covers can be provided with a

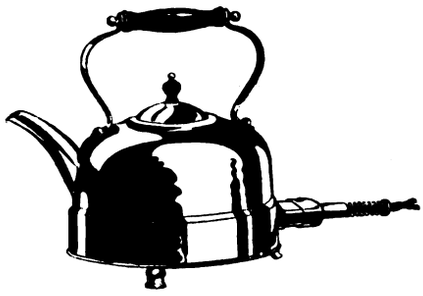


LUNDBERG "TWINOB" MOTOR STARTING SWITCH.

locking device and directions for the operations are simply expressed on the cover. The illustration shows that the switch follows the design of the familiar tumbler switch, with the exception that one of the control arms is controlled by a "throw off" spring, which ensures the starting coil circuit being opened as soon as pressure is removed. It is also provided with a hooded lever instead of the usual knob, and this, enclosing the other, ensures that both circuits are closed by the one operation, that controlled by the enclosed knob remaining so as long as the motor is in use;

A Kitchenworthy Kettle.

We illustrate a "Falco" domestic kettle for which the HOTPOINT ELECTRIC APPLIANCE CO. are the sole distributing agents. It will be remarked that this kettle is commonplace enough, and is probably



THE LATEST HOTPOINT KETTLE.

subject to the same shortcomings as many other kettles on the market. The fact, however, that it is a "Falco" is an assurance of a kitchenworthy device. It can be supplied in both two- and three-pint sizes, and in polished copper or nickel plate.

The Hotpoint Premier Vacuum Cleaner.

In a recent number we referred to the Hotpoint Premier vacuum cleaner, and mentioned that the list price of the complete machine was £15 15s., with accessories. We understand that the list price has now been reduced to £12 5s.

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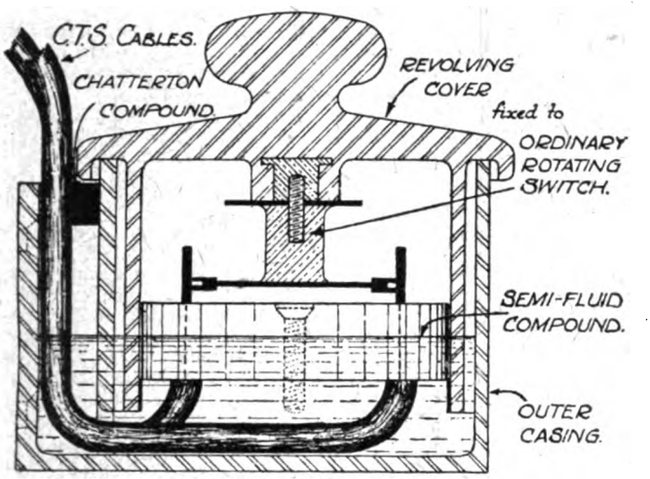
A Contribution to the Solution of the Corrosion Problem.

Slowly, but surely, we are coming to the solution of the problem of corrosion in electrical apparatus. For years many otherwise excellent installations have had to be put out of service for a period to enable the apparatus to be replaced. The trouble has been noticeable with the smaller accessories such as lampholders and tumbler switches, and several manufacturers have put on the market "corrosion proof" devices. Only time can prove their worth, and this is happening with the range of devices manufactured by ST. HELENS CABLE AND RUBBER CO. Time has proved their worth and it is interesting to note the latest contribution of this company to the problem. We give a diagrammatic section of a switch they recently placed upon the market. The main features of the device



DIAGRAMMATIC SECTION. *Patent applied for*

THE ST. HELENS CORROSION PROOF SWITCH.

will be apparent from the illustration, but a short description will be of service.

An ordinary rotary switch is employed, the revolving contacts being operated by a knob on the cover, the sides of which dip into the compound and so prevent corrosion attacking the metal parts. The body of the switch is substantially made in tough ebonite and is provided with extension pieces for fixing to walls, etc. The revolving cover, which is also made in strong ebonite, is screwed on to the rotating contacts by means of the existing screw which ordinarily holds the knob. The switch is easily and quickly wired, as the contacts and porcelain base can be removed as a whole, being fixed to the body by means of two screws. These switches can be supplied for currents of 5, 10, and 15 A.

The "Ever-Ready" Utility Devices.

It is admitted that one of the problems of the retailer is to keep in touch with what there is to sell. This is a greater problem than of knowing what there is to buy. Under broad headings we know what to buy, but when we have to seek what to sell we have to give minute study to what each manufacturer has to offer. Particularly does this fact strike one when studying the 1922–3 catalogue of the EVER READY CO. (Great Britain). We refer especially to the catalogue of electrical specialities, such as pocket lamps, domestic utility lamps, signalling lamps, reading lamps, etc. In arguing that this range of merchandise is one which will sell readily to the public, we are aware of the feelings of the trade. We know that immediately prior to the war the standard of quality and consequently the market in this class of apparatus sunk to a very low level. Events took their inevitable course. The public became tired of buying rubbish and business in this line fell off considerably, with the result that public confidence has not yet been restored. Hence the turnover figure will only mount slowly as better quality devices get into the hands of the public. It is but a commonplace to express the opinion that the Ever Ready Co. are one of the very few manufacturers of this equipment who have not only maintained their high standard but have even improved that standard. In the catalogue there is a wealth of devices which will sell rapidly to the public. They are essentially utility devices. We ask permission to stress this point, because we have in our midst many retailers who still regard pocket lamps and the many other utility devices which must be placed under the same heading, as novelties, and as such there is no time to bother with them. We repeat, therefore, that the Ever Ready line is a line of utility merchandise, and if properly marketed will prove itself in the terms of increased turnover. We illustrate a wall bracket lamp which will find ready buyers at this time of the year.

EVER-READY CO. WALL BRACKET LAMP.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

"Wireless Experience" is to be learned from a folder published by ROGERS, FOSTER AND HOWELL.

From the Y-SWITCHGEAR CO. we have received a leaflet describing the Y-S watertight tumbler switch.

The June issue of the "Benjamin Bulletin" (published by the BENJAMIN ELECTRIC CO.) has now appeared.

EVERSHED AND VIGNOLES announce the publication of a technical and descriptive list of recording instruments.

The "Ella" converter for accumulator charging is described in a folder just issued by LIONEL ROBINSON AND CO.

"Apex" ironclad switch and fuse gear is described in a catalogue recently issued by the FOSTER ENGINEERING CO.

SIEMENS AND ENGLISH ELECTRIC LAMP CO. notify us that the July issue of their trade price list has been issued.

A folder devoted to a description with prices of J.W.B. accumulators has been published by BARNARD AND HAYNES.

"Mazda Gasfilled Projector Lamps" is the title of a folder L. 275, just published by the BRITISH THOMSON-HOUSTON CO.

The Weston-normal cell is briefly described in a mailing card published by the CAMBRIDGE AND PAUL INSTRUMENTS CO., LTD.

The "Reliance" valveless mechanical lubricator is described in a folder recently issued by the manufacturer, CHAS. W. RICHARDSON.

"Special Flush Switches for Wireless Telephony" are described in a leaflet recently issued to the Press by A. P. LUNDBERG AND SONS.

BRUCE PEEBLES AND CO. announce the publication of pamphlet No. 22B. The pamphlet deals in detail with Peebles pedestal induction motors.

The July list of stock ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI is now ready for distribution to all interested readers of THE ELECTRICIAN.

All retailers should seek full details of the summer campaign to increase turnover in "Universal" appliances which L. G. HAWKINS AND CO. have organised.

FERGUSON, PAILIN LTD., announce the issue of a catalogue, No. 160/A1, describing and illustrating a new line of motor starters with several distinctive features of design.

The SLOAN ELECTRICAL CO. have proved that they know the needs of the trade by the recent publication of a new supplementary list illustrating fittings, switchplates, and lanterns.

A pamphlet recently issued by OZONAIR describes the installation of their system which has been in successful operation on the Central London Railway for twelve years.

T. FRANCIS AND SONS make a contribution to the solution of the problem of vibration for lighting equipment. They have just published a folder describing the "Ainscow" anti-vibrator.

Retailers can turn over a useful sum in wireless publications, and the booklet entitled "The Elwell Book of Diagrams," published by C. F. ELWELL, is a publication which will appeal to a large number of enthusiastic amateurs.

Readers of THE ELECTRICIAN who have need to study the buying markets for iron pipes will read with interest a publication recently published by the STANTON IRONWORKS CO. The brochure is an informative treatise on spun iron pipes.

"The Reason Why is Explained Within," a folder, published by AUTOMATIC AND ELECTRIC FURNACE, LTD., inviting engineers to a demonstration to prove that the best results are only obtained by hardening in automatic electric furnaces.

THE SOUTH MIDDLESEX MANUFACTURING CO. offer the trade a line in a new electric boiler and washing machine. The apparatus, which will be marketed under the name of "Blighty," is fully described in a folder just published by the manufacturers.

AUTOMATIC TELEPHONE MANUFACTURING CO. continue to keep the retailer fully informed on the merits of "Excel" heating and cooking apparatus. They have recently published a new price list, No. 62, and we shall comment on some selected lines therein at an early date.

The new illustrated price list published by HOLOPHANE, LTD., is one which every progressive architect, retailer, and contractor, and others whose duty it is to further the cause of better lighting should give close study to. It is probably the most informative catalogue on scientific lighting extant.

The HAMWORTHY ENGINEERING CO. announce that they have received an order from H.M. Office of Works for two 25 B.H.P. air compressors for use in the House of Commons. The complete range of compressors manufactured by this company is described in a folder, which will be posted to all applicants.

The "Sterling" variometer is the latest product of the STERLING TELEPHONE AND ELECTRIC CO. We shall describe the apparatus in detail in our "Merchandise to Sell and Profit By" columns at the first opportunity. Meanwhile retailers should note that the device is described in publication No. 362, a copy of which the Sterling Co. have kindly sent us.

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Parliamentary Intelligence.

Licences for Cable Telegraph Services.

Sir H. BRITTAIN was informed by Sir L. WORTHINGTON-EVANS, on July 24th, that licences to land cables for the purpose of conducting cable telegraph services were granted at a charge of £1 a year per cable, and in addition the companies paid for the wires leased by them in this country and appropriate rates for the use of the Inland Telegraph service where messages were transmitted over Post Office lines. He would deal with the question of the treatment of wireless companies when it arose.

Expenditure on Wireless Stations.

Sir H. BRITTAIN, on July 26th, asked the Postmaster-General if he would give the expenditure and revenue for the first three months of the current financial year for the Post Office wireless stations at Cairo, Leafield, Northolt, and Stonehaven, respectively, distinguishing on the revenue side between revenue for commercial traffic and the paper credit for Government traffic; and how these results compared with those of the previous quarter?

Sir L. WORTHINGTON-EVANS: The accounts for the period in question are not yet completed, so that I regret I am unable to furnish the information.

Imperial Wireless Chain.

Mr. A. T. DAVIES, on July 26th, asked the Postmaster-General whether it was proposed at an early date to issue licences to private concerns in furtherance of the promised Empire chain of wireless communications; whether the subject was under consideration; and whether there was any reasonable prospect that this work might be begun before the meeting of the Imperial Conference?

Sir L. WORTHINGTON-EVANS: I would refer the hon. member to the statement which I made on the 24th instant in connection with the Post Office Estimates.

Post Office Telephone Ducts.

Mr. ERSKINE was informed by Sir L. WORTHINGTON-EVANS, on July 30th, that it was the practice of the Post Office to keep in close touch with local authorities in order to take advantage of any opportunities to lay ducts for Post Office services when roads were under reconstruction or were disturbed for other purposes. In London prospective Post Office works which entailed the opening of streets were notified in advance to the local authorities and also to the Metropolitan Boroughs Standing Joint Committee, and arrangements were made, as far as possible, to carry the works out when the streets had to be opened for other purposes.

Telephone Service Installations.

Mr. PIELOU, on July 30th, asked the Postmaster-General if he was aware of the great delay and inconvenience caused to persons and firms who had made application for telephone instalment; and would he take action to expedite this work?

Sir L. WORTHINGTON-EVANS: The average time for the provision of a telephone exchange line is about three weeks. A temporary shortage of spare plant, or difficulty in obtaining the necessary wayleaves, may be the occasion of delay, but such cases become less frequent with the general development of the service.

Joint Industrial Councils.

Mr. JOHN DAVISON asked the Minister of Labour, on July 25th, whether, seeing that it was the policy of his Department to encourage the establishment of Joint Industrial Councils and to help to maintain those already formed, he would make representations to the Hammersmith Borough Council with a view to inducing that body to refrain from severing its connection with the National Industrial Council for the Electrical Supply Industry.

Sir M. BARLOW: It is the policy of my Department to encourage the establishment of Joint Industrial Councils in suitable ca es and to help to maintain those already formed. The councils are, of course, voluntary bodies, and I have no authority to press particular employers to become or to remain members.

The Broadcasting Committee's Report.

Sir L. WORTHINGTON EVANS, in reply to Mr. D. G. SOMERVILLE, on Tuesday, stated that the Broadcasting Committee were holding a further meeting that day to consider their report, but that it was improbable the report would be issued before the House rose. The report would be issued for general information.

Stoke-on-Trent Tramways.

On the consideration of the Stoke-on-Trent Corporation Bill in the House of Commons on Tuesday, VISCOUNT CURZON moved the deletion of a subsection giving to the local tramway companies the right of appeal to the Ministry of Transport against the decision of the corporation on any application for a licence to run omnibuses on any tramway route. He said that the acceptance of his amendment would put an end to the danger of a monopoly being given to a tramway company whose services were most inefficient.

The amendment was rejected by 120 votes to 113, and the Bill was read a third time.

The Ruhr and British Trade.

In a debate on the Board of Trade Vote on July 26th Sir A. MOND said it was remarkable how many schemes had been held up in the electrical field because negotiations and inquiries had been allowed to drag on. Mentioning the electrification of railways, he said that surely some greater stimulus could be given to some of these problems. He suggested that the Prime Minister should use his influence with some of the great railway amalgamations to hasten and put into operation schemes which they intended to carry out, in view of the slackness of our trade and the difficulties of unemployment. It was high time more attention was given to hydro-electric schemes. The French Government were devoting large sums to experiments on the coast of Normandy for utilising the tides for hydro-electric purposes. The subject required more investigation. There seemed no reason why we should not be able to develop very great hydro-electric force.

In his reply Sir P. LLOYD-GREAME said that in order to provide work for the unemployed, the Government would assist local authorities and public companies by an advance of 50 per cent. of loan interest charges for a period of fifteen years if they would put in hand works of a revenue producing kind which they would not normally undertake in the immediate future. In the case of companies the assistance was coupled with a condition as to limitation of dividend.

East Lancashire District Scheme.

Proposed New Power Station at Padiham.

The Electricity Commissioners held an inquiry at Preston, on Tuesday, regarding the agreed scheme for the EAST LANCASHIRE DISTRICT, to which various municipal authorities were consenting parties in March last. The project, it will be recollected, provides for the establishment of a Mid-Lancashire Electricity Committee to include various county boroughs, urban districts, etc., extending from Colne on the one hand, to Fylde on the other. The Commissioners have prepared a draft order giving effect to their decision, and this came under review at Tuesday's sitting. Sir John Snell presided, and he was accompanied by Mr. H. Booth and Mr. D. S. Cumberlege sitting as clerk. The chairman reported that no representations had been made since the last inquiry was held indicating opposition.

An application for the representation of the Electric Power Co. to be increased from one to two was opposed, the company's counsel stating that it was proposed to erect a power station at Padiham, the increased representation to take effect from that date.

The Commissioners decided to give the matter consideration and accepted a suggestion that representatives should retire in March, 1925, instead of March, 1924.

The chairman agreed to recommend the Commissioners to withdraw certain amendments from the technical scheme provisionally approved. Sir John Snell mentioned that the Lancashire Power Co. had applied for permission to erect a station at Padiham. This would receive the fullest consideration.

Heating and Ventilating Engineers.

Work of the Fan Standardisation Committee.

As in other branches of engineering, the necessity for standardising the terms used in stating the performance or capacity of fans, and also a standard method of testing fans, has been apparent for some time—both to the users and to the makers. The council of the INSTITUTION OF HEATING AND VENTILATING ENGINEERS some time ago appointed a committee known as the Fan Standardisation Committee, composed of representatives of both fan manufacturers and users, together with representatives from the Admiralty and H.M. Office of Works.

This Committee, which has been holding meetings at regular intervals since the spring of last year, finds that there are many difficult problems to settle, and that very considerable differences of opinion exist, both amongst the fan makers and also amongst the users, as to the correct terms to use, and as to the best method of testing fans. They hope, however, eventually to clear up all misunderstandings and ambiguities, and to issue a standard list or terms, also to define a standard method of fan testing and a cleaf method of listing fan performances.

Books Received.

"Light and Colour." By R. A. Houston. (London: Longmans, Green and Co.) Pp. 179. 7s. 6d. net.

"The Ventilation of Public Buildings." By Robert Boyle. (London: Robert Boyle and Son.) Pp. 51. 6s. net.

"Handbuch der Elektrischen Raumheizung." By Wilhelm Heepke. (Halle a. S.: Carl Marhold.) Pp. 264. 3s. net.

"Les Méthodes Modernes D'Organisation Industrielle." By L. Benoist. (Paris: Gauthier-Villars et Cie.) Pp. 208. 18 fr.

"Automatic Telephone Systems." By William Aitken, M.I.E.E. (London: Ernest Benn, Ltd.) Vol. II. Pp. xiii+227. 35s. net.

"A Dictionary of Applied Physics." Edited by Sir Richard Glazebrook. Vol. V. (London: Macmillan and Co.) Pp. 592. 63s. net.

"The Tutorial Physics (Vol. III), A Text-Book of Light." By R. Wallace Stewart. (London: University Tutorial Press.) Pp. 362. 6s. 6d. net.

"Science Abstracts." Sections A and B, July 25th, 1923. Vol. 26, part 7. Issued by the Institution of Electrical Engineers, London, (London: E. and F. N. Spon.) 3s. per section.

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Municipal Electricity Finance.

Further Facts and Figures for the Past Year.

Substantial net profits are shown in the accounts of the municipal electricity undertakings, details of which are given below. As will have been noticed in the details already published of other undertakings, considerable economies effected in the cost of production have in most cases contributed materially to the improved results.

Successful London Boroughs.

The London boroughs are all able to record a successful year's working. SOUTHWARK made a net profit of £16 565, out of which it has been decided to allocate £10 000 to the reduction of rates. The energy generated during the year totalled 914 512 kWh, an increase of 147 925 kWh over the preceding year. Having increased its gross profit by £14 695 to £64 995, the POPLAR undertaking has a net balance of £12 158, the sales for the year being 27 556 971 kWh, or 5 030 465 kWh more than in 1922.

A Record Year at West Ham.

WEST HAM, which still maintains its position as the largest municipal electricity undertaking in the London district, is able to show a net profit of £40 775, constituting a record in the history of the undertaking. This has been accomplished despite the fact that charges have been reduced on two occasions during the past year, and as the average price obtained has dropped from 2·28d. to 1·73d. per kWh, the difference of 0·55d. per kWh. represents no less a sum than £104 871, which has been passed on to the benefit of consumers. Considerable decreases in cost of production were aided by a substantial reduction in the price of coal, coupled with more efficient generation, less cost of repairs, and a fall in the rates of pay of employees. The total sales amounted to 45 762 034 kWh, against 40 505 500 kWh sold in 1922. The rates will benefit from the success of this undertaking to the extent of £10 664. A surplus of £13 131 on the EAST HAM undertaking is to be shorn of £5 637 for rate relief, leaving £2 500 to finance a scheme of deferred payments for light and power installation and £4 994 to depreciation and renewals fund.

Increased Consumption at Marylebone.

Another record net surplus, of £37 236, is recorded by the ST. MARYLEBONE undertaking on a total revenue of £360 192. There was a considerable increase in sales of energy, the 1923 total of 35 820 569 kWh comparing with 24 218 918 kWh sold in the previous year. Consumers increased in number from 13 392 to 14 140. The average price obtained for all supplies was 2·413d. per kWh, or 1·088d. below the 1922 price.

The HAMPSTEAD undertaking made a net surplus of £31 267 on the year, bringing the accumulated surplus up to £56 000 which has been carried forward. These results are not altogether surprising in view of the fact that the average prices obtained per kWh for private consumption and public lighting respectively, were, 4·75d. and 2·28d. The price obtained from private consumers is 1·97d. higher than it was in 1914, and public lighting was as low as 1·66d. in 1920-21. An increase of 458 is recorded in the number of consumers, and the sales of energy increased from 7 437 695 kWh to 8 677 691 kWh.

Progress at Finchley and Kingston.

FINCHLEY, an undertaking which in 1919 had an accumulated deficit of £7 313, has during the past four years converted this into a credit balance of £17 418, in addition to which many improvements have been effected that have added to the efficiency of the station, while at KINGSTON a long series of deficits has given way to a net surplus of £7 698, following a profit of £6 795 in the previous year. The cost of generation shows a marked improvement, due to the somewhat improved load-factor and to the three-phase supply which is being adopted throughout the borough. Considerable progress is shown in the number of new consumers, the total new connections having exceeded those of the previous year by no less than 60 per cent.

A prosperous year at CROYDON resulted in a net profit of £36 371, one of the most remarkable features in the accounts being the increase in the number of consumers from 8 956 to 10 198. Generation costs were reduced by 31 per cent. on an 11 per cent. increase in output.

The ROTHERHAM undertaking is able to record greater progress in the year under review than at any other period of its existence, the net profit being £38 002. As there was a net loss for the previous year of £10 902, the improvement in the profit and loss account as compared with last year is £48 904. In his report the electrical engineer recommends that the profit be devoted towards the cancellation of the deficit of £53 501 accumulated during the past three years. The capital cost of the undertaking is £1 302 449, and with a capacity of 70 000 kW, the cost per kW installed works out at the low figure of £18 12s. An increase of 121 per cent. is recorded in the sales of power to consumers.

Other Results in Brief.

Net profits of £5 798 and £2 500 are reported from LOUGHBOROUGH and LONG EATON respectively, while at STOKE-ON-TRENT a net profit of £11 818 was made, allowing a surplus of £8 770 to be transferred to reserve. The profit at CHELTENHAM amounted to £7 515 and returns from FLEETWOOD show a gain of over £5 000. HESTON and ISLEWORTH report a profit of £4 000, and HASTINGS a profit of £11 000, of which £2 000 goes to rate relief.

Telephone Developments.

Underground Cable Extensions.

Considerable cable extensions in connection with the Post Office telephone system are likely to take place all over the country in the coming year. On Tuesday a Post Office official was able to amplify the particulars given in the Postmaster-General's speech last week. The progress made in the financial year 1922-23 was shown by the growth of subscribers. During the year 97 000 new subscribers and 165 000 new stations were added to the system, representing, after allowing for secessions, a net increase of 51 000 subscribers and 74 000 stations. The increase during the year was equivalent to about 8 per cent., and was the highest recorded in any one year. All research work was carried on with a view to securing economies with increased efficiency by technical progress. All the devices of modern science were tried. The size of cable had been greatly increased, and at the present time a clear and easily audible conversation was possible over 2 000 to 3 000 miles of cable.

Some of the important cables likely to be in use before the Postmaster-General next presents his estimates were the following:—London–Southampton (part of the underground backbone route extending from Portsmouth and Southampton through London and the Midlands to the Scottish capital). London and Bristol. Bristol and Newport (to complete the underground route from London to Cardiff and Swansea). Derby-Leeds (to complete the underground route to London, Sheffield, and Leeds). Oldham, Huddersfield, and Halifax. Birmingham and Worcester. Birmingham, Coventry, and Leamington.

In addition to providing more than 74 000 new stations and laying 100 miles of ducts, and drawing and jointing cables 600 miles in length and containing over 125 000 miles of wire, which is being done, the Post Office is also extending switchboards, providing junction lines, and generally taking care of the service of existing subscribers.

Forty Years Ago.

"The Electrician," August 4th, 1883.

A GOODLY NUMBER OF PATENTS.—The Gramme Electrical Company, together with its members, the Brush, Edison, Fuller, Jablochkoff, Thomson-Houston, United States and Weston Companies, own or control nearly 500 patents, and will support these patents against all infringements. The mere list of patents fills about fourteen pages of a quarto pamphlet.

* * *

ELECTRIC LIGHTING BY WATER-POWER.—A Brush-Swan Electric Light Co. is being organised in Washington. It is intended to light both streets and houses by electricity, and to drive the dynamos by water-power from the canal, a mile above Georgetown, where a 500 H.P. turbine wheel will be placed. The power in the daytime will be utilised to charge storage batteries.

* * *

THE FIRST ELECTRIC LOCOMOTIVE.—"Apropos of various claims," says the "Electrical World," "for the distinction of having invented the first electric locomotive, a writer in the Baltimore 'Sun' recalls the experiments of Dr. Charles Grafton Page, who was born at Salem, Mass., on January 28th, 1812, and died in Washington, D.C., on May 5th, 1868. 'He constructed an electrical machine when only ten years of age,' says the writer in the "Sun," 'and graduated at Harvard University in 1832. In 1838–40 he practised medicine in Virginia, and in 1839–40 filled the chair of professor of chemistry in Columbia College, in the district of Columbia. In 1840 he was appointed examiner in the United States Patent Office, which office he held until his death. He was a frequent contributor to "Silliman's Journal," and is the author of a concise and complete treatise upon the subject of electrical science and discovery. He had been for years perfecting machinery for the effective and economical use of electro-magnetism as a motive power, and had so far succeeded as to be able to use it for the propulsion of machinery, and as a locomotive force. In 1851 he constructed at Washington a locomotive to run by electricity, and at its first trial, on April 29th of the same year, on the Washington Branch of the Baltimore and Ohio Railroad, it more than exceeded the expectation of the inventor, though many difficulties were encountered in matters of detail. The trip was made from Washington to Bladensburg in thirty-nine minutes, including five stops, and the greatest speed attained was at the rate of nineteen miles an hour.'"

An Electric Rolling Mill Installation.

The English Electric Co., Ltd., has received from the Consett Iron Co. the order for the electrical equipment in connection with their new main mill drives. The mills to be electrified are:—A 40 in. slabbing mill and a 42 in. plate mill, both of which will be driven by reversing motors with peak powers of 14 000 H.P. running at 50/100 revs. per min.; a 32 in. light plate mill, which will be of the three-high type driven by a 2 500 H.P. 3-phase induction motor, running at 240 revs. per min.; and a chequer plate mill, which will be driven by a 750 H.P. induction motor running at 240 revs. per min. The electrical equipment will be complete with the necessary flywheel sets for the reversing motors, switchgear, cables, etc. This order is understood to represent the most important rolling mill installation which has been placed in this country in recent years.

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Legal Intelligence.

The London Electricity Scheme.

Prohibition Granted Commissioners' Plans *Ultra Vires*.

The Court of Appeal, consisting of Lords Justices Bankes, Atkin, and Younger, last Friday delivered judgment in the case of the King *v.* the Electricity Commissioners; *ex parte* London Electricity Joint Committee and others, upon the appeal of the supply companies from the judgment of the Divisional Court discharging rules *nisi* for *certiorari* and prohibition which had been obtained against the Electricity Commissioners (see THE ELECTRICIAN, April 20th, p. 431).

The Judgment.

LORD JUSTICE BANKES, in giving judgment, said the Electricity Commissioners were a statutory body set up by the Electricity (Supply) Act, 1919, as the authority to whom a reorganisation of supply of electricity was entrusted. The Commissioners were the authority to approve or themselves to formulate schemes for the formation of electricity districts and the setting up of joint electricity authorities.

Powers Exceeded.

After reading the provisions of section 7 of the statute, his Lordship said the scheme to which objection was taken appeared at the present stage of its existence as a draft order under section 7 of the Act of 1919 constituting the London and Home Counties Electricity District and establishing and incorporating the London and Home Counties Joint Electricity Authority. The objection to that draft order was that the Commissioners were travelling outside their Parliamentary powers and were acting without jurisdiction in putting forward for adoption the scheme in its present form. Whether there were any good and sufficient reasons from the point of view of the business interests of the objectors for taking the objection, it was not for that court to determine. The materials on which to form any opinion on that question were not before them. The only question on that part of the case was whether the objection as to want of jurisdiction was made out. In his opinion it was, and on this short ground. Section 6 (2) of the Act of 1919 enabled the Commissioners to formulate or to approve schemes which contained provisions for enabling the joint electricity authority to delegate to committees of the authority any power of the authority. To get over objections made by the London County Council to having more than one district and more than one electricity authority for London and the Home Counties and the objections of the authorised undertaking within the district to having only one, the Commissioners had propounded this scheme, which, while in name providing for one electricity authority and one district, in fact provided for two.

Provisions of the Scheme.

The scheme provided for the creation of a joint electricity authority under the name of the London and Home Counties Joint Electricity Authority. It then provided that the Joint Committee at their first meeting should appoint two committees of the Joint Committee, one to be called the Local Authority Committee, the other the Company Committee. To create the two authorities under one name the scheme in Clause 9 went on to provide that the Joint Authority shall delegate to the Local Authority Committee and to the Company Committee respectively such of the powers and duties of the Joint Authority as were specified in the third annex to the scheme, and it assigned to each committee a separate portion of the joint electricity district, the effect of that provision was to set up within the one Joint Electricity District which the scheme purported to create two joint electricity authorities, each with its separate district and its independent powers. That was not, in his opinion, authorised by the Act of 1919.

A further objection to the validity of the proposed scheme with the power of delegation which by the statute might be vested by a scheme in a joint electricity authority was by the present scheme exercised by the Electricity Commissioners themselves. His (his Lordship's) view of the construction of the Act of 1919 on that point was that whereas the Commissioners had the statutory right of determining whether a power of delegation to committees should be conferred by a scheme upon a joint electricity authority, the statutory right of exercising that power, if conferred, was vested in the joint authority alone. Without going into other questions, he was of opinion that, on the grounds he had mentioned, the scheme proposed by the Electricity Commissioners was to some extent *ultra vires*. On the point which had been raised as to the effect of section 26 of the Act of 1919, it was sufficient to say that he did not think that that section could be read as giving the Commissioners wider powers on the particular matters he had dealt with than those conferred upon them by the Act itself.

Appeal Court's Jurisdiction.

His Lordship then dealt at great length with the question whether the Court had any jurisdiction to make any order for prohibition or *certiorari*. With regard to prohibition he thought on the authorities that the Court would issue the writ to a body exercising judicial functions, though that body could not be described as being in any ordinary sense a Court. Having regard to the whole matter, he came to the conclusion that there was abundant precedent for the Court's taking action at the present stage of the proceedings of the Commissioners provided it was satisfied that the Commissioners were proceeding judicially in making their report; even though that report needed the confirmation of the Board of Trade and both Houses of Parliament before it became effective. In coming to a conclusion on that point it was necessary to deal with this case on its own particular circumstanes. The Act of 1919 imposed on the Commissioners very wide and very responsible duties and powers in reference to the approval or formulation of schemes. At every stage they were required to hold local inquiries to give interested parties the opportunity of being heard. Their authority extended to the creation of bodies who might exercise all or any of the powers of the authorised undertakers within the electricity district and to whom the undertakings themselves might be transferred on terms settled by the Commissioners. He thought that on principle and on authority it was open to the Court to hold that powers so far reaching, affecting as they did individuals as well as property, were powers to be exercised judicially and not ministerially or merely to proceedings to legislation. On those grounds he thought the appeal against the Order of the Divisional Court discharging the rule *nisi* for a prohibition must be allowed with costs there and below, and the rule for prohibition in the terms of the rule *nisi* must be made absolute. The appeal against the Order refusing to make the rule *nisi* for *certiorari* would be dismissed without costs.

The other members of the Court delivered judgment to the same effect.

Personal Items.

Mr. FREDERIC RICHARD DAVENPORT has joined the board of the Brush Electrical Engineering Co.

Mr. A. T. BLACKALL, late signal and telegraph engineer to the Great Western Railway, has been made an honorary member of the Institute of Railway Signal Engineers.

The Conway Town Council have appointed Mr. DEWI JONES as resident electrical engineer, at a salary to be agreed upon at a future meeting of the Gas and Lighting Committee.

Mr. THOMAS WILKIE, an assistant to the inspector of lighting in Glasgow, has been appointed superintendent of lighting under the Leicester Corporation, at a commencing salary of £400.

Mr. J. DALZIEL, electrical assistant to the chief mechanical engineer of the Midland Railway Co., acted as chief range officer at the railway company's miniature rifle meeting at Derby last Saturday.

There are 45 applications for the position of mains superintendent to Blackburn Electricity Department, rendered vacant by the tragic death of Mr. WALLWORK. A special committee is dealing with the matter.

Mr. J. H. BOWDEN, electrical engineer to the Poplar Borough Council, has prepared a report on a recent visit to America and Canada to investigate the supply of electrically heated water and steam, electric baking and other matters.

St. Pancras Council proposes to alter the title of Mr. J. H. BRYAN, of the Electricity Department, from "Sales Engineer" to "Canvasser and Consumers' Adviser." It is also proposed to increase Mr. Bryan's salary from £328 to £350 per annum inclusive, irrespective of variations in the cost of living.

Alderman J. H. MITCHELL, chairman of the St. Pancras Electricity Committee, and Mr. S. W. BAYNES, the chief electrical engineer, propose visiting the United States to obtain information as to the advantages of using pulverised fuel for steam-raising purposes, with a view to its introduction at the King's Road power station.

OBITUARY.—The Rt. Hon. J. C. WHITE, Craigavad, Co. Down, whose death took place after a serious operation last week, was a keen advocate of the extension of electrical power and lighting in Ireland, and was interested in several schemes for that object.

WILL.—Mr. JOHN TAYLOR OSLER, a director of F. and C. Osler, Ltd., electrical fittings manufacturers, Birmingham (net personalty £77 542) left £78 100.

Business Items.

THE MULLARD RADIO VALVE CO. announces that as from August 1st, the price of the L.F. Ora B and L.F. Ora C valves is reduced to £1 7s. 6d.

PETTERS, LTD., oil engine manufacturers, Yeovil, have been awarded a silver medal by the Royal Agricultural Society of England for their patent cold starting oil engine exhibited at the Society's Show held at Newcastle-on-Tyne recently.

In announcing the conversion of their business into a limited company, HENRY JOSEPH AND CO., importers and exporters of electrical accessories and porcelain, 96, Victoria Street, London, S.W.1, state that the conversion will not affect the general conduct of the business, which will be carried on as heretofore, with the three former partners as directors.

Institution Notes.

A Goldsmid Scholarship, tenable in the Faculty of Engineering at UNIVERSITY COLLEGE, London, of the value of £90 (£30 a year for three years, subject to satisfactory progress) will be offered for competition at an examination to be held at the College in September. Particulars may be obtained on application to the Secretary of the College.

Forty-six candidates out of 74 were successful in the INSTITUTE OF CHEMISTRY'S July examination in general chemistry for the Associateship. Four associates have passed the examination for the fellowship.

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London Electric Railways.

The City and South London Bill Passed.

As briefly reported in our previous issue a compromise has been reached between the promoters of the City and South London Railway Bill and the Southern Railway, whereby the former will cut short their proposed extension at North Morden and will cut out all references in the Bill to the Wimbledon and Sutton Railway.

Explaining the financial system resulting from the modification of the original scheme, LORD ASHFIELD stated in the House of Lords on July 26th, that there would be power for the trains to go beyond North Morden station, in order to get to the car sheds. One result of the agreement would be that some miles of what might be called the more speculative part of the scheme would be dropped. Obviously, the character of the scheme was altered materially, and the City and South London Railway Co. would be under no obligation with regard to the construction of the Wimbledon and Sutton Railway (authorised in 1910, but not yet constructed), so that the capital expenditure would be reduced.

Cost of the Extension.

The estimated cost of the railway would now be £3 600 000, something under £1 000 000 less than the original scheme, whilst, on the other hand, the railway would serve immediately an area where the density of traffic was very much greater than would have been the case with the original proposal.

Discussing estimates which he had arrived at of the result of working the extension, he said there would be seven stations on the extension, five of which would be located in areas where there was very heavy traffic. He had assumed that these stations would deal with 23 000 000 passengers per annum. He had assumed that each of the other two stations would be used only half as much as each of the other five, so that his figure for the two stations would be 5 000 000 per annum. His expectation was that North Morden station would become another Golder's Green, which station was now dealing with about 12 000 000 passengers per annum. For the whole of the 28 000 000 passengers he assumed an average fare of 4d., which would bring the revenue to £466 000 a year, to which he added £20 000 a year for miscellaneous receipts, making a total of £486 000. It was estimated that they would run 5 500 000 car miles per annum; the present operating expenses were 9½d. per mile, and, at this figure, the running expenses would work out to £218 000 per annum on the new line.

£4 000 000 Debentures to be Issued.

It would be necessary to issue some £4 000 000 debentures at 4½ per cent. for building the line, the fixed charges on which would be £180 000 a year, so that the margin would be £88 000 per annum, instead of the margin of £13 000 or £14 000 originally estimated.

Johannesburg Power Scheme.

New Station to Cost Half-a-Million.

H.M. Senior Trade Commissioner in South Africa reports that the Johannesburg Town Council has now voted in favour of THE PROPOSED NEW POWER STATION and advises its erection on the vacant site between the present power station and Jeppe Street. It also recommended that in the period which must elapse before the new power station is completed, a 10 000 kW generator adaptable to the new conditions should be installed in the old power station on temporary foundations to be afterwards removed to its permanent position in the new station, and that the matter should be treated as urgent, in order to have the set running before the winter of 1925.

The total cost of the new station will be about £500 000; it will be equipped with two 10 000 kW generators, together with two generators from the old station, so as to give a capacity of 39 000 kW. Messrs. G. M. Clark have been appointed consulting engineers.

The Finance Committee has also recommended the erection of this power station, provided that authority is obtained from the Administrator to borrow an amount of £525 000. Further particulars are available at the Department of Overseas Trade (Room 52) 35, Old Queen Street, London, S.W.1.

The Austrian Marconi Company.

Constitution of the Directorate.

The Oesterreichische Marconi Aktien Gesellschaft (Austrian Marconi Co. Ltd) which was formally constituted in Vienna on July 13th, with a capital of £133 000, has registered offices at Renn Gasse 14, Vienna. The majority of the board and the entire staff are Austrians.

His Excellency Baron Carl Pitner, formerly Governor of the Bosnian Bank, is Chairman, and other members are: Herr Hans von Mauthner, Vice-President of the Austrian Credit-Anstalt; Herr M. Straffner, Member of the Austrian Council of State; Mr. Consul-General Richard Fanta (Wiener Bankverein); Privy-Councillor Zeisel (representing the Austrian Ministry of Commerce); Ministerial Councillor Haider (representing the Austrian Telegraph Administration); Herr Fritz von Kammann, and Colonel Adrian Simpson.

The Austrian Government has subscribed £40 000 towards the share capital. The company has the sole right of carrying on radio telegraphic services between Austria and other countries for a minimum period of 30 years. The rates will be the same as for ordinary telegrams. Several new stations will be opened for traffic before the end of the year.

Electrification of Railways.

Industrial Group's £50 000 000 Scheme.

That only by developing the resources of this country can the unemployment problem be solved is the conclusion arrived at by the Industrial Group in the House of Commons. In a letter to the Prime Minister the Group points out that as freights are a considerable factor in determining manufacturing costs, every effort should be made to develop power-schemes and cheaper transport facilities.

With this object in view the Group has submitted an outline of railway electrification schemes which would involve, with the necessary power stations, an expenditure of from £40 000 000 to £50 000 000.

The proposals for the Southern Railway Group include the extension of the electrification of the London and South-Western Railway, the completion of the suburban electrification of the London, Brighton and South Coast Railway, and the electrification of the main line to Brighton.

For the North-Eastern Group it is proposed to electrify the suburban lines of the Great Eastern Railway, to electrify the main line from York to Newcastle, and to electrify the Midland Railway to Tilbury and Southend.

Other possible schemes, the letter states, include electrification round Glasgow, the suburban lines round Manchester, and mineral lines in South Wales.

In regard to tube railways the Group points out that the increasing problem of bringing City workers into the metropolis and relieving congestion during "rush hours" makes extension necessary, and quotes as an example the demand for a tube railway beyond the Stratford "bottle-neck" to Ilford.

The British Industries Fair, 1924.

Date Changed to April-May.

It is officially announced that the next BRITISH INDUSTRIES FAIR, organised by the Department of Overseas Trade, will be held at the White City, Shepherd's Bush, London, from April 28th to May 9th, 1924. In selecting this date, the Department appreciated that the holding of the British Empire Exhibition from April to October next year must materially affect the attendance of overseas buyers, since it is unlikely that the visitors from any of the Dominions will make two journeys in a single year, and it is to be expected that they will as far as possible, time their visit after the opening of the exhibition in the spring. Interested trade opinion which was thoroughly canvassed before any decision was reached, is strongly of opinion that the late spring will be the best period for the Fair.

While the British Industries Fair and the British Empire Exhibition have a common object in the promotion of British trade, their activities are in no way competitive but rather complementary. Participation in the Fair, will, as hitherto, be confined to British manufacturers, and admission will be restricted to *bona fide* trade buyers. The British Empire Exhibition, on the other hand, is for the public and welcomes participation by any British firm, whether manufacturer, merchant or retailer.

United Kingdom firms eligible for participation in the Fair will receive forms of application for space during the first week of October, 1923. Meanwhile, notification of the intention to exhibit will be welcomed by the Department. The Birmingham Section of the Fair will open on the Monday following the close of the Fair in London, so enabling buyers to visit both sections of the Fair in comfort.

The Real Situation in Europe.

Need for Optimism and Goodwill.

As the situation now stands, optimism and goodwill are needed where the future of Europe is concerned as they were never needed before. For that reason we regret, says the "European Commercial," to note that a London daily paper, in a leading article on Mr. Baldwin's statement, remarks that "the European economic system with which all our civilisation is interlocked is slowly and steadily sinking." To the casual observer, such might possibly appear to be the case, but to those who care to probe deeper into the heart of things, it is manifest that such a statement is erroneous.

The truth of the matter is, of course, that the European economic system is not sinking at all. Its development, it is true, has been badly interfered with by the Ruhr trouble, which has made itself felt in trading circles all over the Continent. But we hold by the belief that Europe as a whole is not going down, but up. Those who take the opposite view have clearly been deceived by the slower rate of progress which its development, hampered by recent events, has made.

The present negotiations will then, if they are successful, not save a demoralised Europe from the abyss of despair into which it is falling, but remove the obstacles in the path of a development which is being cruelly hindered.

CARGILLS, LTD., export merchants, Balfour House, 119-125, Finsbury Pavement, London, E.C.2, would be glad to receive from manufacturers, latest catalogues and leaflets illustrating and describing their products, together with lowest export terms.

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Imperial Notes.

AUSTRALIA.

British Goods Preferred in Sydney.

It is gratifying to note that SYDNEY CITY COUNCIL recently accepted a British tender for poles amounting to £1 166, and that this tender only exceeded an American tender by £26. A tender for Canadian disc insulators was also accepted. A Japanese tender was the lowest, but it was stated that the Japanese insulators had been found unsatisfactory on a previous occasion.

Melbourne Tramways Development.

The Melbourne and Metropolitan Tramways Board is seeking sanction for an increase of its borrowing powers from £750 000 to £3 000 000. The Boards' scheme of development includes the ELECTRIFICATION OF ALL ITS CABLE LINES, at a cost of £4 200 000, and the extension of the system to all the outer suburbs, at a cost of £5 000 000. This programme it is proposed to execute in from 15 to 20 years.

Electricity Supply Projects in N.S.W.

WALGETT Shire Council is borrowing £3 600 for electricity supply in the town of Walgett.

COWRA Gas Co. proposes to supply electricity in Cowra. The Town Council declines to assent to the proposal, and is taking advice as to the company's right to carry out such a project.

BOURAL Council has decided to borrow £7 000 for the plant and distribution system required for lighting the district by means of current to be supplied in bulk by the Port Kembla station.

CLARENCE County Council has sealed the agreement under which Sir W. G. Armstrong, Whitworth and Co. will carry out the equipment work of the Nymboida hydro-electric scheme. The council is borrowing £100 000 to pay for the work.

WINGHAM municipality has discussed with Crompton and Co. (Sydney) a suggestion for a hydro-electric undertaking on the Bulga. Sir W. G. Armstrong, Whitworth and Co. also offer, provisionally, to carry out a similar scheme to supply electricity to Wingham, Taree and adjacent districts.

Australian Telegraph Practice.

In a paper read at a recent meeting of the Melbourne Division of the Institution of Engineers, Mr. F. R. Bradley, telegraph engineer, of the Australian Commonwealth, dealt with the TYPES OF APPARATUS AND CIRCUIT CONNECTIONS employed in the operation of the dual submarine and land lines of the Commonwealth.

A report of the paper in the "Post Office Electrical Engineers' Journal" states that the author said the Morse quadruplex system was in considerable use on long lines, but had in recent years been displaced by the Wheatstone duplex, with or without the Creed receivers and printers; while the 5-unit Duplex multiplex system, using Baudot receivers and Murray keyboard perforators and transmitters, was just being introduced. Owing to the very long distances that had to be covered, circuits with several stations and special arrangements had to be utilised, such, for instance, as a Simplex set intermediate on a Duplex Morse line, for occasional messages.

Closed circuit working was used on Simplex circuits to economise battery power; but this system had certain disadvantages during bad weather, and was not used on long lines or on lines between busy centres where duplex working might be required. At such places there was generally available a fairly cheap power supply.

The author considered that the hand-operated Morse circuit, because of its simplicity and reliability, would be used in Australia for many years to come on all lines where the amount of traffic was of moderate amount; whilst he considered that the Wheatstone with Creed would deal equally well with the heavy traffic on long lines and on cables.

CANADA.

Automatic Telephony in Montreal and Toronto.

The Bell Telephone Co., of Canada, has prepared plans for placing its service on an automatic basis, although the change will not be completed for some years. The automatic system, states the Montreal correspondent of "The Times," is being introduced in connection with new exchanges in Montreal and Toronto. Officials of the company state that if the extension of telephone service in recent years should continue at the same rate, it would be impossible to obtain a sufficient supply of girls as operators. The automatic system is expected to overcome the increasing difficulty in this connection. The demand for telephone services in the principal cities of Toronto and Quebec is so great that large extensions are necessary, and the company has a development programme which will probably require new capital issues almost every year for a considerable period.

NEW ZEALAND.

Electricity Supply in Auckland.

In an address on the formation and work of the AUCKLAND POWER BOARD, Mr. W. J. Holdsworth, chairman of the Board, said the Board took over the Auckland municipal electricity undertaking in April of last year at a valuation of £1 061 500. A sum of £350 000 was raised on the London market, and the two 5 000 kW sets which were to be installed in the King's Wharf station would bring the capacity of the plant up to 30 000 kW, but as the Board's area extended from Ponsonby to Papakura, and it would evidently be 1930 before the Government could supply power from Arapuni, the Board would have to consider the installation of another 5 000 kW set.

Foreign Notes.

EUROPE.

Changes in Spanish Import Duties.

A recent Spanish Royal Decree converts certain *ad valorem* import duties into specific rates. For electrical installations and commutators up to 1 000 kilos duty per 100 kilogs is now 160 pesetas under the first and 80 pesetas under the second tariff, while the corresponding duties for similar goods over 1 000 kilogs are 120 and 60 pesetas, the conventional rate being 45 pesetas.

Conference of Norwegian Power Houses Association.

The NORWEGIAN ASSOCIATION OF ELECTRICAL POWER HOUSES has held recently a national conference at Tönsberg. Alluding to an interview with the secretary of the association the "Norges Handels og Sjöfartstidende" states that the importance of the conference consisted in the fact that it has enabled experts to deal with the effective control of electrical installations, and the large imports of foreign electrical goods. The conference formulated suggestions regarding a system of control which is to be worked under the supervision of the Government in co-operation with the insurance and electricity supply companies. Consequently the regulations concerning the power stations, which up to now have been established by each separate undertaking according to its own requirements, are to be standardised, and special consideration has been given to installations in small groups. Among other items dealt with by the conference were the projected Electricity Bill, and the use of aluminium cables.

Swiss Electricity Supply Results.

Details given in the report of the Forces Motrices Bernoises for 1922 as to the consumption of the various classes of customer show increased consumption by small consumers, municipalities, co-operative societies, railways, electricity works, and industrial undertakings. The output for the year was 246 500 000 kWh, compared with 212 500 000 kWh in 1921. Requirements of consumers were for the most part met by the plant in the company's own power stations, and only 21 500 000 kWh had to be taken from other concerns. The company expects that in the course of the next few years it will be necessary greatly to increase the amount of supplementary power taken from outside sources to meet the demands on the system, since the work on the new power stations at present in hand is by no means yet completed. The accounts show a net profit of 2 449 000 frs., as compared with 2 140 000 frs., and a dividend of 5 per cent. will be paid on the capital of 44 000 000 frs. Another electricity concern which has recently issued its report is the Enterprises Electriques Fribourgeoises, which shows a net profit of 511 257 frs., as compared with 668 844 frs. in the preceding year. More satisfactory results were shown by the Laufenbourg electricity works, which closed the year with a net profit of 977 439 frs., compared with 591 322 frs. in the preceding year. The output, including a small amount drawn from subsidiary sources, was nearly 314 000 000 kWh, a figure which was only exceeded in 1918. It is stated that the profits would have been more satisfactory but for an outstanding long-term contract for the supply of electricity in Switzerland, which was entered into at a time when production costs were considerably less.

U.S.A.

Electricity Production in 1922.

A recent report of the Department of the Interior shows that the PRODUCTION OF ELECTRICITY IN THE UNITED STATES, during 1922, totalled 47 659 004 000 kWh, against 40 975 617 000 in 1921. Of the 1922 total, New York supplied 15·57 per cent., Pennsylvania 9·50 per cent., and California 9·19 per cent. The production of electricity from water power totalled 17 206 465 000 kWh, as compared with 14 970 408 000 kWh in the previous year. California was the leading producer of hydro-electric power, with 21·95 per cent. of the total; New York coming next with 17·15 per cent.

The above statistics were compiled from all public utility power companies in the United States, whose monthly production of electricity is more than 10 000 kWh. At present the total capacity of generators in these power plants is 16 150 000 kW.

Inter-Imperial Trade.

F.B.I. Committee's Report and Suggestions.

A second interim report of a committee appointed by the FEDERATION OF BRITISH INDUSTRIES to inquire into the future of inter-Imperial trade, which has just been issued, states that the committee is convinced that the completion of the scheme for reciprocal enforcement of judgments, including arbitration awards, proposed by the Imperial Conference, will substantially facilitate commercial dealings between the different parts of the Empire. The Federation refers specifically to the case of State-owned ships, and recommends the resolutions adopted by the London Conference of the Comité Maritime International (October 1922) as a basis for an International Convention.

It is suggested that the Dominions and Colonies should be consulted with regard to the development of their local aviation services, with a view to their being linked up with Imperial services. The Federation recommends that the Imperial Economic Conference should be urged to agree to the duty-free admission of British catalogues throughout the Empire.

The opinion is also expressed that a British Empire patent is desirable, and that the preferred scheme mooted by last year's conference should be pressed for.

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Electricity Supply.

Extensions and Developments.

SWANSEA Town Council has applied for sanction to borrow £30 000 for mains and services.

WORTHING Town Council has decided to extend its electricity works at an estimated cost of £8 170.

ILFORD Urban Council has deferred consideration of a proposed agreement with the West Ham Corporation for a bulk supply of electricity until September.

EPSOM Urban Council has applied to the Electricity Commissioners for a loan of £5 506 for the installation of an engine and dynamo and extensions to buildings, switchboard, etc.

CHERITON Urban Council has consented to the Folkestone Electricity Co.'s application for permission to a change in the system of supply from continuous to alternating current.

HAMMERSMITH Electricity Committee recommends the extension of mains at an estimated cost of £887. Various extensions of the low-tension distribution system, estimated to cost £702, are also recommended.

PRESTON Town Council is applying to the Commissioners for sanction to borrow £409 510 for the erection and equipment of the Ribble power station and a further £74 826 for transmission lines, sub-stations, etc.

WALTON-ON-THAMES Urban Council is to obtain advice as to its position under the Electric Lighting Order, 1904, with reference to the Council taking over the undertaking from the company which operates in the district.

CHESTER Corporation Electricity Committee recommends the Council to apply for sanction to borrow £13 250 for the purchase of machinery and transmission lines in connection with the proposed conversion of the new Crane Street works into a sub-station.

WALSALL Town Council has approved a recommendation of the Electricity Committee that, with a view to providing work for the unemployed during next winter, and subject to the schemes being approved for Government grant, and to the Electricity Commissioners sanctioning a loan of £5 000, extensions be carried out to the electricity mains in various parts of the borough.

MORECAMBE Council has been informed that the Electricity Commissioners see no objection to various works in connection with the electricity undertaking being put in hand, but they cannot at present give formal sanction to the borrowing of £43 000. The Commissioners are also willing to consider favourably the proposed agreement between Morecambe and Lancaster Corporations regarding the suggested joint electricity scheme.

ST. PANCRAS Electricity Committee has received the consent of the Commissioners to the extension of the King's Road generating station. The Finance Committee recommends that application be made to the London County Council for the advance of £44 585 for electricity purposes. The Committee further reports having received sanction from the Commissioners to the borrowing of additional sums of £8 794 and £70 255. The first-named sum is required for services, meters, and wiring. The larger sum is for buildings and plant.

Tentative proposals for works for the relief of unemployment recommended by the HACKNEY Electricity Committee include the conversion of the street lamps in Stamford Hill district from gas to electricity. The total number of lamps in this scheme would be 1 450, and its adoption would involve an expenditure of approximately £24 250. The Committee further proposes to convert the whole of the lamps in the borough from gas to electricity, which would involve the laying down of 50 miles of cable. The capital cost, excluding feeder cables, feeding centres, and other distributing work, would be approximately £100 000 with an additional sum proximating £35 000 on account of lamp service.

Alterations in Charges, Proposed and Actual.

SHREWSBURY Town Council has decided to reduce its charges for electrical energy from the previous increase of 60 per cent. to 50 per cent.

CROYDON Town Council has reduced the charges for electricity for lighting from 7d. to 6½d. per kWh, and for heating from 1s. 0½d. to 1s. 0¼d. per kWh.

CHELMSFORD Town Council has protested to the Electric Supply Corporation, Ltd., against a continuance of the present charges for electricity, and asking for a reduction at the earliest possible moment.

ALDERSHOT Town Council has applied to the Ministry of Transport for an Order to retain the existing maximum charge of 10d. per kWh, with minimum payments of 12s. 6d. for each winter quarter, and 8s. 4d. for each summer quarter.

A LONDON County Council committee recommends that the Notting Hill Electric Lighting Co. be asked whether any further reductions in the prices of electric current are contemplated. The County of London Electric Supply Co. will be asked whether it is proposed to make any further reductions beyond those made in January last.

Tapping New Areas.

SCUNTHORPE Council hopes to be in a position to supply electricity for the town in the near future.

A company, to be known as the Petersfield Electric Light and Power Co., is to be formed to supply electricity to PETERSFIELD.

Application is being made to FLEETWOOD Council to ascertain if it will supply the district with electricity in bulk, and, if so, upon what terms.

NEWNHAM Urban District Council has rescinded the resolution opposing the grant of an Order to the West Gloucestershire Power Co. to distribute electricity within the Council's area.

WELLINGBOROUGH Rural Council have decided to offer no objection to the applications of the Wellingborough Electricity Supply Co., Ltd., and the Rushden Electricity Co. for orders to extend their area of supply so as to include parishes in the Council's area.

Inquiries and Orders.

An inquiry is to be held at KINGSTOWN (Dublin) into the Urban District Council's proposal to raise a loan of £33 000 for the erection of a generating station and distributing system.

The Minister of Transport proposes to confirm the special order authorising the Cumberland Waste Heat Owners' Company to supply electricity in the EGREMONT and CLEATOR MOOR urban districts.

Miscellaneous Supply Items.

Slight damage to switch-gear was sustained at the ROATH power station last Friday, owing to an electrical breakdown.

SOUTHGATE (London) Urban Council is to receive £5 000 a year from the North Metropolitan Co., from 1924 to 1938 inclusive, for refraining to exercise its right to require a re-transfer of the electricity undertaking in 1924 and 1931.

EALING Town Council has informed the Electricity Commissioners that, by scrapping seven obsolete generating sets and replacing them by a turbine set, it will be able before next winter to meet all demands for electricity within the borough.

Tenders received for a turbo-generator set for the Valley Road generating station at BRADFORD are said to show a large difference in price between English and foreign tenderers. It is stated that, while it is desired to place the work in English hands, if possible, the prices are heavily in favour of the foreign offers.

ST. PANCRAS Electricity Committee recommends that consent be given to the London, Midland and Scottish Railway Co. to supply electrical energy to the London and North Eastern Railway Co. for lighting and power purposes for their King's Cross Station, subject to an agreement being entered into between the companies and the Council that the supply of energy to be afforded to the London and North Eastern Railway Co. shall not be used otherwise than for the London and North Eastern Railway Company's own purposes.

On Friday last, the members of the BIRMINGHAM City Council, accompanied by the Lord Mayor and the chief officers of the Corporation, made an official inspection of the new power station at Nechells, recently inaugurated by the Prince of Wales. Alderman J. B. Burman, chairman of the Electric Supply Committee, who entertained the company, which numbered over 100, to tea, explained the general features of the works, the technical details being supplied by the city electrical engineer (Mr. R. A. Chattock) and the chief assistant electrical engineer (Mr. F. Forrest).

Miscellaneous.

As we go to press the annual report of the CHIEF INSPECTOR OF FACTORIES has come to hand. We hope to deal with this report in our next issue.

We are informed in connection with our description of the installations at the new Portobello power station, that all the boilers were fitted with " Crosby " feed water regulators.

On Tuesday the report of the LONDON COUNTY COUNCIL Special Committee on London Electricity, whose recommendations were summarised in our previous issue, was adopted by 50 votes to 17.

During the recent cessation of work at the Fifeshire collieries several mines in the Cowdenbeath district converted their hoisting machinery from steam to electric. Over a dozen collieries in the west of Fife are now being run solely on electric power.

On Wednesday, Princess Mary, Viscountess Lascelles, formally opened the new hydro-electric power station of the York Corporation at Linton Lock on the Ouse. The present capacity of the station is 1 070 kW. A full description of the plant will appear in our next issue.

At a recent inquest at the City Coroner's Court, London, concerning a fire at 8, Redcross Street, Dr. Waldo, the City Coroner, expressed the opinion that legal powers in regard to electrical installations should be provided for the City of London, whereby a model set of regulations similar to those issued by the Institute of Electrical Engineers might be adopted.

In its latest circular, the BRITISH CAST IRON RESEARCH ASSOCIATION states that a joint research with the Electrical Research Association is being arranged to carry out important work in connection with the resistance of cast iron to sea water. It is estimated that the experimental work will occupy about two years and will be carried out at the coast and in tidal rivers.

The Clothworkers' Co. has offered an annual contribution of £3 000 for the period of five years, 1923-1927, to the governing body of the Imperial College of Science and Technology, South Kensington, to be applied towards the maintenance and development of the CITY AND GUILDS (ENGINEERING) COLLEGE, one of the three constituents of the Imperial College of Science.

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Tenders Invited and Accepted.

GREAT BRITAIN.

WARRINGTON TOWN COUNCIL, August 11th.—Three electrically-driven centrifugal pumps. Particulars from the waterworks engineer, Mr. James Gray.

LONDON COUNTY COUNCIL, August 13th.—Pipework and de-aerating plant for the Greenwich power station. Specifications from the General Manager, London County Council Tramways, Victoria Embankment, London, W.C.2.

BASFORD GUARDIANS, August 13th.—Electric light, wiring and fitting of the Institution at Bulwell. Particulars from Mr. W. C. C. Hawtayne, 9, Queen Street Place, London, E.C.4.

BRADFORD CORPORATION, August 16th.—Two 1 000 kW rotary or motor converters. Particulars from Mr. S. Roles, city electrical engineer, 45-53, Sunbridge Road, Bradford.

CHORLEY TOWN COUNCIL, August 18th.—Electrical installation at the Town Hall. Particulars from the borough surveyor, Chorley.

HAZEL GROVE AND BRAMHALL URBAN COUNCILS, August 20th.—(1) 3-phase, 4-core, l.t. cable and laying; (2) l.t. sub-station switchgear; (3) meters for U.D.C. Particulars from Mr. T. L. Miller, 316, Royal Liver Buildings, Liverpool.

LEEDS CORPORATION, September 3rd.—Supply and erection of 3-phase switchgear for generating station. Particulars from Mr. C. N. Hefford, Electricity Department, Whitehall Road, Leeds.

GRIMSBY CORPORATION, September 4th.—High pressure turbine, generator and condensing plant. Specifications from Mr. W. A. Vignoles, borough electrical engineer, Grimsby.

ARGENTINA.

ARGENTINE STATE RAILWAYS.*—Electrical materials; signal, telephone and telegraph material.

AUSTRALASIA.

SYDNEY (Postmaster-General's Department.)*—Motor generators.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS.*—Frequency changer for the White Bay power house.

VICTORIAN ELECTRICITY COMMISSION, October 6th.—22 000 V insulators. Specification (No. 23/117) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

BLEAN (KENT) BOARD OF GUARDIANS has accepted the tender of Mr. S. Terry for an electrical installation at the Institution at £325.

EPSOM Urban Council has accepted the tender of Vickers-Petter, Ltd., for an engine and dynamo at £3 841, and maintenance for eight years at £1 050.

A contract has been placed with the Siemens and English Electric Lamp Co. for four months' supply of incandescent electric lamps to the SOUTHERN RAILWAY Co.

COLCHESTER BOARD OF GUARDIANS has accepted the tender of Truslove and Co., for an electrical installation in the Master's quarters and Casual Ward at £26.

A tender from the British Thomson-Houston Co. for eight sets of complete tramcar electrical equipment has been accepted by BLACKPOOL TRAMWAYS COMMITTEE.

BLACKPOOL CORPORATION has accepted the tender of Messrs. Morrison, of Birley Street, Blackpool, for an electrical installation at the Devonshire Road Council School.

BIRKENHEAD Town Council has accepted the tender of W. T. Henley's Telegraph Works Co. for supplying and laying high-tension main cables round the borough at £10 074 17s.

The Siemens and English Electric Lamp Co. has obtained the contract to supply 14 052 Siemens vacuum and gasfilled type train lighting lamps to the BOMBAY, BARODA AND CENTRAL INDIA RAILWAY.

LONDON County Council has accepted the offer of Tilling-Stevens Motors, Ltd., for a petrol-electric chassis for a turntable ladder in use in the fire brigade in substitution for the Braun electrically-propelled chassis, and the conversion from gas to electrical power of the gas-driven apparatus of two other turntable ladders.

WORTHING CORPORATION has accepted the tender of the Enfield-Ediswan Cable Works (lowest tender received) for the supply of cables in connection with electricity supply in the parish of Durrington, at £1 484 10s. Sixteen tenders were received, the highest being £2 005. The tender of the English Electric Co. for a 750 kW dynamo, with Diesel engine, £11 365, has also been accepted.

SHOREDITCH (LONDON) BOROUGH COUNCIL is recommended to accept the following tenders:—General Electric Co., 1 500 kW rotary converter (375 revs. per min.), £6 651 (eight tenders received, varying from £5 721 10s. to £6 730, the lowest being also from the G.E.C. for 500 revs. per min.); Babcock and Wilcox, two superheaters, £1 475; Davidson and Co., ventilating apparatus for Coronet Street sub-station, £333.

The tender of the Brush Electrical Engineering Company for 25 covered tramcars, at £915 per car has been accepted by CARDIFF CORPORATION. Seven tenders were received varying from £750 to £1 169 per car. The British Thomson-Houston Co. has the contract for the electrical equipment, at £476 12s. per car, and the Peckham Truck and Engineering Co. is to supply the trucks at £183 each, making the total cost £1 574 12s. per car.

Tenders accepted by BIRKENHEAD CORPORATION include the following:—Bruce Peebles and Co., 500 kW rotary converter for Beaufort Road sub-station, £2 696 2s.; British Thomson-Houston Co., 500 kW rotary converters for South End and Prenton sub-stations, £2 570 14s. each; and switchgear for Beaufort Road and South End sub-stations, £321 15s. and £838 respectively; Ferguson Pailin Ltd., switchgear for Flaybrick Hill and Prenton sub-stations, £506 11s. and £914 2s., respectively.

The following tenders have been accepted by MANCHESTER CORPORATION:—Welding and Electrical Co., repair boiler; British Insulated and Helsby Cables, Callender's Cable and Construction Co., Enfield, Ediswan Cable Works, Pirelli-General Cable Works, Siemens Bros. and Co., Western Electric Co., Johnson and Phillips, and Macintosh Cable Co., cables; Bertram Thomas, l.t. d.c. switchgear; General Electric Co., and Ferguson, Pailin Ltd., 6 600 V cubicle type switchgear.

*Particulars from Department of Overseas Trade.

Telegraph and Telephone Notes.

Australia Asks for Cheaper Cable Rates.

Following Viscount Burnham's plea for a reduction in cable rates in a recent deputation to the Postmaster-General, a determined effort is being made in Sydney in this direction, states a "Daily Telegraph" correspondent. The importance of an early reduction is recognised, as wireless rates are based on two-thirds of the cable rates. If it was possible to secure a one-third reduction on cables in the ensuing year, cost to wireless from Australia to England would be half the existing cable rates, 1s. 6d. per word full rate, instead of 3s., with Press and other rates proportionate. Investigation of the position discloses the following facts. The Pacific cable is admittedly financially able to reduce rates immediately, as there are large annual profits, despite substantial amounts to reserve funds, but, as the lines are now working at full capacity, any increased traffic following reduction would create serious congestion. Complete duplication would enable the board to handle this increase, but duplication between Suva and Bamfield is held up pending experiments with a new type of cable.

An International Telegraphic Conference.

Reuter's Agency is informed that a committee consisting of the directors of the British, French, and Italian telegraphic services was held at the London office of the League of Nations recently to examine a proposal of the Italian Government for an international conference on wireless telegraphy. The committee declared itself unanimously in favour of a universal conference, telegraphic and radio-telegraphic, in the first half of 1924. The committee proposes to meet in October to re-examine the Italian proposal that this conference should be held with the co-operation of the League of Nations in case the negotiations between certain Governments have not met with success by this date.

Miscellaneous Items.

GRENADA Legislative Council has agreed to the Colony's joining in the West Indian All-British telegraph scheme.

A trunk telephone line is to be provided, at a cost of £20 000, between SYDNEY (N.S.W.) AND BRISBANE (Queensland).

The INDO-EUROPEAN TELEGRAPH Co. announces that telegraphic communication over its lines with South Russia, Turkey, Iraq, Persia, Persian Gulf, India, and the Far East will be reopened shortly.

An Agencia Americana message states that the municipality of MONTEVIEDO has decided to establish a network of subterranean telephones throughout the capital, and it is expected that the work of construction will shortly be started.

EDINBURGH Town Council will shortly be asked to adopt a new system of street telephone fire alarms which are expected to cost approximately £1 000. The scheme would involve the distribution in the city and suburbs of 72 emergency street telephones in direct communication with the Fire Brigade headquarters.

The DOMINION EXPRESS Co. of Canada has come to an arrangement with the Postmaster-General whereby, on and after Wednesday, telegraph money orders for Canada will, after transmission over the Imperial cable, be handed over to the company for payment in Canada. The Dominion Express Co.'s offices in Canada—in addition to its existing money transfer business—will also accept telegraph money orders for payment at any place in Great Britain through the Post Office.

Mining Electrical Engineers.

Interesting Visit to Newcastle-on-Tyne Works.

Members of the local section of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS recently visited the Newcastle-on-Tyne works of J. H. Holmes and Co., when the party was received by Messrs. J. H. Holmes, S. Holmes, O. Holmes, W. J. Holmes, and C. E. Holmes. The visitors were conducted round the works under the guidance of Messrs. T. Carter, A. T. Robertson, G. E. Higginbottom, W. Ford, and R. Robinson. Interest was evinced in a large testing set which has just been completed for the National Physical Laboratory. It is arranged to convert direct current into alternating current at any frequency between 20 and 70 cycles per second, and either single, two, or three-phase for meter and general testing purposes. It consists of two 100 V variable speed motors coupled to two alternators, the stator frame of one alternator being provided with an arrangement by which it can be racked round by hand or alternatively by a small d.c. motor.

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Electric Traction.

Tramway Extensions and Developments.

The formal ceremony incorporating the PAISLEY tramways in the Glasgow system took place on Wednesday.

LAMBETH Council has referred back a proposal to extend the London County Council Tramways service to the Crystal Palace.

HULL Corporation Tramways Committee has decided to seek powers to extend the service in various directions at an estimated cost of £130 000.

CROYDON Borough Council has decided to adopt a system of railless tramcars for the Addiscombe route, which is to be re-constructed at a cost of £110 000.

Many cars will have to be replaced at no distant date with new vehicles of larger capacity, states the annual report of the NEWCASTLE-ON-TYNE municipal tramways undertaking.

LIVERPOOL Tramways Committee is contemplating the expenditure of about £200 000 on the conversion of Tournament Hall, Edge Lane, as a tramway construction and repair works, with facilities for the construction or repair of over 200 cars.

WEST HARTLEPOOL Corporation is contemplating the establishment of trackless trams on the ground that these would only cost £3 000 per mile, as against £13 000 a mile for the reconstruction of the existing tramway tracks and rails. The Unopposed Bills Committee of the House of Commons last week passed the Bill sanctioning the scheme for the third reading.

Fares, Receipts and Passengers.

BARROW tramway receipts for the week ended July 21st, at £659, were within 11½d. of the corresponding total for last year.

During the week ended July 25th the receipts of the London County Council Tramways were £86 680 compared with £93 858 in the corresponding week last year.

Receipts on London tramways controlled by the "Underground" group during the week ended July 21st totalled £238 351, an increase of £501 on the corresponding week last year.

NEWCASTLE-ON-TYNE municipal tramways made a net surplus of £43 479 last year, out of which £39 407 has been spent on recent renewals and developments. The total number of passengers carried was 89 776 039.

From April 1st to July 12th BLACKPOOL Corporation trams carried 10 108 627 passengers, an increase of over one and a half millions on the corresponding period last year. The receipts were £83 498, an increase of £4 764.

MANCHESTER Tramways Committee has adopted a new method of calculating tramway fares. The scheme will allow a passenger coming into the city by any route, and desiring to get to some part of the central area to which his car is not travelling, to secure an extension ticket for an extra halfpenny.

OFFICIAL RETURNS of thirty-four of the principal tramway undertakings in the United Kingdom, as published by the "Tramway and Railway World," for the week ended July 14th, give total receipts of £355 884, or £1 635 less than in the corresponding week of last year. The total length of track included in the returns was 1 948 miles. Receipts this year were at the rate of £182 13s. 10d. per mile of single track, and last year at the rate of £183 10s. 7d. thus showing a decrease for the week of 16s. 9d. per mile open.

Electric Railway Items.

It is rumoured that the electrification of the GLASGOW subway railway will be undertaken in the course of the next few months.

Recent rumours regarding the proposed electrification of the LONDON MIDLAND & SCOTTISH COMPANY'S line from Preston to Carlisle are said to be unfounded.

It is probable that the scheme of running electric trains on the LONDON & SOUTH WESTERN line between Waterloo and Guildford will be carried out within the next two years.

For the week ended July 21st the traffic receipts of the MERSEY RAILWAY totalled £4 254, bringing the total receipts for the first 29 weeks of the year to £131 648.

BRENT STATION, the first station on the new extension line from Golders Green to Edgware, which is rapidly approaching completion —is something entirely new in the way of "Underground" station buildings. It is designed to harmonise with its rural surroundings. The station consists primarily of a large booking hall, entrance being effected through a Portland stone portico formed of coupled Doric columns. A touch of colour will be given by sand-faced bricks of varying tones of red and purple, which will contrast pleasantly with the white stone of the portico. The booking hall will be equipped with three of the latest pattern passimeter booking booths, constructed in oak and harmonising with the booking hall.

Foreign and Miscellaneous Traction News.

A motion to abolish advertisements on CARDIFF tramcars has been rejected by the City Council.

EDINBURGH tramway returns show that about four-fifths of the traffic was carried on the electric trams, the remainder being carried by 'bus.

In a BERLIN street having a tramway track separate from the motor and horse roads the track is sown with grass and bordered with flowers for a distance of several miles.

BRIGHTON Tramways Committee recommends the acceptance of a Belgian tender to supply steel tyres at £14 13s. per ton, as the price quoted is much below the British offers.

Wireless News.

Use of Wireless in Mine Rescue Work.

In the near future wireless telephony will probably play an important part in the work of colliery rescue parties. As the rescuers carry out their duties, constant communication will be kept up with those directing operations from a base. That is the object underlying a series of experiments being conducted at Ashington Colliery by Mr. Thomas Forsyth and Mr. Thomas Boutland. A considerable measure of success has already attended their efforts, and quite recently speech and music were successfully received underground. A party equipped with a three-valve receiving set descended the shaft of the Carl Pit, and fixed a 20-ft. aerial on the baulks supporting the roof. Only one head telephone was used, but so clear was the reception that the five men composing the party all heard distinctly.

Mr. E. H. Wilding has carried out a successful wireless experiment with a standard four-valve set at Priestner's Pit, Westleigh. Along with a number of officials, he descended the shaft, and at various points was able to hear the broadcast wireless concert. The depth of the shaft is nearly 300 yards, and so clear was the music at the lowest depth that it is proposed to carry out a further experiment at the New Parsonage Pit, which is 1 000 yards deep.

The Wireless Parasite.

Everyone who listens-in with a wireless receiver has been compelled to make the acquaintance of the wireless parasite. This enemy of wireless reception, better known by the term "atmospheric," has been investigated by wireless engineers ever since wireless was first introduced, and every effort has been made to eliminate it from the receiver, but still only partial success has been achieved. Under the auspices of the British Radio Research Board, experiments have been conducted over a long period, in order to study the nature of these parasites. In this week's issue of the "Wireless World," Mr. Watson Watt describes this work and shows how interesting a study it can be made. It is shown that these parasites may be photographed and how they may be divided up into distinct families and types. These investigations, it is hoped, may assist considerably in the elimination of this kind of interference in reception, because an intimate knowledge of the nature of the disturbance will prove a great aid in solving the most serious problem in wireless.

Manchester Transmission Improvements.

The new broadcasting station in Dickinson Street, Manchester, which is to be opened to-day (Friday) by Lord Gainford, promises to effect still further improvements in transmission locally. The new transmitting set embodies the latest improvements, and it can be controlled by one man who will also have visual control, through sound-proof glass, of the studio itself.

Wireless News in Brief.

A demand for WIRELESS RECEIVING SETS is anticipated in Rhodesia as soon as the Government's large wireless station is erected in the Union of South Africa. Meanwhile, broadcasting is being done by private enterprise in the Cape Province.

Announcement has been made that a GOVERNMENT WIRELESS STATION is to be erected on St. Paul's Island, which stands in the entrance to the Gulf of St. Lawrence, off the most north-easterly point in Nova Scotia.

With the object of making possible the RECEPTION OF BROADCAST ITEMS on an ordinary crystal set anywhere in the country, the British Broadcasting Co. is contemplating the erection of from 11 to 15 relay stations in various parts of the kingdom.

It is understood that the AUSTRIAN MARCONI Co. will take over and reconstruct all Austrian wireless stations and, after founding similar organisations in Budapest and the Balkan States, they will establish a regular central European wireless connection with the entire world.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"What the Public Reads: Notes from the Home Journals"; "The Decoration of Furniture: Painted Work."

THE CHEMICAL AGE.—"Synthetic Camphor," by Dr. S. P. Schotz; "The Origin of Petroleum," by Dr. P. E. Spielmann.

THE EUROPEAN COMMERCIAL.—"Trade Terms: A List of Standard Definitions"; "European Unemployment Statistics: Post-War Causes and Tendencies Reviewed"; "Trade and Commerce of Yugo-Slavia in 1922."

THE FRUIT GROWER.—"The Amended Merchandise Marks Bill"; "Stripe Disease of Tomatoes"; "Speech Day at Swanley College" (illustrated).

GARDENING ILLUSTRATED.—"Saxifrages at the R.H.S." (illustrated); "Allotment Work in August"; "Some Recent Roses."

THE GAS WORLD (Special Monthly By-Product Coking Section). —"Guarding Against Electrolysis of Gas Mains"; "Gasworks Testing."

THE HARDWARE TRADE JOURNAL.—"Chats on Silver and Plate: Novelties in Cabinets"; "Hints on Stocking and Storing Rubberware"; "The Development of Inter-Imperial Trade."

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Companies' Reports, Dividends, etc.

FELLOWS MAGNETO CO.—At the annual meeting, on July 26th, Mr. V. L. Fellows said the number of magnetos sold had increased very largely, but unfortunately the average selling price was lower than it was in 1921, consequently the increase in the amount of the turnover was not so marked as it would otherwise have been. They were not now entirely dependent upon magnetos for their profits. They were among the first in the country to manufacture wireless apparatus on a large scale. When this new business was instituted, sales began in a very small way, and did not grow to any great extent until towards the end of the year. Consequently, the beneficial results accruing to them from this branch of the business were not very considerable in the accounts under review. The sales of wireless parts showed very rapid growth up to May last, when sales fell off somewhat. It was hoped, however, that this was only temporary. There was no doubt that business in this department would increase again very shortly, and would continue during the autumn and winter seasons. The wireless business was in its infancy, and if the hand of officialdom did not bear too heavily upon it, it should develop into a great and important industry.

Stock Exchange Quotations.

THE STOCK EXCHANGE COMMITTEE has granted official quotations to £500 000 5 per cent. redeemable debenture stock, 1933-1943, of the Metropolitan District Railway Co.; £675 000 joint power house 4 per cent. rent charge stock of the Metropolitan District and London Electric Railways; 240 000 £1, fully paid, ordinary and 250 000 £1, fully paid, 6 per cent. cumulative preference shares of the Urban Electric Supply Co., and 108 000 £5, fully paid, shares of the United River Plate Telephone Co.

Supply and Lighting.

CITY OF LONDON ELECTRIC LIGHTING CO.—An interim dividend is declared for the half-year of 5 per cent. actual.

RUSHDEN AND DISTRICT ELECTRIC SUPPLY CO.—The interim dividend for the past half-year is maintained at 3½ per cent. actual.

CHELSEA ELECTRICITY SUPPLY CO.—For the past half-year an interim dividend is announced of 4½ per cent. actual against 4 per cent.

LLANELLY AND DISTRICT ELECTRIC LIGHTING AND TRACTION CO.—The directors announce an interim distribution of 3 per cent. for the half-year ended June 3rd.

NORTHAMPTON ELECTRIC LIGHT AND POWER CO.—Holders of 4 per cent. ordinary "B" shares will receive on August 23rd an interim dividend for the year of 4 per cent.

AMERICAN WATER WORKS AND ELECTRIC SUPPLY CO.—Announcement is made of a dividend of 1 per cent. on the 6 per cent. participating preferred stock, and the regular quarterly dividend of 1¾ per cent. on the 7 per cent. cumulative first preferred stock, both payable on August 15th.

TOTTENHAM DISTRICT LIGHT, HEAT AND POWER CO.—Dividends in respect of the half-year ended June 30th have been declared of 5 per cent. per annum on the preference stock, 8 per cent. per annum on the "A" stock, and 6½ per cent. per annum on the "B" stock, all less tax, payable on August 11th.

NORTH OF SCOTLAND ELECTRIC LIGHT AND POWER CO.—After making provision for income tax and reserve, for renewal of plant, and meeting debenture loan interest and preference shares dividend, and adding the amount brought forward, there remains a balance in net revenue account of £4 783. The directors recommend the payment of a dividend of 7 per cent. on the ordinary shares, free of tax, placing £1 000 to general reserve, leaving £283 to carry forward. The dividend paid last year was 1½ per cent.

KALGOORLIE ELECTRIC POWER AND LIGHTING CORPORATION.—At the recent annual meeting in London, Mr. G. C. Howard (the chairman) said the directors were considering proposals to instal new generating plant involving a fairly considerable expenditure of money. He thought the year's results were satisfactory, especially as the profits had been earned on lower power sales. The increased profit was the result of reduced costs, but it would have been much higher but for the destruction of many of the company's lines by a cyclone.

Cable, Telegraph and Telephone Companies.

INDO-EUROPEAN TELEGRAPH CO.—The accounts for the year ended December 31st last show a gross income of £198 400 and a net profit of £33 993, to which must be added £17 991 brought in, making available £51 984. Two dividends, totalling 7 per cent., have been paid, leaving £22 234 to be carried forward.

PARA TELEPHONE CO.—The accounts for 1922 show that, after writing off £6 804 for loss on exchange, etc., and allowing £1 809 for taxation, the net profit amounted to £2 843 (against £2 482 for 1921). Adding the balance of £4 457 brought forward, there is an available credit balance of £7 300, which it is proposed to carry forward. Owing to the above loss on exchange the directors do not propose a dividend. For 1921 the dividend was 6 per cent., free of tax. It is stated that the number of subscribers increased during the year by 132 to 1 401.

MARCONI'S WIRELESS TELEGRAPH CO.—In a circular to shareholders the directors state that in view of the expected statement by the Postmaster-General on the proposed agreement between the Government and the company they consider it highly important that when they meet the shareholders in annual meeting they should be in a position to give them detailed information in regard to the agreement. In these circumstances they have decided to defer the annual meeting for the short period which will be necessary to enable them to make a definite announcement. Meantime, although the audit of the accounts for the past year is not yet complete, the directors are in a position to state that the profit for the period will not be less than that of the preceding year.

Traction Companies' Results.

DUBLIN UNITED TRAMS.—An interim dividend at the rate of 4 per cent. per annum, less tax, has been declared on the ordinary shares.

ISLE OF THANET ELECTRIC TRAMWAYS AND LIGHTING CO.—The company, states the "Financier," has paid a dividend of 2s. 6d. per share, less tax, on the preference shares for the half-year to October, 1909.

LIVERPOOL OVERHEAD RAILWAY CO.—The directors have declared an interim dividend for the half-year ending June 30th at the rate of 5 per cent. per annum, less tax, on the preference shares, payable on August 17th.

BRAZILIAN TRACTION LIGHT AND POWER CO.—Presiding at the annual meeting in Toronto, Sir W. Mackenzie pointed out that the results for 1922 (summarised in our issue of July 6th) must be considered as satisfactory, having regard to conditions in Brazil and the low rate of exchange prevailing during the period under review.

METROPOLITAN DISTRICT RAILWAY CO.—The result of the working for the six months ended June 30th admits of the payment of the dividends on the several issues of preference stock and of an interim dividend at the rate of 3 per cent. per annum on the ordinary stock. The latter payment compares with a rate of 2½ per cent. per annum paid in respect of the corresponding period in 1922.

KALGOORLIE ELECTRIC TRAMWAYS.—Mr. A. N. P. Stoneham, who presided at the annual meeting in London on July 25th, said the total receipts for the year amounted to £30 887, as against £28 632 for the previous year, and the operating expenses were £19 830, as against £19 606. The net profit for the year was £8 139, as against £5 817 for the year 1921. They had hoped this year to have shown a substantially improved position, and had conditions continued as they were at the beginning of the financial year, the result of the year's working would, under the circumstances, have been very satisfactory, but the long strike of the engineers and the consequent restricted operation on the mines were responsible for a falling off in the traffic.

New Companies.

JOHN GIBBS AND SON, LTD.—Private. Cap., £5 500 in £1 shares. Electrical engineers. Reg. office: 72, Duke Street, Liverpool.

J. BRENT AND CO., LTD.—Private. Cap., £100 in £1 shares. Electricians, etc. Reg. office: 2A, Marlborough Road, Watford.

RENFIELD ENGINEERING AND TRADING CO., LTD.—Private. Cap., £100 in £1 shares. Electrical engineers, etc. Reg. office: 47, Renfrew Lane, Glasgow.

T. MILLMAN, LTD.—Private. Cap., £1 500 in £1 shares. Electric lighting engineers, etc. Reg. office: 1A, Gloucester Road, South Ealing, London, W.5.

W. G. PROSSER AND CO., LTD.—Private. Cap., £3 000 in £1 shares. Electric welders, etc. A director: W. G. Prosser, "Rose Cottage," Greatham, Stockton-on-Tees.

PETERSFIELD ELECTRIC LIGHT AND POWER CO., LTD.—Cap., £20 000 in £1 shares. Business indicated by title. Reg. office: 27, Lavant Street, Petersfield, Hants.

GARDNER AND PEDERSEN, LTD.—Private. Cap., £1 100 in £1 shares. Manufacturing electricians, electrical engineers and contractors, etc. Reg. office: 2A, Albert Street, Fleetwood.

BRITISH HUSH-A-PHONE CO., LTD.—Private. Cap., £250 in 1s. shares. To acquire the undertaking of the British Hush-a-Phone Co. Reg. office: 19, Berkeley Street, Berkeley Square, W.

GARNETT, WHITELEY AND CO. LTD.—Private. Cap., £5 000 in £1 shares. Manufacturers of telegraphic and telephonic instruments etc. Reg. office: Lotus Works, Broadgreen Road, Liverpool.

HAMILTON BROS., LTD.—Private. Cap., £500 in £1 shares. Electricians, manufacturers of and dealers in wireless apparatus, etc. Reg. office: 113 and 114, Fenchurch Street, London, E.C.

BRITISH ELECTRICAL INSTRUMENTS, LTD. Private. Cap., £1 000 in £1 shares. Manufacturers of, agents for, and dealers in electrical and other instruments and appliances in connection with wireless telegraphy, telephony, etc. Reg. office: 79, Corporation Street, Manchester.

BOURNEMOUTH WIRELESS TRAINING COLLEGE CO., LTD.—Private. Cap., £6 000 in 4 000 ordinary shares of 10s. each and 4 000 participating preference shares of £1 each. Wireless engineers and dealers in accessories and spare parts. Reg. office: 20, Lansdowne Road, Bournemouth.

HAZELTINE NEUTRODYNE RADIO SETS, LTD.—Private. Cap., £5 000 in £1 shares. To acquire the right to use an invention known as "The Hazeltine Neutrodyne Radio Receiver" and to manufacture and deal in apparatus made in accordance with the said invention, etc. Reg. office: 147, Queen Victoria Street, London, E.C.4.

RODERICK ELECTRIC SUPPLIES CO., LTD.—Private. Cap., £2 500 in 2 450 7 per cent. non-cumulative preferred ordinary shares of £1 each and 1 000 deferred shares of 1s. each. Manufacturers, importers and exporters of and dealers in electric light, cooking, heating and all kinds of electrical apparatus. Secretary: Miss E. Roderick, 109, Guilford Street, London, W.C.1.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

BACKHOUSE, Mr. T., Burden Lane, Cheam, electrical engineer. £15 19s. 8d. June 12th.
BROWN, William Joseph, 23, Spencer Road, St. John's Hill, S.W., electrical engineer. £13 13s. 8d. June 13th.
ELLIOTT, Mr. D. S., 15, Sea View, Hoylake, electrical engineer. £11 1s. June 14th.
FRANCIS, Leonard, 75, Pontefract Road, Castleford, electrical engineer. £13 10s. 4d. June 13th.
IDEAL ELECTRIC SUPPLY CO., 11, Russell Street, Keighley, electrical engineers. £10 5s. 5d. June 12th.
PORTER, Mr. W. H., 44, Church Street, Birmingham, electrical engineer. £35 2s. 6d. May 3rd.
SPREADBOROUGH, L., AND CO., 14, Frith Street, Soho, electrical engineers. £44 17s. 7d. June 12th.

Receiverships.

BIRMINGHAM CENTRAL SUPPLY CO., LTD. W. Lloyd, of 12, Cherry Street, Birmingham, was appointed receiver on July 12th, 1923, under powers contained in second mortgage debentures dated August 12th, 1922.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

BRISCOE (C. T.) AND SON, LTD., Blackburn, electrical engineers. Registered July 12th, £1 000 mortgage. *Nil. March 24th, 1922.
ELECTRICITY HOUSE, LTD., Wolverhampton. Registered July 9th, £70 debenture; general charge.
FRIEND WINTLE AND CO., LTD., electricians. Registered July 9th, £4 500 debenture; general charge.
THAMES ELECTRIC WIRELESS CO., LTD., London, S.W. Registered July 13th, £800 debentures; general charge. *£800. June 27th, 1923.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

EVANS, Mrs. Emily Louise, trading as the WATERLOO ELECTRIC CO., electrical factors, 129, Waterloo Road, and 73, New Cut, Lambeth, London, S.E. Creditors were called together recently and decided to accept an offer of 6s. 8d. in the £. A statement of affairs was presented which showed liabilities of £1 482 and net assets of £262, a deficiency of £1 220. Mr. W. A. J. Osborne (of Corfield and Cripwell) reported that the debtor commenced the business in June, 1922, with a capital of £270. She took empty premises and seemed to have worked up a substantial business. The purchases for the business had totalled £7 994, while the sales had amounted to £8 540. The overhead expenses were not heavy, but the debtor seemed to have spent an abnormal amount on advertising, the expenditure in that direction being no less than £912. No proper books had been kept. The trading had resulted in a net loss of £690, while the debtor had spent about £150 at the recent Bristol exhibition. In May a company was formed to take over the business, but the assets were not transferred. During the discussion it was stated that the business should be continued profitably, the turnover being as much as £400 to £500 a week, during the busy season. The following are creditors:—General Electric Co., Ltd., London, £422; Gent and Sons, Ltd., £57; Kent Bros. and E. H. Phillips, £52; Mosses and Mitchell, £40; Radio Equipment Co., £25; Siemens Bros. and Co., £47; Sterling Telephone and Electric Co., £158; Sanders Electric Co. (Coventry), £17; South-Eastern Manufacturing Co., £22; Three Star Accumulators, £29; Wates Bros, £100; Warrington Wire Ropeworks, £25.
SURREY SCIENTIFIC APPARATUS CO., LTD., Shrewsbury Works, Isleworth. The creditors have asked the company to pass the necessary resolution for voluntary liquidation, it being suggested at the meeting that a liquidator might be able to come to terms with the execution creditors. A previous meeting had been adjourned with a view to a cash offer of 5s. in the £ being submitted, but it had not been possible to obtain the support necessary to submit such a composition.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Companies Winding-Up Voluntarily.

BRITISH WIRELESS SUPPLY CO., LTD. W. Adgie, chartered accountant, Park Row, Leeds, appointed liquidator. Meeting of creditors, Metropole Hotel, Leeds, on Friday, August 10th, at 12 noon.
CALPHOS ELECTRICAL CO., LTD. C. T. Payne, 80, Lancaster Road, West Norwood, appointed liquidator.
LOWTH AND SMITH, LTD. J. McGregor, 4, St. Ann's Square, Manchester, chartered accountant, appointed liquidator.

Bankruptcy Information.

ADAMS, Ernest Walter, lately carrying on business as The WIRELESS ACCESSORIES STORES, 664, Old Kent Road, London. Receiving order, July 21st. Debtor's petition.

Notice of Intended Dividend.

DAVISON, Thomas, carrying on business at 30, Falkner Street, Liverpool, as RADIO TECHNICAL COLLEGE. Last day for receiving proofs, August 11th. Trustee, E. D. Symond, 11, Dale Street, Liverpool.

Bankruptcy Proceedings.

PERRIER, Cyril Charles, with STUART, Arthur Curtiss, trading as the STUART WIRELESS TELEPHONY CO., 109, Kingsway, W.C. The joint statement of affairs lodged by Perrier shows liabilities £4 13s (£3 165 expected to rank), and assets £198. It appeared that in June of last year this debtor entered the employment of the Stuart Wireless Telephony Co., started by Stuart for the puprose of manufacturing and dealing in wireless sets and parts. Perrier was employed as sales manager until August, when he became a partner and tried to obtain further capital for the business. He was, however, not successful and a private meeting of the firm's creditors was held in November, when a resolution for bankruptcy was passed and the business was closed. He attributed the failure and insolvency of the business to depreciation of stock, machinery and fittings, to loss in trading chiefly brought about by the delay in the commencement of broadcasting, and to loss incurred through the enforced destruction of a number of sets which did not conform with the Government regulations issued in or about August last.

Prices of Metals, Chemicals, etc.

TUESDAY, July 31.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£68 0 0	—	£1 0 0
Electro Wirebars	,,	£72 15 0	—	5s.
H.C. Wire, basis	per lb.	10 1/16d.	—	—
Sheet	,,	10½d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2 1/16d.	—	—
Brass 60/40—				
Rod, basis	,,	7½d.	—	—
Sheet, basis	,,	10d.	—	—
Wire, basis	,,	10½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 14 0	—	1s.
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 0 0	—	10s.
Lead Pig—				
English	,,	£25 15 0	—	—
Foreign or Colonial	,,	£24 7 6	—	2s. 6d.
Tin—				
Ingot	,,	£185 2 6	—	£1 10 0
Wire, basis	per lb.	2s. 5½d.	—	½d.
Aluminium Ingots	per ton	£120 0 0	—	—
Spelter	,,	£31 11 3	£1 6 3	—
Mercury	per bottle	£10 0 0	—	5s. 0d.

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2½d.
,, (Roll-Brimstone)—,, £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. ,, £26 per ton, £7 10s.
Boric Acid (Crystals). ,, £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2d.; plantation 1st latex, 1s. 2½d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd. and the rubber prices by W. T. Henley's Telegraph Works Co.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

197 972 E. C. R. MARKS (Soc. S.A.A.E. Soc. ANON.). Multiplication of phases o a.c. network with a view to feeding rectifiers. (19/11/21.)
197 982 A. L. LARGE. Electrically heated kettles, etc. (17/2/22.)
197 986 Sir C. A. PARSONS and J. ROSEN. Electrical machinery. (23/12/21.)
197 988 A. MANSELL. Means for adjusting electric light pendants. (9/1/22.)
174 606 D. VON MIHALY. Phototelegraphy. (18/2/19.)
198 006 BRITISH-THOMSON HOUSTON CO. and A. P. YOUNG. Magneto-electric machines. (25/1/22.)
198 011 WESTERN ELECTRIC CO. Multiplex transmission systems, particularly submarine cable systems. (15/2/22.)
175 635 GES. FUR DRAHTLOSE TELEGRAPHIE. Thermionic wireless transmitters. (16/2/21.)
198 016 A. J. TROTT and E. L. J. WEIGHT. Electrically heated incubators. (17/2/22.)
198 024 E. A. ASHCROFT. Electrolysing fused salts of metals and recovering metals and acid radicles, and application of process to recovery of valuable constituents from metal-bearing ores and materials. (18/2/22.)
198 034 R. L. CHASELON. Current tapping connector. (20/2/22.)
177 152 E. G. BUDD MANUFACTURING CO. Jigs for use in assembling and electrically welding parts of automobile bodies, etc. (15/3/21.)
198 040 C. J. COLEMAN. Means for transmission of messages through cables having high electrostatic capacity. (22/2/22.) (Cognate application, 14043/22.)
198 044 F. E. PERNOT and L. J. RICH. Loading submarine cables. (23/2/22.)
198 046 R. D. ARCHIBALD. Continuous current machines excited with series winding. (23/2/22.)
198 052 H. G. C. FAIRWEATHER (W. DUBILIER). Selectively transferring electrical oscillatory energy. (23/2/22.)
198 062 H. T. WORRALL. Electric meters. (24/2/22.)
198 064 T. L. CARBONE. Arc lamps. (25/2/22.)
198 085 H. H. BERRY and C. A. PAINTON. Decorative electrical devices. (28/2/22.)
184 141 BRITISH THOMSON-HOUSTON CO. Arc welding apparatus. (27/7/21.)
198 119 F. SCHUSTER. Electrically heated mould for finishing stockings, gloves, etc. (14/3/22.)
198 124 J. A. PAYNE. Safety switch devices for motor vehicles. (18/12/22.)
177 173 AKT.-GES. BROWN, BOVERI ET CIE. Multiple control apparatus for electric railways with motor-actuated main switch drums. (17/3/21.) (Addition to 126 278.)
198 127 METROPOLITAN-VICKERS ELECTRICAL CO. and T. FERGUSON. Control of electric traction motors. (18/3/22.) (Cognate Application, 17677/22.)
198 131 F. MCCLARENCE. Dials for telephone services. (22/3/22.)
198 134 A. DRUMMOND. Electrical ignition systems. (23/3/22.)
198 137 L. I. ROBINSON and W. E. WARRILOW. Coverings for wires, cables, tubes, etc. (24/3/22.)
198 139 H. B. PRENTICE. Electric distribution or fuse-boards and the like. (25/3/22.)
198 150 FRANCO-BRITISH ELECTRICAL CO., LTD., and A. H. BRACKENSEY. Time switches. (29/3/22.)
198 182 EVERSHED AND VIGNOLES and G. B. ROLFE. Instruments adapted directly to measure and indicate electrical resistance. (28/4/22.)
198 189 W. EDE, E. W. SCAMMELL and S. H. VAN ABBOTT. Electrical resistances. (2/5/22.)
179 946 A. MEVERE. Arc lamps. (12/5/21.)
198 200 SOC. ANON. DES ANC. ETAB. HOTCHKISS ET CIE and H. M. AINSWORTH. Exhaust and induction systems of internal combusion engines. (16/5/22.)
198 202 E. J. CLARKE. Electrodes for electric welding or soldering. (16/5/22.)
198 209 F. W. WILLIAMS. Electrically controlled illuminated pictures and signs for advertising purposes, etc. (22/5/22.)
198 211 F. J. MOLLER. Electric heating apparatus. (25/5/22.)
198 214 E. PHILLIPSON. Electric heating apparatus. (29/5/22.)
184 441 BOSCH AKT.-GES. R. Electric head-lights for vehicles. (11/8/21.)
198 215 METROPOLITAN-VICKERS ELECTRICAL CO., J. B. HANSELL and B. BEESLEY. Terminals for transformers. (30/5/22.)
198 221 AUTOMATIC TELEPHONE MFG. CO., A. E. HUDD and A. E. TATTERSALL. Railway signalling systems. (10/6/22.)
182 782 A. E. WALLER. Welding of wires for resistances, etc. (6/7/21.)
198 247 A. H. S. COLEBROOKE and W. A. WILLIAMS. Renewal of filaments in thermionic valves, etc. (8/7/22.)
198 270 J. BAGEART. Electric starting-gate for racecourses. (11/8/22.)
185 727 CIBLES AUTOMATIQUES MICHOUD SOC. ANON. Electrical signalling devices. (7/9/21.)
198 274 W. D. NICKUM. Electrolytic apparatus and method of depolarising the same. (22/8/22.)
185 123 BRITISH THOMSON-HOUSTON CO. Electric heaters. (24/8/21.)
185 416 PHILIPS' GLOEILAMPENFABRIEKEN. Electric lamps with enclosed arc discharge. (1/9/21.)
198 276 S. GINSBURG. Plug connectors for use with electric flat irons. (30/8/22.)
198 278 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Motor control. (22/9/22.)
187 215 JUPITER KUNSTLICHT KERSTEN AND BRASCH. Arc lamp. (13/10/21.)
186 916 F. KRUPP AKT.-GES. Switch drums for starting and controlling motors. (4/10/21.)
198 298 E. C. R. MARKS (Soc. S.A.A.E. Soc. ANON.). Self-inductances permitting increase of delivery by rectifiers of alternating current. (19/11/21.) (Divided Application on 197 972.)
198 307 F. M. VAN GELDEREN. Insulating cap for cable joints. (9/2/23.)
198 383 V. HOPE. Fuses or cut-outs. (28/11/21.) (Cognate Application, 18 098/21.)
198 384 J. A. TAYLOR. System of coloured electric lighting in combination with piano or organ. (2/9/22.)
198 401 SIEMENS BROS AND CO., D. A. CHRISTIAN, and J. BERRY. Impulse senders for automatic telephone systems. (2/2/22.)
198 413 WESTERN ELECTRIC CO. Telephone systems. (27/2/22.)
198 416 C. V. DRYSDALE. Windings for electrical apparatus. (28/2/22.)
176 365 K. KANDO. System of pole-changing for polyphase induction motors. (2/3/21.)
198 425 L. G. PRESTON, C. E. HORTON, and G. W. HARRIS. Direction-finding apparatus for use in wireless telegraphy. (1/3/22.)
198 426 H. C. BRAUN. Electric burglar and fire alarms. (1/3/22.)
198 428 H. J. ROUND. Reception of wireless signals. (1/3/22.)
176 368 J. BETHENOD. Electric railway signal repeating system. (1/3/22.) (Convention date not granted.)
176 371 O. KURZ. Electromechanical driving-apparatus for vehicles. (2/3/21.)
198 454 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electric switches. (9/3/22.)
198 460 METROPOLITAN-VICKERS ELECTRICAL CO., LTD., and G. H. CHEETHAM. Fuses for electric circuits. (11/3/22.)
198 467 G. A. BARTHOLOMEW. Electric power accumulator. (14/3/22.)
198 471 E. TEMPLE. Means of attaching electric wires to sparking plugs. (16/3/22.)
198 474 BRITISH THOMSON-HOUSTON CO. and H. W. TAYLOR. Electrical machines. (16/3/22.)
177 169 A. BADERNA. Cut-outs. (17/3/21.)
187 571 R. BOSCH AKT.-GES. Electrically-operated signalling appliance or hooter. (17/10/21.)
198 489 H. J. S. THOMAS. Electrical contacts. (24/3/22.)
187 938 FELTEN AND GUILLEAUME CARLSWERK AKT.-GES. Method of equalising pairs of self-induction coils for loading pupinised four-wire telephone lines. (22/10/21.)
198 499 J. TIMMS. Storage batteries. (20/3/22.)
198 502 P. C. RUSHEN (SIEMENS SCHUCKERTWERKE GES.). Electricity meters of the electrolytic type. (29/3/22.)
198 504 J. GREENHALGH. Connector or coupling for cables. (31/3/22.)
178 134 SIEMENS UND HALSKE AKT.-GES. Telephone systems. (9/4/21.)
198 509 CHLORIDE ELECTRICAL STORAGE CO. (W. E. KERSHAW). Storage batteries. (11/4/22.)
178 443 A. H. PEHRSON. Rotating or oscillating electric furnace plants. (12/4/21.)
198 512 A. G. BULLEN and R. L. JENKINSON. Clips for laying conductors in plaster walls, etc. (13/4/22.)
179 159 A. NEGROMANTI. Electrically-heated fabrics (30/4/21.) (Addition to 173 205.)

APPLICATIONS FOR PATENTS.

July 16th.

18 275 S. EDEN GREEN. Clip for holding crystals for wireless reception.
18 278 G. N. EWING and V. LLOYD. Receiving device for electric telephone.
18 292 and 18 293 ABBEY INDUSTRIES, LTD., S. J. TYRRELL, and N. MELVILLE-SMITH. Telephone receivers.
18 294 ABBEY INDUSTRIES, LTD., S. J. TYRRELL, and N. MELVILLE-SMITH. Telephone headpieces.
18 316 J. OGUTI. Electric multiplex communication. (17/8/22, Japan.)
18 320 F. EDWARDS. Crystal receiver sets and cabinets therefor.
18 330 E. B. THURSTON. Electro magnets.
18 332 E. Y. ROBINSON. Vacuum electric tubes.
18 339 C. F. ELWELL, LTD., and B. MITTELL. Electric coils.
18 341 F. C. B. CHASE. Electric terminal connections for wireless apparatus.
18 342 F. C. B. CHASE. Electric light fittings.
18 348 A. NIELSON. Heating units for electric heaters.
18 352 SIEMENS BROS. AND CO., LTD. and H. E. HUMPHRIES. Relay devices for automatic telephone systems.
18 353 SIEMENS BROS. AND CO., LTD., and H. E. HUMPHRIES. Telephone systems.
18 355 G. SCOTT AND SON (LONDON), LTD., and H. J. POOLEY. Apparatus for drying and impregnating insulated electric cables.

July 17th.

18 371 B. THOMAS. Semi-automatic electric sub-stations.
18 380 R. V. WILLESFORD. Crystal detectors.
18 383 O. STOKES. Receiving device for telephony.
18 372 L. B. ALLEN and E. WILCOX. Electric fuses.
18 385 N. ISHERWOOD. Mechanical connector for wire cables.
18 406 FULLER'S UNITED ELECTRIC WORKS, LTD., and A. P. WELCH. Coil holders for wireless tuning coils.
18 410 R. HORNBY and and A. N. JACKS. Electric switches for electric meters.
18 412 ELECTRICAL IMPROVEMENTS, LTD. Fuel distillation.
18 419 P. G. A. H. VOIGT. Amplifiers.
18 424 and 18 425 W. R. BULLIMORE. Thermionic valves.
18 433 WESTINGHOUSE BRAKE AND SAXBY SIGNAL CO., LTD., E. F. FLEET, and F. HORLER. Terminals for electric current conductor.
18 448 W. ELLSDON DEW, L. PRICE, and L. B. WOODWORTH. Heat control for electric furnaces. (13/1/23, U.S.)
18 466 CIE GENERALE DE TELEGRAPHIE SANS FIL. Telephone systems. (5/5/23, France.)
18 468 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Thermionic discharge tubes.
18 471 OLDHAM AND SONS, LTD., J. OLDHAM, and G. H. DARBY. Miners', etc., electric lamps.
18 479 and 18 480 MEASUREMENT, LTD. Electrical apparatus. (17/7/22, France.)
18 482 AKT. GES. FELTEN AND GUILLEAUME CARLSWERK. Means for inserting conductors of submarine cable into junction sleeve. (17/7/22, Germany.)
18 483 AKT. GES. BROWN, BOVERI ET CIE. Apparatus for controlling motor compressors on electric vehicles. (20/7/22, Germany.)

July 18th.

18 492 A. M. TAYLOR. Electric power transmission systems.
18 493 H. A. MADGE. Switches for transmission of wireless telegraph signals, etc.
18 500 L. H. MANSELL. Receiver for telephonic, etc., signals.
18 519 WESTERN ELECTRIC CO., LTD. (WESTERN ELECTRIC CO., INC.). Method of adding capacities to telephone circuits.
18 527 and 18 528 RADIO ENGINEERING CO., LTD., and P. B. SNOADEN. Electric control devices.
18 529 RADIO ENGINEERING CO., LTD., and P. B. SNOADEN. Induction coil holders.
18 538 H. J. WISEMAN. Electrical strain insulators.
18 550 G. UNTERBERG. Electric lighting apparatus for motor cars.
18 557 IGRANIC ELECTRIC CO., LTD. (CUTLER-HAMMER MANUFACTURING CO.). Braking systems for motor driven machinery operating on alternating current.
18 564 C. W. CROUCHLEY. Crystal detectors for wireless reception.
18 567 MARREC, LTD., and Y. MARREC. Variable electric condensers.
18 580 BRITISH THOMSON-HOUSTON CO. Electrodes. (3/8/22, U.S.)
18 583 METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Double reduction gearing (28/7/22, U.S.)
18 589 H. R. MORGAN. Tuning device for radio telegraphy, etc.

July 19th.

18 602 R. L. O'SULLIVAN. Crystal detectors.
18 615 WESTERN ELECTRIC CO., LTD. Telephone systems. (26/7/22, U.S.)
18 632 A. ORLING. Telephone receivers.
18 642 CIE POUR LA FABRICATION DES COMPTEURS ET MATERIAL D'USINES A GAZ. Telegraphy, etc. (20/7/22, France.)
18 645 EFANDEM CO., LTD., and A. HOOPER. High-tension batteries for wireless apparatus.
18 649 BRITISH THOMSON-HOUSTON CO. Automatic electric sub-station control equipments. (15/9/22, U.S.)

July 20th.

18 687 J. S. A. WAISH. Terminals for electric conductors.
18 702 ECONOMIC CAR LIGHT, LTD., and W. W. LEWIS. Apparatus for reception of wireless signals.
18 703 G. AUSTIN, LTD., and G. AUSTIN. Control apparatus for electrical machines.
18 708 WESTERN ELECTRIC CO., LTD. Radio broadcasting systems. (14/8/22, U.S.)
18 709 METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Control systems for dynamo-electric machines. (20/7/22, U.S.)
18 711 METROPOLITAN-VICKERS ELECTRICAL CO., LTD. (WESTINGHOUSE ELECTRIC AND MANUFACTURING CO.). Control systems for dynamo and electric machines.
18 712 O. F. DUPONT and A. HEWER. Apparatus for generation of electricity.
18 714 J. ISITT and G. H. VINCE. Wireless crystal detector.
18 729 H. LOWY. Aircraft for electrically prospecting for minerals or water.
18 730 H. LOWY. Means for electrically exploring interior of the earth, etc.
18 735 IGRANIC ELECTRIC CO., LTD. Variable inductance devices.
18 764 TINGEY WIRELESS, LTD., and F. BLENCOWE. Wireless receiving apparatus.

July 21st.

18 793 J. H. COLLINGS and M. J. RAILING. Electric switches, wall plugs, etc.
18 808 J. H. SMITH. Device for connecting pocket lamp batteries together.
18 815 W. J. HOAD. Electric switch.
18 823 MARCONI'S WIRELESS TELEGRAPH CO., LTD., and A. F. SYKES. Telephone transmitters and receivers.
18 825 A. F. SYKES. Electric apparatus for production, etc., of photographic sound records.

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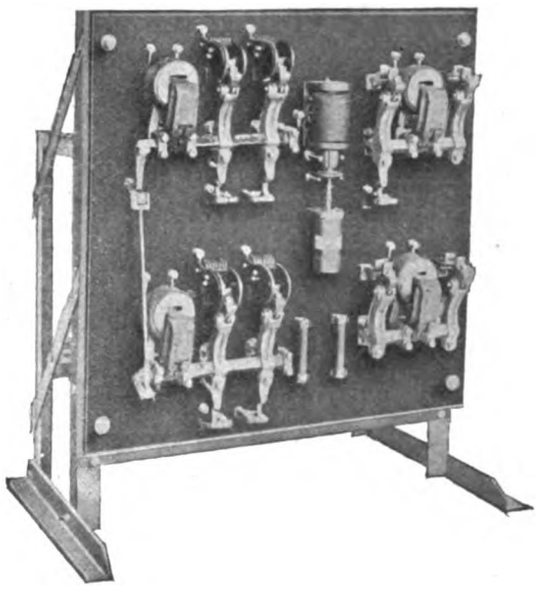

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Notes of the Week.

Carelessness in Factories.

The report of the Senior Electrical Inspector of the Home Office, Mr. G. S. RAM, for the year ended December 31st, 1922, shows that, of the 309 accidents due to electricity reported during that period, nearly every one was caused by carelessness on the part of someone—employee, employer, contractor, manufacturer, or designer. For what other term can be used to describe the action of the man who does not see that isolating switches are open before working on a circuit, of the employer who allows his electrical plant to get into bad condition, of the contractor who carefully strips off the armouring instead of using it to bond up the motors or switchgear to which the cable is connected, and of the designer whose equipment contains features which are unsuitable for high tension conditions? It may, in fact, be said that while the apparatus can still be improved in minor particulars, the ways in which it is used and maintained also leave much to be desired. Unfortunately for poetic justice, punishment for this lack of care does not always fall on the real culprit. Nevertheless, some advance is being made, as the number of accidents fell from 322 in 1921 to 309 in 1922 in spite of the increased use of electrical equipment, though the number of fatal cases rose from 12 to 17, probably owing to the wider employment of higher pressures. It would be interesting to have these figures worked out per horse-power installed, or on some such basis, in order that a direct comparison from year to year might be made.

Some Defects in Electrical Practice.

As is customary, Mr. RAM uses his report as a vehicle for one or two short essays on applied electricity. He points out that alternating current at 250 V or less caused ten fatal accidents as against none with direct current. Experience shows that the use of non-earthed metal lamp-holders on portable lamps is dangerous, a description which also applies to the connection of single pole switches in the wrong wire, especially on four-wire three-phase systems. This is contrary to the regulations, and the use of a "pocket electroscope" is suggested to test its prevalence. Supply authorities would do well to note. A serious fire occurred in a sub-station owing to a fault in a transformer igniting the cooling oil which ran out and destroyed a large amount of switchgear and three rotary converters. Mr. RAM recommends the use of thermostats which shall give due warning of a dangerous rise in temperature. He also points out that transformers are often placed in positions where they will do the maximum damage in case of fire, and draws attention to the practice of placing this equipment over pits filled with broken granite, into which the oil can run without risk of fire.

Research on Electric Shock.

Another point which we are surprised to see emphasised at this period in electrical history is the need for continued recourse to artificial respiration after an accident. In many cases it was successfully employed, and the number would probably have been larger had it been persisted with. Nevertheless, especially in the case of low tension alternating current, it is not always successful, and the question arises whether any other method is available. Electric shock, Mr. RAM points out, may cause death by paralysis of the respiratory centre, or by arresting the proper action of the heart and putting it into a state of "fibrilation." This latter result is readily brought about by alternating current, and is not easily treated by artificial respiration, though a bad fall immediately after the shock seems to be a successful but somewhat drastic cure. At least this doubt suggests a line of research. It is to be hoped this matter will be taken up by medical men, as it requires clearing up. Generally, Mr. RAM is to be

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congratulated on the useful work he and his assistants are performing, and it is to be hoped that the lessons which he teaches will be taken to heart.

The York Hydro-Electric Scheme.

Her recent connection with Yorkshire and the interest which the Royal Family is now taking in electricity supply does not make it surprising that PRINCESS MARY should have consented to open the new hydro-electric station of the York Corporation at Linton Lock, on the Ouse, last week. The scheme adopted and the station itself are otherwise intrinsically interesting. York itself, like most of the East Riding, would not fit well into any electricity district, and it is for that reason, no doubt, that the Commissioners have approved of the erection of such a small station. About 1 000 kW is the present, and also presumably its ultimate, capacity. The energy generated will mainly be used in York (11 miles distant), though it is hinted that the villages passed on the way may be conected up. We hope they will, for this seems to us to be the only justification for such a scheme. True, the present station at York is not favourably situated for coal supply, but we should have thought it would have been possible to have found a site where plant of a greater capacity; both present and ultimate, than that at Linton Lock could have been erected. We are not told what the hydro-electric station cost, but having in view the constructional difficulties a steam station would probably have been cheaper both to build and to run.

Some Disadvantages of Interconnection.

WE hear so much of the advantages of interconnection as a factor in the development of electricity supply that it is as well sometimes to turn round and consider some of its disadvantages. One of the greatest of these, or perhaps it would be more accurate to say, one of the greatest of the difficulties that will have to be overcome before the benefits of interconnection can be fully reaped is to be found in the differences in voltages and frequencies which exist in the various districts which it is proposed should be co-ordinated. So long as distribution can be separated from generation and transmission this in many cases will not be a grave problem, but where it is necessary for an area which is now supplied at a non-standard frequency to receive its energy at a standard frequency one of two decisions will have to be adopted. Either frequency changers will have to be installed or all the consumers' apparatus will have to be changed. In an industrial area the first of these alternatives would seem to be the only possible solution, but the second has many advantages where the load is mainly lighting or of a domestic kind. Fortunately we are not in so bad a condition as we might be, and as far as primary transmission voltages are concerned we should do well to take account of recent American experience.

Voltage Difficulties.

IN the North-East part of that country where the problem is now being tackled, there are a dozen or more voltages in use for primary distribution, and these will have to be standardised when any scheme of interconnection is considered. The difficulty is especially great with the voltages on the minor systems, and it is suggested in the "Electrical World" that the solution lies in the use of linking transformers which would shift the load from one pressure to another. This, however, can only be a temporary arrangement, and every effort should be made to unify the system. It seems to us that this must be a costly business even if the change does not have to be made all at once. In this country, except in London, the problem is a good deal easier, but that is no reason why it should not be tackled so that the best economic and technical solution may be found.

An Idealistic Commission.

Like this country, South Africa possesses Electricity Commissioners, whose duties under the Union Electricity Act of 1922 include the regulation of the supply of electricity in that country. In our issue of May 20th, 1921, we gave details of the measure which has since become law, and a recent report from H.M. Trade Commissioner in South Africa deals with the results of the first year's working. A novel feature is that the Commission is subject to a Control Board to whom it must apply for a licence before it can establish or acquire a power supply undertaking. Moreover, all its actions are subject to the approval of the Governor-General, and it consists of three members, only one of whom is on a "full-time basis." The Commission only started work in May of this year, but already several schemes are under consideration, the most important of which are those in the Witbank mining area and for the electrification of the Natal Railways. A new power station is also being built at Durban. It is interesting to note that once Government approval is obtained the Commission is free to operate on business lines, and it is, in fact, a business undertaking intended to combine the elasticity and freedom of action of private enterprise with the advantages of a national institution as regards the facility for raising capital, the elimination of private profits and the development of the use of electricity for domestic, industrial and farm purposes. These are worthy ideals. We shall be interested to see how they work out in practice.

The London Case—An Echo.

IN a letter to last Saturday's "Times" Mr. EDMUND BAX, chairman of the Westminster Electric Supply Corporation, complains that though the London companies have won their case against the Electricity Commissioners, yet they will have, owing to an anomaly, to pay a part of the costs. The reason, of course, is that the expenses of the Commissioners are paid by the electricity supply industry. The people who ought to complain, however, are the remainder of the supply undertakings in the country who took no part in the litigation and who, in the aggregate, will have to pay a far greater proportion of the costs without, unlike the London companies, getting anything for it. By winning their case in the Court of Appeal the companies have settled a point, important or unimportant according to the point of view, but had they been more amenable to the Commissioners' suggestions in the first place, the matter in dispute need never have been raised. Incidentally they have shown that to fight the Commissioners is a luxury that has to be paid for, and if other undertakings learn by their experience the outcome will not have been wholly evil.

Hydro-Electric Supply in Tasmania.

THE report of the Hydro-Electric Department of the Government of Tasmania for 1921-2 contains evidence of good progress in electric power developments in that country. One piece of work completed is the diversion of water from the Ouse along the canal to the Great Lake. Apparently, great trouble and delay was caused by serious rifts in foundations discovered in connection with the work on the Great Lake Dam. Five new turbo-alternators and the necessary transformers have been installed at Waddamana and the new double transmission line from this centre has now been erected. All the plant is stated to be in a satisfactory condition and apparently most of the branches are showing a small profit, with the result that the initial loss has now been wiped out. The stations are now able to deal with a maximum load of 63 000 H.P., and when the Waddamana development is fully loaded a regular profit should be earned. However, it is stated that "a fundamental feature of our hydro-electric policy has been not to make profits, but rather to make electrical energy available for all purposes at such rates as could not be

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equalled elsewhere in Australia." The rates at present charged, 5d. for lighting, 1d. for domestic heating and cooking, and ½d. for continuous hot water systems are creditably low and we are not surprised to hear that they "are very popular." The hydro-electric supply is already finding a good market with such concerns as the Carbide and Electro-Products, Ltd., and the Electrolytic Zinc Co., and a scheme of irrigation throughout Tasmania is in prospect.

Municipal Electricity.

If the consumption of electricity is a true barometer of the country's industrial position, the results of the trading of our municipal electricity supply departments for the year ended March 31st, 1923, indicate a certain unsteadiness. There are some cases where there has been a substantial decrease in the units consumed for power, and if all that we can learn about our trade is true this is not surprising. On the other hand, this decrease is often more than balanced by increased consumption on the domestic and lighting sides. There are also some cases where large increases in the energy supplied for power may be noted, the outstanding example being Rotherham, where the consumption under this heading has risen by 121 per cent. If this goes on it looks as if more gargantuan turbo-generators will be required in that town. At Manchester, too, there has been an increase in the total volume of business amounting to 17 per cent., and the same feature is to be noted in some of the smaller undertakings such as Coventry, Croydon and Southend-on-Sea. Whatever the state of trade generally, therefore, it may be granted that the electricity supply industry has done well, and it is gratifying to note that there is every prospect of its doing even better.

Drawbacks as a Trade Barometer.

Purely as a trade barometer, however, electricity supply results during the past year cannot be taken as really typical. The lessons learnt during the war are still being applied, and manufacturers and others who formerly obtained their power in other ways are still changing over to electricity. This change for the better may be regarded as the harvest of many years of hard work when electrical engineers were preaching the benefits of using electric power to apparently indifferent listeners. It is part of the eternal irony of things that those who did not preach are reaping the benefits as well as those who did. But this is no reason why the pressure should not be constantly applied as there is still much to be done in developing the power load, though the work is easier than it used to be. Only in this way can that smoke abatement of which we have been hearing a great deal lately be satisfactorily brought about.

Attractive Price Essential.

We have argued again and again that to sell electricity in large quantities the price must be attractive. This is important where power is concerned; it is still more important where the domestic load is being developed. Price, we shall be told, is not everything, but it is a great deal; and every effort should therefore be made to reduce it as we are glad to see is being done in a large number of places.

Price Reduction is Sound Finance.

Quite apart from development, price reduction in municipal electricity supply is sound finance. If the reserve fund is adequate large net profits are not required, and the lower the selling price, consonant with financial stability, the better for all concerned. That this is not generally realised by electricity committees and city fathers is evident from the results obtained during the past year by many undertakings throughout the country. At Sheffield the surplus was no less than £173 916, of which £34 817 went to the relief of the rates. This result was obtained after a reduction in charges, but there appears to be an argument for still further reduction. This is the more to be recommended as the year's working at Sheffield was extraordinarily gratifying on the technical side. The cost of coal was only £129 452 compared with £246 507 in 1921–22, though 123 000 000 kWh were sold as against 103 000 000 kWh in that year. Even in that year the coal costs were only 0.58d. per kWh sold, and in 1922–23 they reached 0.252d. per kWh sold, a figure of which all concerned may be proud. With a little change in financial policy, therefore, Sheffield should be a place where electricity is really cheap.

Coal Costs—Pre- and Post-War.

Another undertaking where the coal costs are being brought down in spite of geographical and other natural disadvantages is Croydon. In 1922–23 16 554 661 kWh were generated, 19 369 tons of coal being used, or 2·62 lb. per kWh generated as against 2·9 lb in the previous year. The coal costs in 1921–22 were 0·96d. per kWh sold, and as during the past year the price increased by 5s. to 6s. per ton, the figure of 0.522d. obtained is highly satisfactory. A similar drop in coal consumption is recorded for Stoke-on-Trent, where, in spite of the fact that the kilowatt hours generated increased by some two millions, the coal consumption was less by 500 tons, bringing the coal consumed per kilowatt hour generated down from 3·23 lb. to 2·75 lb. The coal costs per kWh sold in 1921–22 were 0·94d. and in 1922–23 0·52d.

Coventry, as perhaps might be expected, seeing its position in the country is distinguished by low coal costs. The cost per kilowatt hour sold was 0·33d. as against 0·912d. in the previous year, a drop almost as astonishing as the figure itself. The total costs reached the low figure of 1·096d. per kWh sold as against 2·15d. in the previous year. But the net "profit" was £46 039 as compared with £6 739 so that we hope the prices are coming down.

Results with Diesels.

A large profit was also obtained at Southend-on-Sea, though not as large as was expected owing to the reduction in charges. Good results are being obtained from the Diesel engines, the cost of generation being 0·71d. as against 1·27d. with the steam plant. At one of the Diesel stations the costs are as low as 0·55d., so assuming that steam plant had been installed there, the monthly saving by present methods is about £2 000. The capital cost of the engines was estimated at £45 000, which should be saved within three years owing to the greater economy obtainable.

Policy and Reserve Funds.

At Wolverhampton the net "profit" was £34 042, of which £10 000 went in relief of the rates and just over £5 000 to reserve. It would be as well if the amounts of these contributions had been reversed or the first eliminated altogether, as the committee point out that the present reserve fund is many thousands short of the 10 per cent. of aggregate capital expenditure provided for by the original Order and the building up of a strong reserve fund is essential. We need hardly say that we heartily agree with this, as we do with the further statement that renewals and depreciation should be adequately provided for. These items should be the first care of every municipal electricity supply undertaking. It is pleasant to see that large savings were achieved on the technical side. Though the cost of fuel has risen by 74·5 per cent. since 1914, the average amount consumed per kilowatthour generated has fallen by 34 per cent., amounting to a saving of 21 870 tons a year or, in money, nearly £15 000.

These results generally indicate that the municipal electricity undertakings are well managed and are operating satisfactorily. If the same energy is devoted to the reduction of selling price as to the reduction of coal costs, and the mistaken "profit" policy is replaced by sounder finance, development should be accelerated and the general well-being of the community much increased.

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Notes on Wireless Matters.

The Beverage Wave Antenna.

By Prof. G. W. O. HOWE, D.Sc.

Since the earliest days of radio-telegraphy it has been known that signals could be picked up by means of horizontal wires a little above, or on, or even below the earth's surface. From time to time experiments have been made with this type of aerial, both in Germany and America. Generally speaking, however, the published results have left the matter in an unsatisfactory state. The experiments necessary for the complete elucidation of the phenomena involved were not easy to carry out since they would require a large stretch of flat country and fairly extensive resources in material, personnel and time.

German Results in East Africa.

In the "Radio Review" of June, 1921, the writer devoted the editorial to a description of the striking results obtained by the German forces in East Africa by the extensive use of horizontal receiving antennæ. When war broke out attempts were being made to receive signals from Nauen at Dar-es-Salaam on an umbrella aerial 100 m. high, but the results were very poor and the signals were generally too weak to be readable. On August 8th, 1914, the tower was demolished, but instead of cutting them off from European sources of information this actually had the reverse effect because of the excellent results obtained with long horizontal wires run out on posts a few feet above the earth's surface. It must be admitted, however, that the improved results were due, to some extent, to the introduction of amplifiers. It was found that stronger signals and very pronounced directive selection were obtained by lengthening the wire until one of its harmonics corresponded to the received wave. The editorial review concluded with the statement that the subject was one that required systematic investigation.

Practical Results of the First Importance.

The paper by Messrs. Beverage, Rice and Kellogg which has recently been running as a serial in the "Journal" of the American Institute of Electrical Engineers shows that the subject has now had a very thorough and systematic investigation with practical results of the first importance. The experiments have been made at the Riverhead receiving station of the Radio Corporation of America in connection with the development of a low horizontal antenna for the reception of European signals. The practical tests have been accompanied by measurements of the various physical quantities involved and by the application of the mathematical and graphical methods of calculating transmission line phenomena to the antenna. The result is that the reader is enabled to form a fairly clear conception of the action of the antenna and of the effects of variations in the various factors involved.

The Principle of the Beverage Antenna.

In its simplest form the Beverage antenna consists of a wire suspended on insulators at a height of a few feet and running in the direction of the transmitting station the signals from which it is desired to receive. The receiving apparatus is inserted between the earth and what we may call the far end—that is, the end farthest away from the transmitting station. So far it resembles previous horizontal antennæ, but Beverage introduces a novel principle by earthing the near end through a non-inductive resistance of just such a value that all the energy arriving at that end as waves along the line is absorbed, thus preventing any reflection. This result is obtained by making the resistance equal to $\sqrt{(L/C)}$ where L and C are the inductance and capacity of unit length of the line. If the resistance is made greater or less than this value, reflection will take place to some extent. Any disturbance arriving at the receiving apparatus must be due to waves originally moving in that direction, since all waves in the other direction are absorbed without reflection at the other end. If the receiving apparatus were suitably designed and adjusted it could also be made non-reflective and stationary waves would then be quite impossible on the antenna; a wave travelling along the wire would be a pure progressive wave from end to end irrespective of the relation between the length of the antenna and the frequency of the wave.

Tilted Waves.

Electro-magnetic waves arriving from the transmitting station will have a tilt in the forward direction—that is to say, the electric field will not be vertical but will have a horizontal component, which, in combination with the magnetic field, which is also horizontal, gives a supply of energy downwards to cover the losses occurring in the earth. To clear the mind of any complication due to the vertical component, it is advisable to consider an aerial actually on the earth's surface or slightly below it. Were the earth a perfect conductor there would be no reason why the radial alternating currents should flow in the wire in preference to the surrounding ground, but, since the earth's crust consists of materials of high resistance, the copper wire offers a path of relatively high conductivity and the currents will flow through it in preference to the surrounding ground. If an electro-motive force is induced in the wire at any point, pulses will travel from the point in both directions, carrying the electro-motive force and its resultant current to the ends at a velocity somewhat less than that of light, the actual velocity depending mainly on the character of the ground. In the American experiments the velocity was found to be about three-quarters of that of light. If the losses are small the amplitude will be but little reduced as the pulses travel along the wire; the pulse travelling towards the near end will be absorbed on arrival, but that in the opposite direction will affect the receiving apparatus.

In this case, however, the inducing E.M.F. is due to the horizontal component of the electric field of the arriving wave; it does not merely induce a current at the near end and leave it to travel as a pulse down the line, but travels with it, continually inducing e.m.f. and building up the pulse as it travels along the line. If the pulse travelled at the same speed as the electro-magnetic space wave, this building up could go on indefinitely, but the latter is travelling at the velocity of light and the former at something less, so that they gradually get out of step and beyond a certain length of antenna the amplitude would begin to decrease; hence there is an optimum length of antenna for a given set of circumstances. If made of this optimum length, the pulse travelling along the antenna just arrives at the receiving end when built up to its maximum strength of current and voltage.

For waves arriving in the opposite direction there will be the same building up, but on arrival at the end the built-up wave will be entirely absorbed in the earthing resistance. The antenna is, therefore, unidirectional.

The Double-Wire Beverage Antenna.

Strictly speaking, the earthing resistance should only be non-inductive if the line were either entirely free from all losses or had its conductor losses equal to its dielectric losses. As it is, arrangements have to be made not only for adjusting the value of the resistance, but also for making it slightly inductive or capacitive to obtain the best results with any given wave length. As it would be very inconvenient to make this adjustment at one end whilst receiving at the other, which may be ten miles away, an ingenious modification was introduced whereby the receiving and all the necessary adjustments are carried out at the near end. The antenna consists of two wires in parallel which, together with the earth, form a transmission line, along which the wave is built up as described. On arrival at the

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far end the antenna currents pass through the two coils S_1S_2 and then through the coil P to earth. The coils S_1S_2 being wound close together and carrying currents in opposite directions will offer only a small inductance to these currents. The coil P replaces the receiver in the original arrangement. Similarly, any pulse travelling in the reverse direction will pass through P_1 and P_2, and then through the absorbing resistance R to earth. Now P is the primary of a transformer of which S_1 and S_2 form the secondary, and the currents in P will induce currents in S_1S_2, which are then transmitted back along the two wires as a metallic circuit to the primaries P_1P_2 of the transformer at the operating end. The signal currents are thus transferred to the secondary S, which is connected to the amplifiers and detector. All the apparatus requiring adjustment is thus brought together at one end of the antenna.

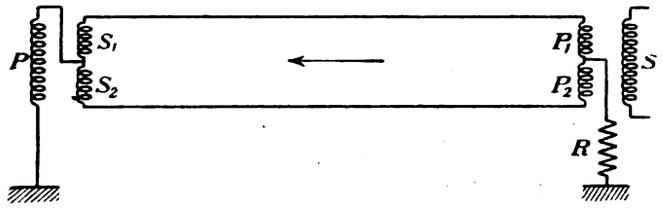

FIG. 1.

The antenna itself is not very selective for frequency, but any desired selectivity can be obtained by introducing tuned circuits between S and the detector. In practice, several amplifying and detecting sets tuned to various frequencies are connected to S and the antenna used for multiplex reception.

Best Length of Antenna.

The best length of antenna depends not only on the range of wave length to be received, but also on the characteristics of the antenna, and especially on the nature of the ground. If the ground were very conducting the wave front would be almost vertical and the horizontal electric field therefore weak, but the wave velocity on the antenna would be nearly equal to that in free space and the antenna could be made very long without exceeding the optimum length. If, on the other hand, the losses are great, the horizontal component will be strong, but the velocity on the antenna will generally be less and the optimum length will be reduced. The subject is complicated, however, by the effect of the specific inductive capacity of the ground, which we cannot here consider. The predetermination of the design of such an antenna on a given site involves some interesting applications of the theory of transmission lines.

Pan-American Standardisation.

Proposed Washington Conference in 1924.

In America simplification in manufacture and unification of methods and work, tending towards the greatest amount of interchangeability, especially in small component parts, is a burning question, and is discussed not only in the technical press, but, by many of the daily papers also.

At the moment it is interesting to note that America is making strenuous efforts to persuade the South American Republics to give preference to American manufactures, as is evidenced by the fact that under the ægis of the United Department of Commerce, of which Mr. Hoover is Secretary, a Pan-American Conference on Standardisation is to be held in Washington next year. The South American Governments are to be invited to participate in the conference, and it is presumed that the governing idea will be to endeavour to obtain the adherence of the various American Governments to American standards. It appears to be a fact that American manufacturers, except in special lines, are not foremost as exporters of industrial products; they concentrate more on domestic demands, while European industries are heavily dependent on their export trade. The proposed Pan-American Conference on Standardisation is therefore a movement which merits the closest attention of British manufacturers.

The Possibilities of Transmission by Underground Cables at 100 000 to 150 000 V.

A discussion of Major A. M. TAYLOR'S paper on the possibilities of Transmission by Underground Cables at 100 000 to 150 000 V, an abstract of which appeared in our issue of December 15th, 1922, took place recently before the Liverpool sub-centre of the North-Western Centre of the Institution.

Mr. A. E. MALPAS remarked that the author had mixed his units. It was very desirable to adhere to the metric system. The usual limiting diameter for underground cables to convey 150 000 V was 4 in. A cable with intermediate lead sheaths might develop incipient cracks, unrecognised at 45 000 V, but causing breakdown under higher pressures. The case of a 250 mile transmission line in the U.S.A. had been mentioned where transmission charges amounted to only 0·16d. per kWh. An underground cable of equal length would apparently increase the cost of power by 4·4d. per kWh, nearly 30 times as much.

Voltage Limit in Sight.

Mr. W. HOLTTUM said it appeared that we were within sight of the limiting voltages of transmission owing to the limit of dielectric stress having been reached. The author sought to increase the limit by other means. But it seemed that whatever was gained by redistribution of voltage gradient was lost by lower effective working voltages of a portion of the copper. The method of jointing would be difficult and costly. He doubted if the conclusions in Section VII. showed much in favour of the system. The first four emphasised reliability, but here three-phase cable transmission was satisfactory.

Mr. T. D. CLOTHIER remarked on the complexity of the diagrams which were difficult to follow. The cost of the proposed system was compared with transmission by 10 cables at 30 000 V, but not with a straight 100 000 V system with earthed neutral using 57 000 V cables. The proposals of the author appeared feasible, but their commercial application depended largely on ability to produce reliable single core cables capable of working without the intersheaths.

Continental Experience Not Utilised.

Mr. A. B. MALLINSON thought that in England we were too much inclined to try to do things differently, instead of utilising foreign experience. There was great scope for overhead transmission in this country. Obviously underground cables must be guaranteed for a longer period than one year. The method of finishing off the ends of the cable, illustrated by the author, would be exceedingly difficult to the mains engineer. The final claims were important if they could be substantiated.

Mr. W. P. FULLER thought that Major Taylor had exaggerated the effects of temperature. Dielectric stress was nearly independent of temperature. With regard to intersheaths breakdown of dielectric was not entirely a matter of maximum stress, and it was a mistake to devote too much care to obtaining uniform stress. In general, as the diameter was increased the stress must be reduced.

Intersheath Idea Old.

Dr. E. W. MARCHANT said that the idea of using intersheaths was comparatively old. It was undoubtedly a gain to diminish dielectric stress in the inner layers of the cable. But it was doubtful if the introduction of transformers along the cable was worth while. In an ordinary 100 000 V three-phase cable with centre point earthed the total p.d. between the phase and the earthed middle points would be 50 000 V instead of 77 000 V, with Mr. Taylor's arrangement. If intersheaths were used for conveying power as well as equalising pressure the copper would not be so efficiently used as if the whole power were transmitted at the higher pressure.

Mr. J. W. WARR remarked that with the new method the consumer would apparently have to do more compensation for power factor than at the present time. From the standpoint of the mains engineer the system appeared very complicated. Limitations of space in laying cable deserved attention.

Single Core Cables More Efficient.

Mr. F. MERCER suggested that a cable of the type described was less efficient than a single core cable of the same sectional area. Intersheath cables had several drawbacks. Capacity currents necessitated an appreciable sectional area of copper for intersheaths alone, and the space occupied by intersheaths might be usefully occupied by dielectric.

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Electricity Supply in York.

Formal Opening of New Water Power Station.

Owing to the high price of coal at the end of the war, the York Corporation has been studying the advisability of erecting a hydro-electric power station in the neighbourhood of the city, as the best means of meeting the increasing demand for electricity. It was found that one of the most favourable sites was on the River Ouse, at Linton Lock, which is about 11½ miles from York.

The Ouse, like most rivers without natural compensation, has a variable discharge; roughly speaking, this varies from 50 000 cub. ft. per min. in the dry periods to 200 000 cub. ft. in the wet months. Taking 100 000 cub. ft. per min. as an average, with 8·83 ft. head, 1 200 H.P. could be expected from the proposed station. A close calculation showed that the available energy in years of normal rainfall would exceed 2 750 000 kWh per annum. In these circumstances the scheme was considered a sound one, and the York Corporation decided to proceed with it. In order to concentrate supervision and responsibility, and to make the co-ordination of the various parts of the work easier, it was decided to include the civil work, the buildings, and the supply of plant in one comprehensive contract, and this was eventually awarded to THE ENGLISH ELECTRIC CO.

Situation and Site Details.

Linton Lock Hydro-Electric Power Station, which was formally opened on August 1st by Princess Mary, Viscountess Lascelles and Viscount Lascelles, is situated on an island. The nearest railway station is about 4½ miles distant, and there was no carriage way from the nearest main road, about half a mile away. The old lock at Linton had also to be bridged in order to get materials on to the island.

The site proved to be soft silt below water level, and much difficulty was experienced in getting the foundations down below the river to the requisite depth; cofferdams, both of timber and steel, had to be constructed, and much pumping done. The work was also handicapped by high floods, of which the one that occurred a few months ago was the highest experienced for twenty-three years.

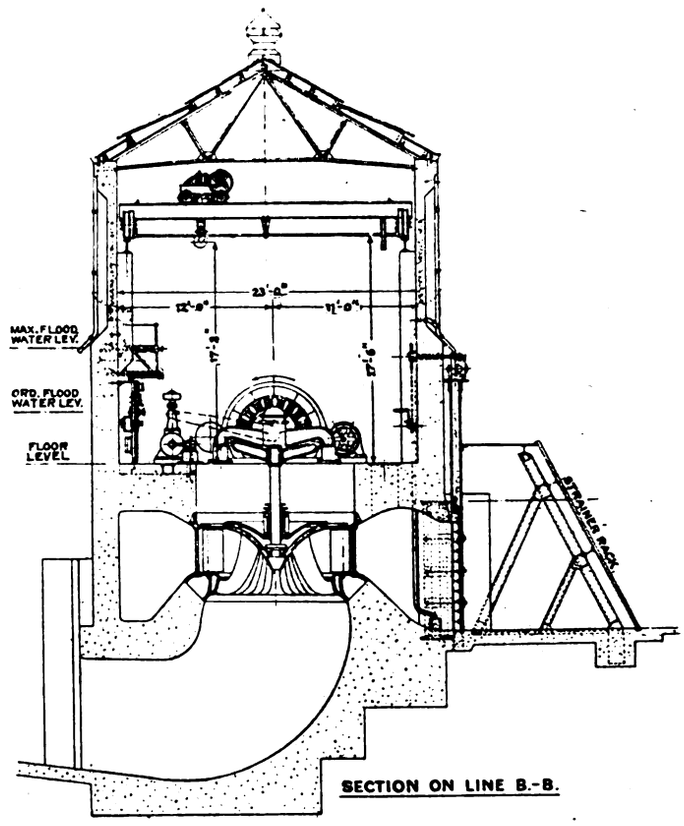
Head and Tail Race Construction.

The power house is carried on 110 ferro-concrete piles which go down to 60 or 70 ft. below the normal ground level, and is now built of reinforced concrete instead of brickwork, as originally intended. The foundations of the walls to the head and tail races involved some difficulty on account of the running silt, and they were ultimately constructed of reinforced concrete also. Owing to the danger of the water in the headrace finding its way below the power house through the soft silt, it was necessary to take many precautionary measures to make sure that no such leaks could take place. Considerable care had to be exercised also in connection with the foundations owing to the nearness of the lock cut to the works, as it was clear that if the river when in flood did break through the temporary works, it would have washed out the silt very quickly and have done great damage along the river, both above and below the site.

The existing weir across the river was built about 100 years ago, and as no drawings were available showing the details of construction below water level, it was necessary to proceed with the work in the neighbourhood of this old dam with great caution. It can be seen from Fig. 1 that the water is led to the forebay by means of this weir, but large automatic weir shutters have been constructed in order to keep the river at its correct level; these shutters fall in times of flood, thus enabling the flood water to pass, and as the river regains its normal flow, the shutters automatically rise and retain the water at its usual level. The automatic shutters themselves are controlled by counterweights made of pumice stone concrete of the correct specific gravity for the conditions under which they operate; the general design is shown in Fig. 3. This arrangement does not interfere with the operation of the existing fish pass at the right bank of the weir.

Generating Plant.

The water entering the headrace or forebay on its way to the power house passes through strainer racks and the main sluice gates to three turbines; two large ones of 430 H.P. each, running at 60 revs. per min. and driving a 540 kW generator, and one small one of 330 H.P. running at 75 revs. per min. and driving a 210 kW generator. By using the three turbines in accordance with the following working table it is possible to have the running plant always loaded up to more than 72 per cent. of its rated full load, apart from the lower limit in No. 3, or during a few exceptionally dry periods.



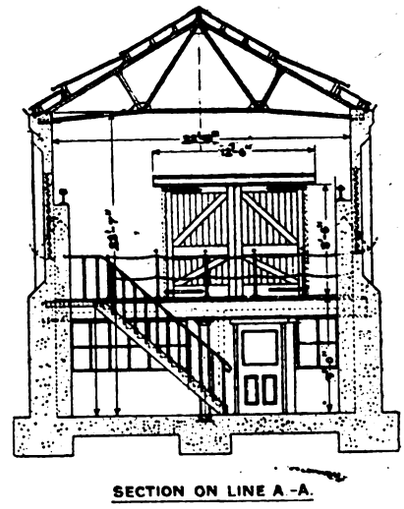


FIG. 1.—CROSS SECTION OF POWER STATION.

No.	Plant running.	Available output.	Per cent. of full load on turbines.
1.	Small turbine	0— 330 H.P. ..	0—100
2.	One large turbine	330— 430 H.P. ..	77—100
3.	Small and one large turbine ..	430— 760 H.P. ..	57—100
4.	Two large turbines	760— 860 H.P. ..	88—100
5.	Three turbines	860—1190 H.P. ..	72—100

This means that the power station, on the average, works with an hydraulic efficiency of 75 to 83 per cent., according to the available heads, and will generate in years of normal rainfall about 2 780 000 kWh per annum.

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The small turbine was specially designed to deal economically with the small loads. It has a specific speed so chosen as to give a high efficiency over a long range of partial loads, and therefore will enable the power station to work efficiently even when only small quantities of water are coming down the river. The water passes to the gate apparatus of the turbine inside the power house through concrete spirals, a refinement which allows of a higher water velocity and effects a gain in efficiency as well as a saving of space, as compared with ordinary pits.

their ends in bronze bushes carried by the foundation rings, and operated from above by means of levers and linkwork. The massive foundation rings of cast iron are connected by steel pillars and built into the concrete, thus forming a good and rigid assembly. The weight of the runners is considerable owing to their dimensions; for the large turbine, which has an exit diameter of 10 ft., it amounts to over 5½ tons. From the vertical shafts of the turbines the drive is transmitted to the generators by means of machine-cut, double helical bevel gears.

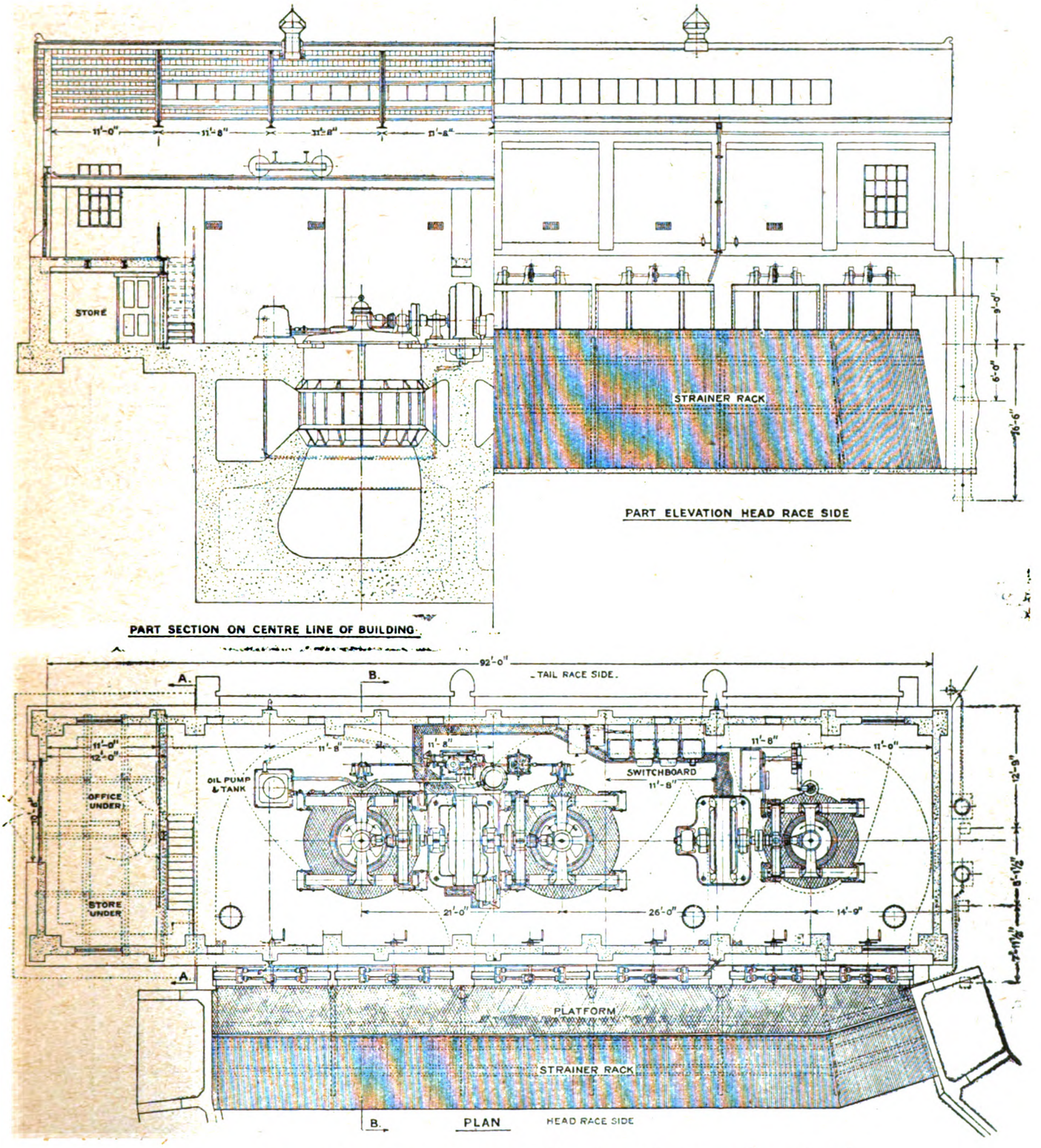

FIG. 2.—SECTIONAL ELEVATION AND PLAN OF NEW POWER STATION AT LINTON LOCK.

Gate Apparatus.

Each gate apparatus consists of 20 guide vanes, 43·3 in. high for the large turbines and 35·5 in. high for the small turbine. These vanes are of cast iron and are pivoted at

Governing Equipment.

The speed of the sets is controlled by two automatic oil pressure governors, and both head and tail races are connected to a water level recorder in the power house which

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traces on a chart the head under which the turbines are working.

The generators are alternating current, three-phase, 50-cycle machines, working at a terminal pressure of 6 600/7 000 V. Both generators can withstand the runaway speed of the turbines, which is about 1·9 times their normal speed. The full load efficiency of the generators is about 94 per cent., and taking 80 per cent. as the average efficiency for the turbines and allowing 2 per cent. loss in the bevel gears, the overall efficiency of the power station is about 74 per cent.

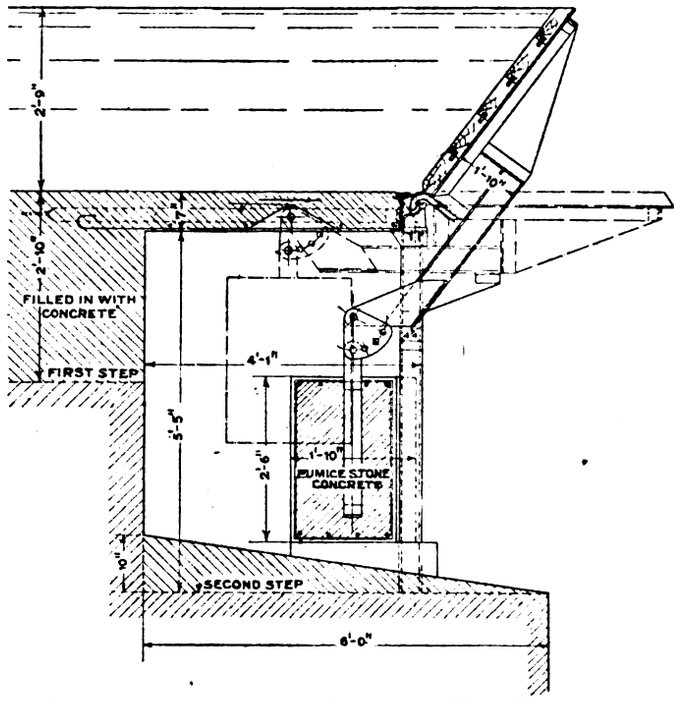

FIG. 3.—ARRANGEMENT OF AUTOMATIC WEIR SHUTTER.

The switchgear for controlling the two generators and one feeder is of the " English Electric " cast iron, draw-out pillar type, combining a very high degree of safety with extreme compactness and ease of inspection. All live parts are completely enclosed, and fully interlocked in order to render them foolproof.

The electric power generated will be transmitted to York by means of underground cables, from which a supply will also be given to villages, etc., along the route.

Empire Producers and the Economic Conference.

Government and Public Body Contracts.

A meeting of the representatives of the principal producing associations of the British Empire was held last Thursday at the offices of the BRITISH EMPIRE PRODUCERS' ORGANISATION, the Chairman, Mr. Ben H. Morgan, presiding, for the purpose of considering the representations to be made by them to the forthcoming Empire Economic Conference. The meeting unanimously passed a special resolution dealing with preferential import duties; while in regard to Government and public body contracts, a resolution was passed to ask the Conference to recommend to the various Governments represented that all contracts and sub-contracts arising therefrom issued by Government Departments, county councils, municipal and public bodies and bodies enjoying public charters throughout the Empire, should be given to British Empire firms using only British Empire labour and materials.

Press-the-Button Telegraphy.

Mr. Donald Murray has issued a second edition of his " Press-the-Button Telegraphy," which was originally a reprint of articles with alterations and additions which appeared in the " Telegraph and Telephone Journal " for November, 1914, to July, 1915. During the eight years which have elapsed since their first appearance there has been a remarkable growth in machine telegraphy, until it now seems strange not only that there should have been any doubt about printing telegraphs, but that it should have been supposed their operation would not be automatic or multiplex. Indeed, it may be said that the age of machine telegraphy on a large scale has begun. The present edition consists of the first five articles as they originally appeared with slight additions. The sixth article, which contained a description of the Murray multiplex printing telegraph system, has been largely recast and rewritten. The whole forms an interesting historical and technical summary of a very important problem.

Atomic Projectiles and Their Properties.

(*Concluded from page* 121).

Range Proportional to Velocity.

In the latter part of his sixth lecture before the Royal Institution Sir Ernest Rutherford, describing the results obtained with his new observing apparatus, said that it was noticed that the range of the liberated particles was proportional to the velocity (and hence to the range) of the bombarding α rays, and that their numbers also depended upon that velocity. This was exemplified by the curves in Figs. 30 and 31, illustrating experiments made with α rays from different sources and of different velocities and ranges. The swiftest rays used, those of thorium, had a range of 8·6 cm. (curve Fig. 30); the range of the slowest rays used (curve *D*) was only 4·9 cm. The range difference was, therefore, considerable, but the corresponding changes in the velocity of the respective rays did not much exceed 10 per cent.; yet they made a very great difference in the ranges of the

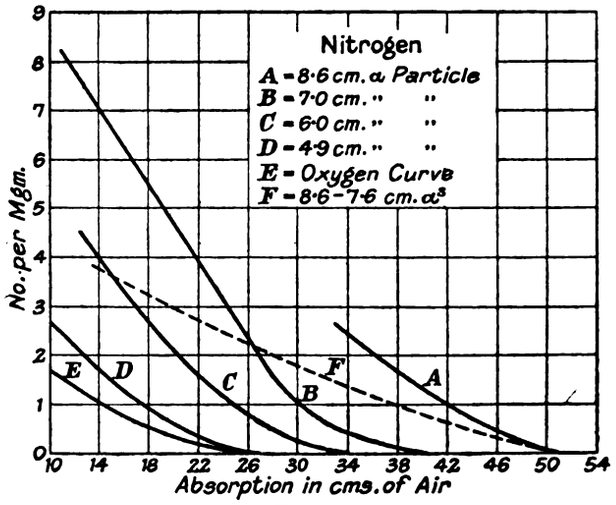

FIG. 30.

particles liberated, as the curves *A*, *B*, *C*, *D* indicated. The curve *E* referred to oxygen. In the other cases, and also in case *F*, nitrogen was being bombarded; in this last case the velocity of α particles from thorium was, by the interposition of silver screens, gradually cut down to 7·6 cm. Curve *D* showed that the number of particles liberated and their ranges became small as the range of the bombarding α rays decreased. This was supported by the curves of Fig. 31, in which aluminium was the substance bombarded; and it would appear that with the range of the α particles falling much below 5 cm., the power of the projectile to liberate long-range particles would altogether be lost.

Liberation in Two Directions

These experiments also revealed another peculiarity, first observed in the almost explosive liberation of particles from

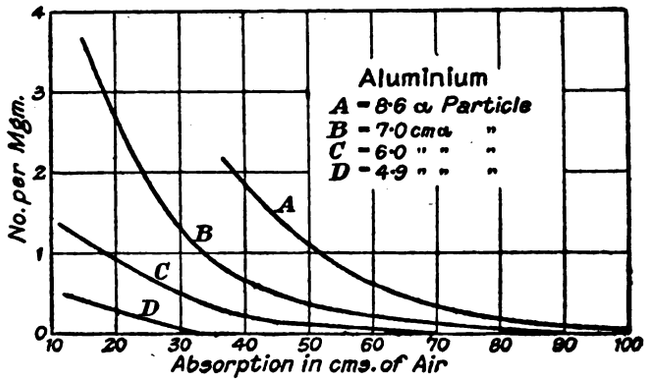

FIG. 31.

aluminium. The liberated particles were not only driven forward, in the direction of the projectile, but also backward and in all directions, and approximately in the same numbers. For the further investigation of this peculiarity the arrangement of the apparatus was so modified that the bombarded

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foil was not between the disc *R* and the screen, but on the other side of *R*. With aluminium the curves of Fig. 32 were obtained, showing that the general character of the liberation of particles was the same for the forward and the backward expulsion of the particles, and the numbers and ranges did not differ very much, forward expulsion always predominating. This was confirmed in experiments with other substances; but the forward and backward expulsion was again limited to the six "active elements," the respective ranges being: boron, 58 forward, 38 backward; nitrogen, 40, 18; fluorine, 65, 48; sodium, 58, 36; aluminium, 90, 67; phosphorus, 65, 49. Nitrogen alone, it would be noticed,

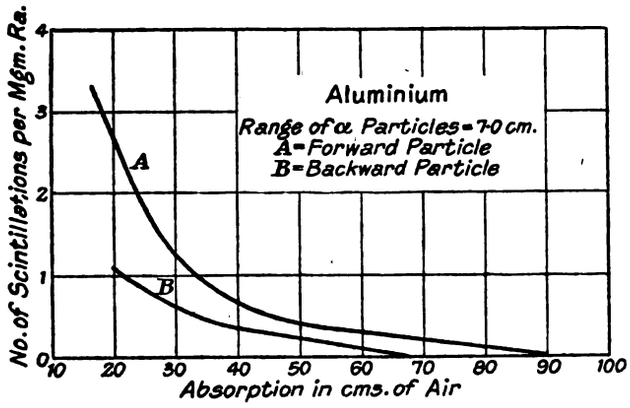


FIG. 32.

showed a marked difference in the two ranges. These ranges, Sir Ernest pointed out, were only approximate.

That these long-range particles must be hydrogen nuclei (protons) had soon become clear, but a verification had been desirable and had been obtained by the aid of the apparatus illustrated in Fig. 33. The source was placed on the bar *R* which was supported in a slanting position; *S* was a brass plate so mounted that it would not allow any particles to strike below the middle *E* of the screen. There might thus be a sharp edge between an upper scintillating half and a lower dark half of the screen. But the number of particles was too small, and the magnetic field was therefore applied to send the particles either upward or downward. If the particles liberated were positively charged, they should be more (or less) deflected upward than downward. In this way, and by bombarding foils of aluminium and of paraffin, it was demonstrated that the long-range particles were really hydrogen nuclei of charge 1 and mass 1.

Explanation of Expulsion Phenomena.

But how could the expulsion of these protons in all directions be explained? The idea was that the proton might not be present in the aluminium atom as an independent constituent,

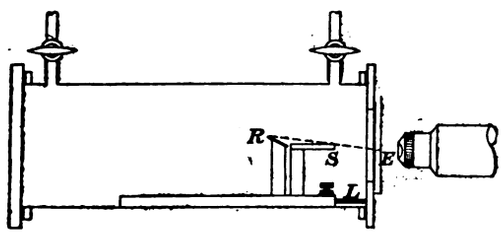
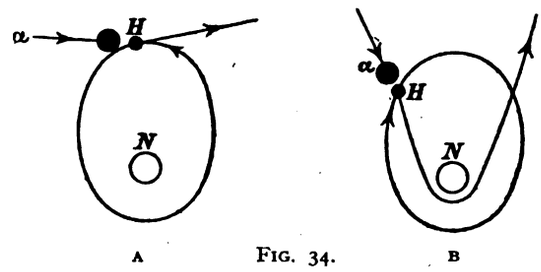


FIG. 33.

but as a "satellite" (Fig. 34), describing an orbit about the nucleus *N* of the aluminium atom. An α particle coming on, as in Fig. 34 A, would drive the *H* forward; if it approached as in Fig. 34 B it would drive the *H* first down and then out in an apparently backward direction. Scattering in other directions might similarly be explained. We should then have to consider the hydrogen nuclei as satellites in other elements, and it was instructive to examine the periodic table of the elements, their atomic numbers, A No., and masses M in this connection. The subjoined table was limited to elements of low atomic weight; the crosses marking the six "active" elements.

Element	A. No.	M.	Element	A. No.	M.
H	1	1·008	×Na	11	23
He	2	4	Mg	12	24, 25, 26
Li	3	6·7	×Al	13	27
Be	4	9	Si	14	28, 29
×B	5	10, 11	×P	15	31
C	6	12	S	16	32
×N	7	14	Cl	17	35, 37
O	8	16	A	18	36, 40
×F	9	19	K	19	39, 41
N	10	20, 22			

All the active elements had odd atomic numbers, which ran in the natural sequence, 5, 7, 9, 11, 13, 15, beginning and stopping abruptly; neither Li3 nor Cl17 was one of the active elements, nor were any of the intermediate even numbers; the six were further all "pure" elements, devoid of isotopes, with the exception of boron. The masses of the six, $B = 10 = 2 \times 4 + 2$ (or 3), $N = 14 = 3 \times 4 + 2$, $F = 19 = 4 \times 4 + 3$, etc., could all be expressed by the formula $4n + a$, where a had the value 3 except in the case of nitrogen ($a = 2$) and one of the boron isotopes. Thus nitrogen (leaving boron apart) occupied a somewhat anomalous position among the six, which was shown also in the forward and backward ranges (above alluded to), and this was further marked in the energy calculations. Though very uncertain and involving assumptions, the estimates, of which Sir Ernest gave particulars, showed that the hydrogen nuclei gained energy by the disintegration (due to collision with an α ray) in most cases, this gain amounting



A FIG. 34. B

to 42 per cent. in the case of aluminium, to 6 per cent. in the case of sodium, and to intermediate values in the other cases, whilst there was a loss of energy, amounting to 13 per cent., in the case of nitrogen. Considering the smallness of the atomic nuclei an exceedingly small number of actual collisions, one in a million perhaps might be expected, but to judge from the scintillations, the number of protons liberated was far smaller than would be anticipated, and that might partly be due to the hydrogen being present in the condition of a satellite. Only very swift particles might be able to disturb the system sufficiently to shake off the satellite.

Other Interesting Points.

Some other interesting points arose in this connection. If the hydrogen nucleus, positively charged, were to form a satellite to the nitrogen nucleus, also positively charged, there must be attraction between the two nuclei, and we had to assume that the forces of repulsion between similar charges became attractive at very close approach. The fact that the nuclei generally held together indeed necessitated the assumption of a change in the mutual force, as to magnitude and sign. But the nature of the forces were not understood. There were other considerations. He had pointed out that the six active elements all had odd atomic numbers. Perhaps they were in a measure unstable, and were gradually breaking up. Harkins (Chicago) had shown that even-numbered elements were far more abundant than those of odd atomic numbers, perhaps because they were more stable. The disintegration method might throw further light upon these problems. But further ocular evidence was wanted. A close examination of photographs of the Wilson type might reveal the three tracks of the α ray, the hydrogen nucleus and the residual nucleus instead of the two so far identified. Prof. J. C. Bose, of Calcutta, thought he had obtained such evidence. A thorough search would be made, though 10 000 photographs might have to be studied before finding one case. The study of atomic collisions and of the capture of electrons—to which Sir Ernest had referred in his discourse the preceding evening on the Life of an α Particle—was one of the most promising methods of solving problems of structure.

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Receiving Microphones, or Thermophones.

By LESLIE MILLER, A.M.I.E.E.

This description of a new type of telephone, operated by heat instead of electro-magnetism, is intended to call the attention of the scientific world, and especially of the wireless experimenter, to the feasibility of using a microphone for receiving, as well as transmitting. It does not seem to be generally known that this instrument is double-acting.

In a Paper read before The Wireless Society of London (now The Radio Society of Great Britain), on November 23rd, 1921, entitled "Loose-contact, thermal, Receiving Telephones," the writer gave the early history of the subject, and described and demonstrated his thermophones. Since then he has gone on developing them, especially from the wireless side, and now proposes to give some details which will enable any amateur electrician to construct one, quite possibly of a better type. Then another useful tool, with a very wide field of application, will have been added to the world's workshop.

A loose contact between any two conducting substances, inserted in an electrical circuit, will, under suitable circumstances, re-transform electrical oscillations caused by sound waves, elsewhere in the circuit, into sound vibrations once more. In order to bring these conveniently to the ear, one of the contacts should be fixed in the centre of a diaphragm, of approved size, such as the mica disc of a gramophone, or a stalloy steel telephone diaphragm held in an ordinary telephone receiver case through the back of which a large, very finely-threaded adjusting screw passes, with the other contact fixed at its point.

The best substances to use for contacts appear to be sulphides, carbon, and tellurium, alone or in combination. Lead sulphide (galena) has proved to be more stable than iron sulphide (marcasite) mentioned in the earlier paper.

Conditions For Best Reproduction.

To produce the best and loudest reproduction of speech and music, it is not enough that the alternating current due to the varying sounds in the transmitter should alone pass through the contact. This must be superimposed on a direct current, of a strength suitable for the actual contacts in use. This probably is not the same current required by the transmitter, but the proper proportion at each end can be obtained by shunting with an inductance.

The way the thermophones act is almost certainly the same as the well known Trevellyan "Rocker," explained by Tyndall many years ago. The two conductors cohere, owing to the formation of a minute bump on one of them, where the heat is localised at the point of contact. This forms a short conducting bridge, which expands and contracts with the varying alternating current. The diaphragm is moved to and fro accordingly, causing sound waves to reach the ear.

It must, however, be pointed out that Prof. Fleming, in his recent Kelvin lecture on "Problems in Telephony, Solved and Unsolved," said the effect might be due to a varying slight separation between the contact points, owing to repulsion between the elements of a conductor conveying current.

Accuracy and Carbon Microphone.

It is not generally recognised what an accurate converter of sound vibrations into electric oscillations an ordinary carbon microphone must be in spite of its diaphragm. Even after the speech current has been distorted by being passed through the inductance of the telephone winding, the world is more or less satisfied with it, and generally gives the whole credit of the result to Graham Bell, instead of the larger share to David Hughes, whose end of the circuit must really do the work of conversion the most accurately. This affords good grounds for believing we are building on a firm foundation, when developing a receiver on the same lines as a transmitter.

In a thermophone suitable for general purposes, including wireless broadcasting, the galena contact fixed to the diaphragm should be of the "treated" variety, sold for wireless rectifying purposes under various trade names, such as kainite, hertzite, permanite, etc. These may slightly differ from one another, but are essentially the same. They are of low resistance, compared with some kinds of granulated galena, which also act well in high resistance circuits. In most of these substances, the resistance falls rapidly with increasing current through the contact, but an average working resistance is about 200 Ω in the one kind, and up to 2 000 Ω in the other. Marcasite is of much lower resistance.

The amount of direct current that can be forced through the contact, without injuring its action by burning, naturally depends on the resistance of it. The fraction of a watt that can be usefully converted into heat in the contacts is probably about the same, no matter what the material may be.

The Sensitising of Current.

To obtain the necessary sensitising current, two, four, or six volts, direct current, is necessary. Close adjustment serves no purpose. In wireless valve receivers the filament accumulators may be made use of to give the one or two milliamperes needed. When the thermophone is in the secondary circuit of an ordinary telephone transformer, dry cells must be added, till the best result is obtained. This must also be done when there is a condenser in the line, the receiver being shunted by a battery, in series with an inductance.

The small flat disc of treated galena, fixed on the mica diaphragm, can be held in a light brass cup by Wood's fusible metal, used when it is just on the point of solidifying. The mica should be about 0·2 mm. (one fifth of a millimetre) in thickness. This is important, because it acts as a light spring, to press the contacts together, as well as a sounding board. The three carbon shot, each 1·5 mm. in diameter, form a triangle in a round flat bottomed cavity at the end of the adjusting screw. Three are used merely to get an average contact between them, as the shot are never quite spherical.

A single sharp carbon or galena point is rather more sensitive but not so reliable. As galena is said to have a negative coefficient of expansion, while carbon has a positive one, the combination does not seem ideal, for producing motion of the diaphragm; but the merit of the substances used as contacts appears to depend on their power to form a good cohering bridge. This cannot be settled except by trial. This bridge should evidently be small, and stable, as it must heat and cool readily, at audible frequencies up to a few thousand per second. Too much current through it is indicated by a "frying" sound; but short of this, the loudness of the response generally increases with the sensitising current.

The Results Obtained.

As to results, the reproduction of the voice, or music, is excellent as regards quality, but the volume of sound is only moderate. Even when listening to broadcast music, under bad conditions, as when using a three valve, low frequency amplifier, there does not seem to be any of the distortion of some of the high notes, that can be heard in a Bell telephone attached to the same receiver. Consequently, listening-in is a pleasure, though more valves are needed than would otherwise be required.

The chief fault of thermophones, in their present stage of development, is their want of sensitivity, compared with the electro-magnetic type. This applies chiefly to wireless reception. They cannot be used with a crystal, but some of the contacts are self-rectifying. To hear American stations in London, a large commercial aerial and four or five valves are needed, so far as the writer has had any experience.

Some Important Applications.

In addition to the reproduction of sound, it is possible the new instruments can be made useful for sight-reading of signals, in aeroplanes or other noisy places. When a thermophone with galena-carbon shot contacts was under test, working from a large frame-aerial, at the National Physical Laboratory, while the writer was present, some strong C.W. signals happened to come in and Mr. Hollingsworth pointed out that the needle of a small milliampere meter, used for measuring the d.c. current through the contacts, jumped forward with each signal. Had the instrument been a little more dead-beat the signals could have been read. Each one evidently temporarily reduced the resistance of the combined contact quite appreciably. Apart from sight reading, the effect may be used to give an indication of the comparative efficiency of the contacts in various thermophones, tested from the same amplifier.

As the electro-magnetic type, according to Prof. Fleming, converts only one part in a thousand of the energy it receives into useful sound waves, there seems no inherent reason why a receiver, operated by heat, should not be of higher efficiency. The thermophone therefore offers a very promising field for research, both from a scientific and a commercial standpoint.

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Thermionic Valves on Public Supply Systems.

The chief disadvantage of the ordinary thermionic valve is that it requires an accumulator and dry cells to work it, and the possibility of drawing the necessary current from an ordinary supply system is a matter which is claiming a fair amount of attention. A paper read before the American Institute of Electrical Engineers by Mr. P. D. LOWELL, describes a five stage amplifier which is said to work satisfactorily on 60 cycle supply systems without the use of batteries for the filament or plate, and is therefore opportune. The first arrangement tested consisted of one radio frequency amplification

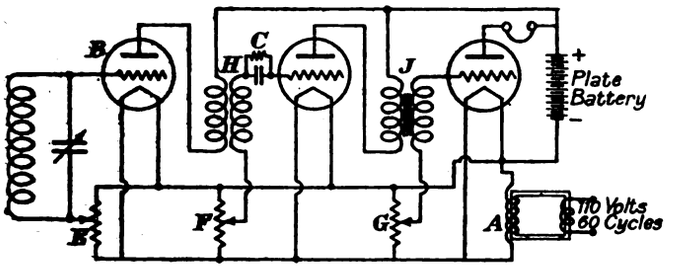

FIG. 1.

stage, a detector, and an audio frequency stage. The filaments of the three valves were supplied by a step down transformer, the primary being connected to 110 V 60 cycle mains and the filaments to the 6 V secondary winding. The filament lighting transformer is shown at *A* in Fig. 1, and the three valves at *B*, *C*, and *E*. The amplifier input circuit is connected to the grid of the tube *B* and to the slides of a balancing resistance *E*, which has a value of 200 O and is connected across the wires which supply current to the filaments. A radio frequency

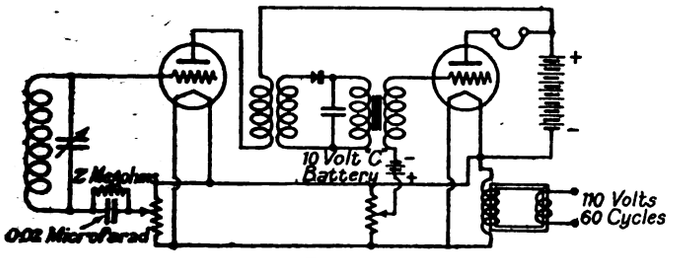

FIG. 2.

transformer is shown at *H*, a second balancing resistance at *F*, an audio frequency transformer at *J*, and another balancing resistance at *G*. The function of the balancing resistances *E*, *F*, *G* is to keep the normal voltage of the grids at a steady value with respect to the average voltage of the electrical mid point of the filament, and thus eliminate the hum which variations of the grid voltage would otherwise produce, all the resistances being adjusted until the hum is eliminated.

Tests with this arrangement showed, however, that these balancing resistances would not by any means completely eliminate the hum, but the employment of a crystal detector in place of the thermionic valve detector reduced the hum very considerably.

An Improved Arrangement.

This arrangement gave quite good results, for the 60-cycle hum was practically eliminated and the crystal detector gave almost as good rectification as the valve detector. It was found, however, that better amplifying action could be obtained by inserting 0·02 microfarad condensers shunted by 2 megohm grid link resistances in the grid circuits, in series with the sliders of the balancing resistances. The grid condensers and grid leak resistances allow the grids to assume a normal voltage which is more favourable for amplifying purposes, and the leak resistances allow any accumulated charge on the grids to leak off to the filaments. Still better amplification and quieter operation was produced by replacing the series grid condenser and leak in the audio stage with a 10 V battery giving a negative charge to the grid (Fig. 2).

Thermionic Rectifier replaces Battery.

Experiments showed that the practice of rectifying the filament current by means of a "Tungar" rectifier was unsatisfactory, for the resultant hum was much greater than that which was experienced when unrectified current was used, for during rectification the wave form is distorted and it becomes impossible to stabilise the grid voltage by means of the balancing

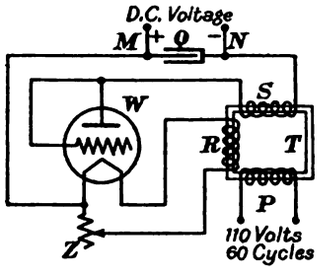

FIG. 3.

resistances. Subsequently the battery used for supplying the plate voltage was replaced by a thermionic valve rectifier connected as shown in Fig. 3. The primary *P* of the small transformer *T* was connected to the power mains, and the winding *R* supplied the filament of the rectifying valve *W* at a pressure of 8 V. The winding *S* gives current at 300 V which is rectified by the thermionic valve *W* and smoothed out by the condenser *Q*, which has about 10 microfarads capacity. This arrangement gives at the terminals *M*, *N* a high voltage direct current, which is quite suitable for use on the plates of amplifying valves. The resistance *Z* varies the brilliancy of the filament of the rectifier and simultaneously varies the plate voltage. The use of a loud-speaking telephone receiver, such as the "Magnavox," was made possible by applying an alternating current rectified by a Tungar rectifier to the field and coil of the telephone, the impedance of this coil being great enough to smooth out the pulsating current sufficiently to reduce the hum to a value which was not annoying. It was found advisable to couple the loud-speaking reproducer circuit to the plate circuit of the last amplifier by means of a *1* to *1* telephone transformer with a 0·02 microfarad condenser in series with the telephone circuit, as this also helped to reduce the residual hum in the telephones. The final arrangement shown in Fig. 4 gives good amplification with a slight residual hum which is not objectionable when receiving signals of ordinary strength, whilst music and speech are said to be clearly reproduced. On switching over the amplifier from a direct current to an alternating current supply, it was found that the amplification under the latter conditions was just as good as that obtained with direct current.

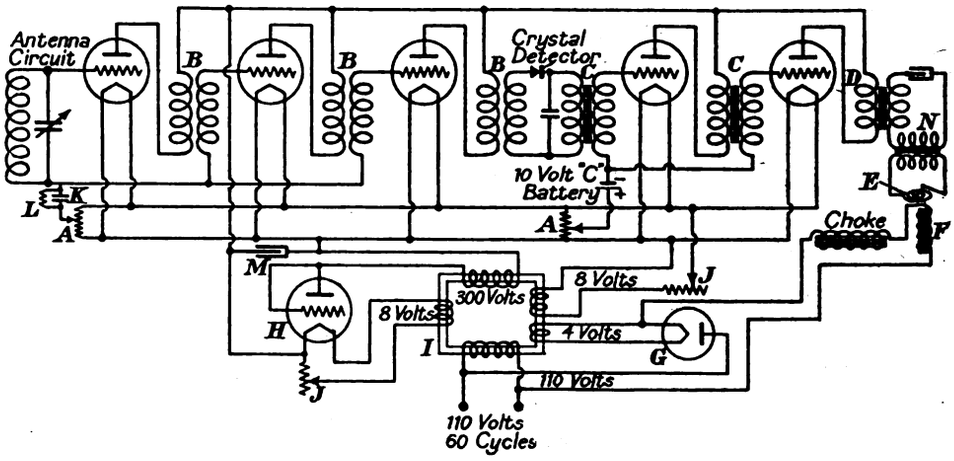

FIG. 4.

A—Balancing Resistances.
B—Radio Frequency Transformers.
C—Audio Frequency Transformers.
D—Telephone Transformer.
E—Armature of Loud Speaker.
F—Field of Loud Speaker.
G—Tungar Rectifier.
H—Plate Voltage Rectifier.
I—Power Transformer.
J—Filament Rheostats.
K—Condenser One Microfarad.
L—Leak Resistance, 2 Megohms.
M—Smoothing Condenser, 10 Microfarads.
N—Step Down Transformer for Loud Speaker.

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Factory Lighting Designs.

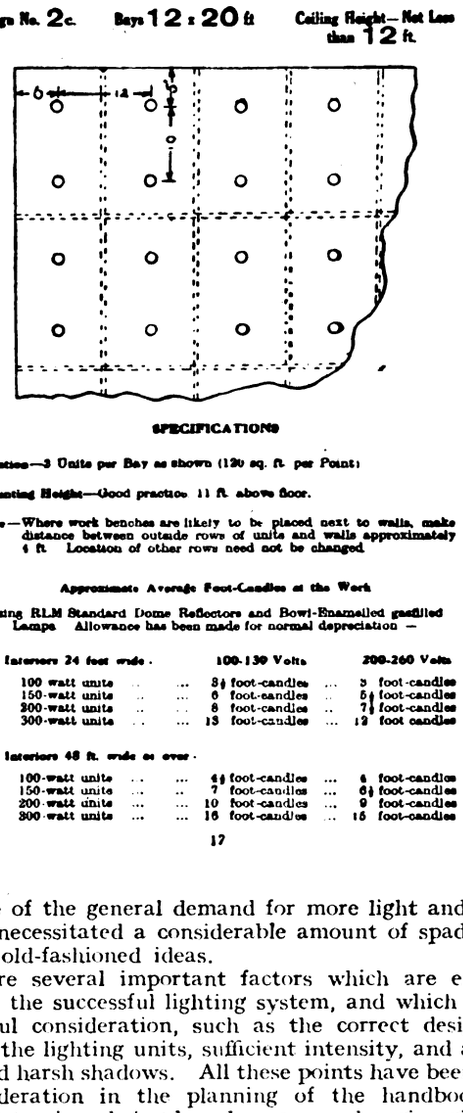
A Useful Handbook on an Important Subject.

In describing the recently instituted Lighting Service Department of the British Thomson-Houston Co. in our issue of July 27th, we mentioned that handbooks would be published giving useful hints regarding the illumination of various kinds of buildings. The first of these, which is entitled "Factory Lighting Designs," has just come to hand.

It deals, as its name implies, with the design of electric light installations in factories and workshops in a practical manner which eliminates the necessity of calculations.

Rule of Thumb and Bad Lighting.

Well illuminated factories and workshops in this country are very few, and this is due to the fact that, up to the present time, rule of thumb methods have been adopted when planning an installation. That such methods do not produce the best results has been realised by engineers for some time, and this,



in the face of the general demand for more light and better light, has necessitated a considerable amount of spade work to uproot old-fashioned ideas.

There are several important factors which are essential features of the successful lighting system, and which require very careful consideration, such as the correct design and spacing of the lighting units, sufficient intensity, and absence of glare and harsh shadows. All these points have been taken into consideration in the planning of the handbook, the practical data given being based on a sound engineering and technical foundation.

No Calculation Required.

The consideration of the factors to produce the best results has hitherto necessitated tedious calculations, and it is realised that there are very few who have sufficient time at their disposal to devote to calculations. "Factory Lighting Designs" solves this difficulty because no calculation whatever is necessary. With the aid of this handbook the technicalities of illumination are reduced to mere diagrams and tables, and the correct lighting equipment for any industrial interior can be found at a glance.

The illustration given herewith is one page from "Factory Lighting Designs"; it shows the planning of a design for a factory where the bays are 12 by 20 ft., with a ceiling height not less than 12 ft. It will be noticed that the intensity of illumination at the work depends upon the size of the lamp used in the unit. The amount of illumination necessary for almost any industrial operation can be obtained from a table at the end of the handbook.

The booklet not only gives details of designs, but also clearly explains various lighting fundamentals. It discusses why the lighting units are located according to bays. It also explains in a concise manner mounting heights, with relative ceiling heights, and the effect of using fewer units than those prescribed in the designs. It also deals with work bench auxiliary lighting, local lighting, and in a chart comparison of good and bad lighting one can readily judge the advantages of the former and the disadvantages of the latter.

One of the interesting features of "Factory Lighting Designs" is the section dealing with the foot-candle meter. This is an instrument which enables illumination, in terms of foot-candles, to be read direct from a scale in much the same manner as one reads temperature degrees with a thermometer. For this reason the instrument is valuable, since it strips light measurements of all their technicalities and it entirely eliminates guesswork. By its means the engineer can himself make sure that an operator is obtaining sufficient illumination for the work in hand.

Copies of "Factory Lighting Designs" can be obtained from the Lighting Service Department of the British Thomson-Houston Co., 15, Savoy Street, Strand, London, W.C.2. It is not for sale, but will be sent to those who believe that "better lighting means better work."

Electrical Coal-Winding Plant.

A Large American Installation.

What, it is claimed, will be the most powerful coal mine winding plant in the world is to be installed at Orient No. 2 mine of the Chicago, Wilmington and Franklin Coal Co., at West Frankfort, Ill. A contract for this winding plant has recently been awarded to the American Westinghouse Electric and Manufacturing Co. and the Nordberg Manufacturing Co., the former of which will furnish the complete electrical equipment for the plant.

The plant contracted for, states "The Engineer," will be twice as large as any coal mine winding installation in North America at the present time. The most powerful coal mine winding plant in that country now is equipped with a winding motor having a capacity of 1 400 H.P., whereas the combined capacity of the two motors for the Orient No. 2 mine will be 4 400 H.P. One motor will be mounted at each end of the drum shaft, and each motor will have a capacity of 2 200 H.P. at 40 deg. C. rise. The maximum winding speed to be obtained will be over 4 000 ft. per min.

Operation will be at exceptionally high speed, the entire working of a single cycle from the time the skip starts from the bottom until it reaches the dumping position at the top requiring only sixteen seconds. This high speed of operation will involve very heavy peak loads during acceleration and heavy regenerative loads during retardation. The load during acceleration will be about 8 000 H.P., and the regenerative load during retardation about 4 000 H.P.

Power will be supplied to the winding motors through a fly-wheel motor generator set, equipped with two 1 800 kW, 600 V, 600 revs. per min. commutating pole, compensated-wound d.c. generators, driven by a 2 200 H.P., 2 200 V, 3-phase, 60-cycle, 600 revs. per min., wound-rotor induction motor. The motor generator set is to be equipped with a fly-wheel, 12 ft. in diameter, weighing just over 40 tons, and built up of steel plates. The control of the winding plant will be exceptionally well provided with safety devices; while automatic acceleration and retardation are also included.

Although the maximum variation in power during a cycle at the winding motor is from 8 000 positive to 4 000 negative, the power drawn from the power system by the a.c. induction motor will remain practically constant at about 2 000 H.P., as the result of employing a fly-wheel which will give up energy during the retardation period.

Electrical Goods for India.

Smaller Imports from Japan.

Trade figures for British India to the end of the last fiscal year show, states "Eastern Engineering," that there is a moderate trade with Japan in electrical apparatus, though there has been a drop in this class of imports since the previous year. The principal imports under this heading are rubber insulated cables and wires, bare copper wire, telegraph and telephone apparatus, electric glow and other lamps.

All but two of these show a drop in amount. The two exceptions are rubber insulated cables and wires valued at £2 000 and electric lamps (other sorts) valued at £3 000, which are both the same as for the previous year. Bare copper wire imports have dropped from £3 000 in 1921–2 to nil, and telegraph and telephone apparatus from £1 000 to nil. Electric glow lamps show a 50 per cent. fall at £1 000, while under the general heading of "other electrical goods" the fall is from £23 000 in 1921–2 to £22 000 in 1922–3.

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Lighting of Factories and Workshops.

Report of the Senior Electrical Inspector.

There is evidence that the importance of good lighting and its effects upon both the health and safety of the workers is being realised, and that more consideration is being given to suitable methods of lighting adapted to the varying nature of the work, states the Chief Inspector of Factories and Workshops in his annual report for the year 1922. Vast sums, however, are spent on installations, and much money is wasted on brilliant lighting, ill-adapted to the particular work, and many manufacturers could no doubt reduce their lighting bills by half, and at the same time have more satisfactory results, if they studied the question carefully and went into all the essential details.

Mr. T. C. Taylor (Leicester), for example, reports that lamps are installed without any thought being given to the result, except to dispel the darkness that would otherwise exist, and he describes a good example of this in a newly-erected factory.

Need of Attention to Shading.

Several inspectors comment on the trying effects of glare and the need for more attention to shading, especially since the use of gas-filled lamps has become general. Mr. Smith (Leeds) reports that the comparative merits of direct as against semi-direct lighting were recently tested at an engineering works in two similar but separate departments of the works. Diffused light was more acceptable to the workers, although the ordinary observer preferred the direct light.

The use of "artificial daylight" lamps, which were exhibited at the Efficiency Exhibition at Olympia in 1920 and have been described in previous reports, appears to be increasing; they are said to be of great value for colour work and work involving matching of colours.

Some inspectors comment on the absence of evidence of accidents attributable to faulty or insufficient lighting, but it seems possible that the majority of these occur in that large group of accidents due to falls, especially of persons falling, which will be investigated during certain months of the current year, with special reference to lighting, and much valuable evidence may be forthcoming.

Avoidable Accidents.

The report of the Senior Electrical Inspector (Mr. G. S. Ram) states that the number of accidents due to electricity reported during the year was 309, including 17 fatal cases, compared with 322 and 12 fatal cases in 1921. In addition there were four "dangerous occurrences." Thirty of the accidents occurred on high-pressure or extra high-pressure systems; 21 of them, including four fatal cases, were on premises of public supply authorities. Seven, one fatal, were due to mistakes on the part of persons in charge in omitting to open isolating switches before working on switchboards or in opening the wrong insulators. All these might have been avoided had a test been made to prove whether the conductors had been made dead before the work was commenced, or if a second authorised person had checked the isolating operations. Three, two fatal, were due to skilled persons deliberately and quite unnecessarily working close to unscreened live conductors. Six accidents, one fatal, occurred to unskilled persons when working in dangerous situations without proper supervision. Two others were due to touching high-tension conductors protected only by insulating tape. Of the medium-pressure and low-pressure accidents ten fatal cases were due to shock from alternating current at 250 V or less as against none from direct current. This is entirely in accordance with the experience of previous years. Two were due to the use of ordinary metal lampholders, unearthed, as portable lamps, another to an unearthed pendant lamp fitting.

Ignition of Transformer Oil.

Several accidents were due to the failure of oil circuit-breakers to clear on a short circuit, resulting in explosion and consequent fire due to the ignited oil. A serious fire occurred in a railway sub-station due apparently to a fault in a transformer which had gradually heated up until the oil ignited. Several other transformers became involved and the burning oil running out caused the destruction of a considerable amount of switchgear and more or less complete ruin to three rotary converters.

This is not the first serious fire which has occurred as the result of the ignition of transformer oil. The risk is one which has not generally received the attention it deserves either in respect of prevention or the localisation of fire should one occur. Prevention of fire by automatic disconnection of the transformers and other apparatus immediately on a fault occurring before serious overheating can take place, is no doubt the best safeguard where the conditions permit. Failing this, means for giving an early warning of any such overheating may avert the danger.

Design of Stations.

The design of electrical stations in reference to the situation and housing of the transformers with a view to preventing the spread of fire to other apparatus and parts of the station is often far from satisfactory, the transformers not infrequently being placed below the switchboard galleries and alongside main cables where the maximum amount of damage is likely to occur in case of a fire.

A contributory cause of a number of low-pressure acciden including several fatal cases during the last few years, has been that the single-pole switch in the circuit for lighting or for portable apparatus has been connected in the wrong wire. This matter is of increasing importance in view of the extending use of alternating current and particularly where direct-current distribution is being changed over to alternating. Such systems usually have an earthed neutral conductor—e.g., in the case of 4-wire 3-phase distribution, the lighting circuits being taken from one phase and the neutral. Many wiring contractors connect the single-pole switches at random in whichever wire happens to be most convenient, with the result that even in otherwise good installations many of the switches are found to be in the neutral conductor, with the result that the full pressure is maintained in the circuit, including the lamp fittings or portable apparatus, whether the switch is "on" or "off." This practice is prohibited by the Regulations, but has been difficult to detect in the course of ordinary inspection without the use of a portable voltmeter. Recently an instrument, a so-called "pocket electroscope," has been put on the market by means of which such wrong connection can be readily detected.

Shock Injuries Mitigated by Falls.

After emphasising the importance of attempting to restore persons rendered insensible by electric shock by means of artificial respiration, the report says it appears to be established that electric shock may cause death by paralysis of the respiratory centre or by arresting the proper action of the heart and putting it into a state of "fibrillation." The latter result appears to be readily brought about by alternating current low-pressure shocks. In the case of the former, artificial respiration is accepted by the medical profession as the proper treatment, but it appears that no successful treatment has been discovered for dealing with the heart when once fibrillation has been set up. In connection with this matter Mr. Ram has been very much struck by the fact that in cases where a man has received a very severe and prolonged shock and has then had a bad fall, if he escapes fatal injuries from the latter as by fracture of the skull, he recovers from the shock. A number of such cases have occurred where a prolonged shock has been received by a man getting hold of the trolley-wires of an overhead crane and being held there by the current until someone has had time to get to the switch and cut off the current. He has then fallen in some cases from very considerable heights, and has recovered.

Work of the Divisional Inspectors.

Much useful work has been accomplished during the year by the four Divisional Electrical Inspectors. Their reports on the year's work contain much valuable information and important matter of general interest.

Mr. McColgan (Northern Area) refers to new problems which arise due to the development of public supplies of electrical energy, and which affect safety of persons employed in various ways—e.g., in the linking-up of large systems; in the supply from large systems to the smaller class of consumers previously having their own plant where the old switchgear is unfitted for the work with the larger amount of power behind it; also to the changing over of direct current installations to alternating current supply, where many of the factory consumers do not realise their added responsibilities under the regulations.

Some Unsatisfactory Sub-stations.

Mr. Brown (Midland Area) notes a great improvement generally in electrical apparatus in public supply stations, but gives instances of certain glaring mistakes in regard to some recent high-tension switchboards, due to the actual designers not having experience in their operation under actual conditions of service. He reports a large number of unsatisfactory sub-stations where the plant has been unduly cramped and safety sacrificed to cheapness. He cites a case of a large works where wire armoured cable was used, the motors and control gear being provided with proper glands for clamping the armouring, which, however, had been cut back in each case and the unprotected tails run into the terminal boxes. The armouring was extensively used for earthing purposes, but was not bonded or connected to earth.

Mr. Swann (Southern Area) refers to the increasing practice of public supply authorities giving supplies to factory premises at high pressures, and points out the unsatisfactory position resulting where the occupier's man in charge has previously had experience only of low-pressure plant. Referring to the danger of fire from the large quantity of oil which may be liberated in the case of a transformer failure, he draws attention to a precautionary measure which has been adopted in a large sub-station which he visited. The transformers are placed over pits, filled up with broken granite of sufficient size to absorb the cubic contents of the tank should the oil escape. Tests have been made to prove that the oil will not burn under such conditions.

Amongst various defects which Mr. Tackley (Western Area) has found he draws attention to many cases of dangerous conditions at overhead cranes as regards want of protection of live conductors both in the driving cabins and alongside the approaches thereto.

Five prosecutions for breaches of the Regulations leading to serious accidents were taken, and penalties of £15, £20, £25 and £72 were imposed. One case in Scotland was dismissed on the grounds that there was no danger to the workman if he had taken reasonable care, and that he had been warned of the danger.

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Merchandise to Sell and Profit By.

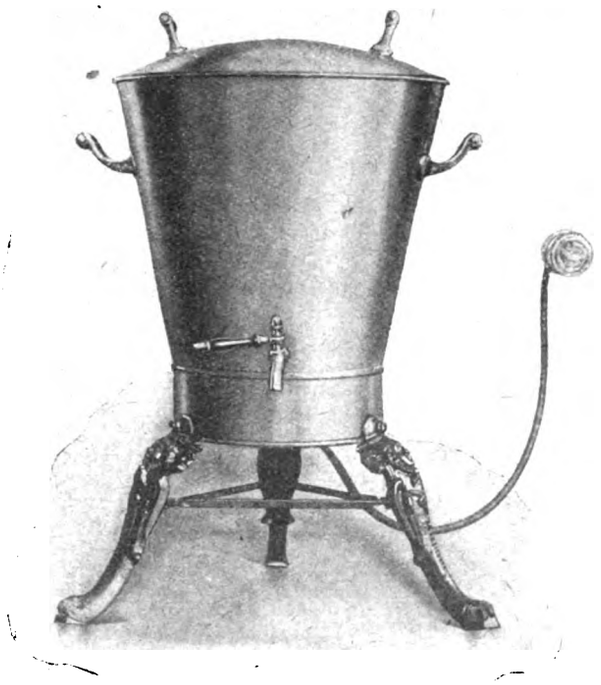
In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

"Blighty"

It may be acknowledged that we are a long way from the final solution of what has become known as the "hot water" problem. Therefore every new piece of apparatus (provided it is a sincere attempt to market a first-grade equipment) should be welcomed and closely studied. We illustrate a kitchenworthy boiler and washing machine which was recently placed upon the market by the

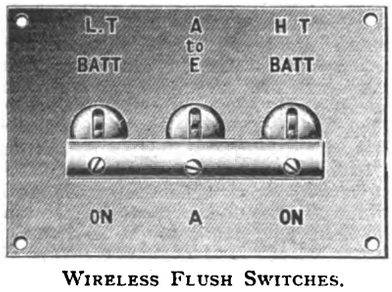


A CONTRIBUTION TO THE HOT WATER PROBLEM.

SOUTH MIDDLESEX MANUFACTURING CO. It is known as the "Blighty." It is listed at 12 guineas, and the specification and "domestic," features of the boiler should make it a good seller at this price. The boiler and washing machine is constructed of copper throughout, all internal parts being well tinned and fitted with non-heat conducting handles and gunmetal draining tap. It is mounted on a heavy metal base which brings the machine to a convenient height from the floor for operating.

Special Flush Switches for Wireless.

Buyers of wireless parts, whether as retailers or buyers of parts for the assembly of complete sets, will be interested in the range of flush switches recently placed upon the market by A. P. LUNDBERG AND SONS. These switches have been specially designed for wireless



WIRELESS FLUSH SWITCHES.

work, which is a point of particular interest, because so many wireless accessories on the market to-day were intended for any other purpose but wireless. Hence many of them are ill suited to the apparatus with which they are used. Our illustration reveals how neat and attractive the design can be if it is carefully thought out. This particular switch performs three functions—connecting the aerial to earth, switching the l.t. battery on or off, and switching the h.t. battery on or off. The complete range consists of eleven different types of switches and each one will add considerably to the appearance and usefulness of the complete receiving set.

The Renaissance of the Crystal Fitting.

We illustrate a crystal fitting which is one of a large range marketed in this country by RICHSON AND CO. There will be a tendency to question whether this is a line of merchandise that will sell. We think it is. Until a few months ago even, fittings of this style were regarded as the fashion of an age that has passed, but a renaissance

A MODERN CRYSTAL FITTING.

has undoubtedly set in. There is to-day a distinct demand for this style of fitting, and the retailer will be wise to consider its possibilities.

The fitting which we show is of Louis XVI. period, and can be supplied with 2, 3, 4, or 5 arms, and one light inside. We understand that leading factors handle these fittings for Richson and Co., and a moderately priced selection in the showroom of the retailer should prove a good investment.

Ediswan Batteries for Wireless.

To emphasise again and again a principle of importance, does not reduce the argument to a mere commonplace. Some questions are so important that they will bear frequent restating. Thus it is with regard to the selection and purchase of batteries for wireless. It cannot be emphasised too clearly how important it is for retailers to keep to the safe path of merchandising batteries of proved quality. The batteries manufactured by the EDISON SWAN ELECTRIC CO. come under this category. The range of Ediswan dry batteries is especially designed and constructed for wireless work. They are thoroughly reliable, silent in working and special attention has been paid to the insulation between cells in order to overcome internal leakage.

The Y-S Watertight Switch.

The ironclad tumbler switch which we illustrate is a useful device to record on the purchasing cards. It will fill the requirements of many situations and particularly meet the severe conditions present in chemical works, ships, shipyards, and breweries. The manufacturers, the Y-SWITCHGEAR CO., claim three distinct features —(*a*) easy wiring, so that it is unnecessary to remove the switch interior to connect the cables; (*b*) that all "dead" metal is in

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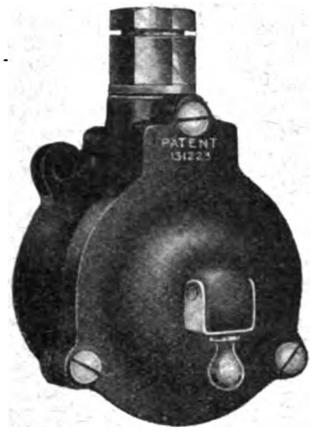
electrical connection, making it impossible to obtain a short when the box is earthed; (c) the special packing washer between the lid and box is made from specially treated asbestos material. The



A USEFUL DEVICE TO MARKET.

switch meets the Home Office requirements. Our illustration shows the switch fitted with a brass reducing gland for armoured, lead covered, or cab tyre cables, but the standard practice is to supply the box with a ¾ in. conduit tapping. The net trade price is 5s.

The "Xcel" Variable Voltage Iron.

The "Xcel" range of heating and cooking appliances distributed by many well-known factors needs no introduction to the retailer. The trade mark "Xcel" is a symbol of good merchandise and carries with it quality and competitive prices. Among the many "Xcel" devices which are manufactured are several patterns of irons which have featuses worthy of comment. One of the most interesting is the variable voltage iron which we illustrate.

This is a small iron designed for use when travelling or in the bedroom. Its complete weight is about 2¾ lb., and the maximum

THE XCEL TOURISTS' IRON.

loading is 200 W. The handle is arranged so that it can be swung down into a horizontal position to take up very little room when travelling. When pulled into the vertical position for use, it is rigidly fixed by a projection engaging in a slot. The change of voltage is made by means of a special connector which fits on three contact pegs. This connector is engraved with the voltage 100 to 125 V on one side, and 200 to 250 V on the other side. By placing it with the required voltage facing a marked point on the instruction label attached to the iron, it can be used for that particular voltage. The iron complete with 2¼ yd. of flex, and b.c. adaptor is listed at 25s., and at this price should sell well. It is marketed by the AUTOMATIC TELEPHONE MANUFACTURING CO.

"As a Man Buys . . ."

"As a man buys so shall he sell" is a truth which has particular application to electrical retailers. Every day almost, manufacturers and factors are placing before retailers some excellent buying propositions which in the majority of cases will prove "best sellers." The prices, the service, and the publicity with which manufacturers back some of these buying propositions make success assured, provided that retailers have courage and vision. Among those who are putting such propositions before retailers are L. G. HAWKINS AND CO. We refer now to their "Universal" summer campaign. The plan need not be elaborated here. Baldly put, it is a plan to induce the public to buy a complete set of certain "Universal" appliances, and with the publicity backing offered by L. G. HAWKINS, it is impossible to contemplate failure. We strongly advise all retailers at least to look over this proposition.

Receiving Sets as an Article of Furniture.

The ABBEY INDUSTRIES, LTD., are to be congratulated on their enterprise in placing upon the market the crystal set which we illustrate. The design has all the essential features necessary to make it a "best seller." It must be confessed that so far as crystal sets are concerned, manufacturers have not shown much originality in the design of the woodwork, which counts for a lot with a piece of furniture, and that is what a receiving set is becoming. In fact, if we are to achieve the turnover we all have in mind, then the sooner this idea becomes universal the nearer we shall get to that haven. A large number of pianos and gramophones which are sold are not sold as musical instruments, but as furniture. Therefore, any effort to make the woodwork of receiving sets more appealing is welcome. We are not overlooking the fact that many manu-

A USEFUL TABLE CRYSTAL SET.

facturers offer the trade some splendid designs in valve sets, but the demand is not limited to these comparatively expensive units. In the set which we illustrate, the manufacturers have embodied several refinements of detail, which add to the appeal of the whole set to the discriminating buyer, and time is proving that the public is becoming more discriminating.

Gent's High-voltage Bells.

The installation of bells to work off high-voltage mains (using the expression "high voltage" to mean circuits up to 250 V and to distinguish them from battery ringing bells) is not followed very extensively. This is very largely due to the shortcomings of the contractor. One shortcoming is that he does not exploit the idea enough. When a job for bells is in prospect the average contractor will offer a "battery ringing" installation. It must be appreciated

A STURDY BELL.

that the majority of users of bells have the idea that bells can only be obtained suitable for battery circuits. It is for the contractor to dispel the idea. The other is hardly a shortcoming; it is perhaps better called a fear or a doubt. The fear or doubt is that these "high-voltage" bells will not really stand up to conditions. There need be no fear on this score. Among the manufacturers who offer the trade a reliable range of bells of this class is GENT AND CO. We illustrate a bell which is typical of their range. The name of Gent should be indexed on the purchasing cards as makers of reliable high voltage bells.

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Parliamentary Intelligence.

Accidents to Public Service Vehicles.

In reply to Mr. D. G. SOMERVILLE on August 1st, COL. ASHLEY said he was not aware that there had been any substantial increase recently in the number of injuries caused by broken glass in connection with accidents to public service vehicles. He was anxious to encourage the use of some satisfactory form of non-splinterable glass in all passenger-carrying vehicles, but he was advised that the cost was so great that it would not be practicable to impose any condition with regard to its use.

Electrical Installation at a Science Museum.

Mr. MUIR, on August 1st, asked the First Commissioner of Works if, in view of the charges which had been made by officials of the Electrical Trades Union against the contractor carrying out the electrical installation at the Science Museum, South Kensington, of evading the specification issued by his Department by putting in faulty cables and generally carrying out the installation in an unsatisfactory manner, and seeing that an inquiry was held on the site, the result proving the correctness of the charges made and that the faulty work had been passed by the divisional engineer of His Majesty's Office of Works, notwithstanding that his attention had been called to the faulty work by the clerk of works on the job, he would make an inquiry into the whole matter and state if any additional cost had been imposed on his Department?

Sir J. BAIRD: I do not admit the accuracy of the statements in this question. The whole matter was investigated on the spot by the chief engineer of my Department, and all the charges proved to be unfounded except one, namely, that a damaged cable had been repaired by the contractor's foreman without the knowledge of the officers of my Department. This has been put right at the contractor's expense. A small charge will have to be borne by my Department for expenses incurred by the contractor in the course of the investigation of the other charges which proved to be unfounded. I see no reason for any further inquiry into this matter. As regards the competence of the contractor, judged by the standard of the work he is doing, he is perfectly competent, and whenever he tenders for any work in future he will get the same consideration as any other contractor.

Mr. MUIR: Will the Minister say what is the reason for trade union officials now being refused permission to go on these jobs, as they were previously allowed to do, since they tendered this complaint?

Sir J. BAIRD: That is a totally different question. It is a matter of detail, and I think the hon. Member will see that if he wants an answer to it he should put it down.

Promotion of P.O. Telegraph Officers.

Mr. MIDDLETON, on August 1st, asked the Postmaster-General whether he was aware that there was great indignation amongst the supervising staff in the telegraph department at Manchester owing to the passing over of officers for promotion; whether he was aware of the fact that a considerable number of officers were passed over in the early part of last year; and whether, in view of the fact that the supervising staff feared there was about to be a repetition, he would cause a searching inquiry to be made into the methods of selection employed at Manchester.

Sir L. WORTHINGTON-EVANS: I am aware of the circumstances to which the hon. Member refers. Under the Post Office Regulations, the officer selected for promotion should be the best qualified of those eligible, and this may, on occasion, involve the passing over of officers, some of whom, although qualified, are not so well qualified as the officer selected. The recommendations in every case of promotion are carefully scrutinised at headquarters, and detailed inquiries are made in any case of doubt. I can find no adequate grounds for taking exceptional action in the case of Manchester.

Lead Poisoning in Accumulator Works.

Lord H. CAVENDISH-BENTINCK asked the Home Secretary, on August 2nd, if his attention had been drawn to the high incidence of lead poisoning in electric accumulator works; if he was aware that the "Ministry of Labour Gazette" reported 14 cases in May and 22 in June; and whether, in view of the fact that strong Regulations for the protection of workers in this occupation existed, he would consider the desirability of appointing additional inspectors to find out whether these Regulations were being properly carried out and, if so, whether new Regulations were required?

Mr. BRIDGEMAN: I am aware of the figures referred to by the Noble Lord which were supplied to the "Ministry of Labour Gazette" by the Factory Department. Most of the cases in question (10 in May and 19 in June) were reported from two works at which there had been a sudden increase of orders and work had been carried on under conditions which, though not involving any breach of the Regulations, were unsatisfactory. The matter has been taken up strongly with the firms, both of whom are reorganising the departments affected. The cases occurred mostly amongst workers newly engaged and, I am glad to learn, have not been serious in character. Apart from these cases, however, the Factory Department has for some time been dissatisfied with the results obtained under the existing Regulations, and a special inquiry was commenced some time ago with a view to ascertaining in what respects the Regulations might require strengthening. This inquiry has now been completed and further action will be considered in the light of its results. No ground has arisen for the appointment of additional inspectors. The works in question have been regularly visited by the district staff and a number of special visits have been paid by the technical officers engaged in the inquiry. The chief inspector is satisfied that the increase of lead poisoning cases in these works is not attributable in any way to any lack of inspection.

London Traffic Bill.

Sir WILLIAM BULL was informed by Col. ASHLEY, on August 2nd, that the Government had decided to introduce a Bill on the subject of London traffic in the autumn. The Bill would follow the general lines of the suggestions made to the Royal Commission on London Government in the evidence given on behalf of the Ministry of Transport.

London and Southend Telephones.

Sir L. WORTHINGTON-EVANS informed Capt. MARTIN, on August 2nd, that Southend could not be served through the toll exchange until additional circuits necessary to afford a no-delay service were available; the provision of these circuits was dependent upon the completion of the new arterial road between London and Southend.

Electrical Developments to Relieve Unemployment.

In the debate on the Consolidated Fund (Appropriation) Bill on August 1st, railway electrification schemes received a considerable amount of attention in connection with suggestions for relieving unemployment during the coming winter. Mr. LANSBURY suggested the raising of a big public works loan of about £100 000 000 to be placed at the disposal of a special committee to electrify railways and to carry out other schemes. Then there was that great scheme of electrical stations, which Lord Haldane's Committee brought forward years ago, and which, Mr. Lansbury said, ought to have been carried through long ago. Everybody knew that electricity could be most efficiently and cheaply generated at the pit-top.

Sir M. BARLOW, who thought there were possibilities in the public works loan scheme, broadly outlined the programme of the Cabinet Unemployment Committee. Dealing with the Trade Facilities Act in its bearing on employment, he instanced the case of the extensions and improvements now in progress on the London Underground Railway, which had found direct employment for some 10,000 men. There was also the South-Eastern section of the Southern Railway which had had a guarantee of £5 500 000 for electrification work. As to acceleration of Government work, the Post Office was initiating two very useful proposals, the first of which was trunk telephone cable laying. Plans were prepared which would involve an estimated cost of over £500 000, and 80 per cent. of the work would be completed by March 31st next. Then the Post Office London railway would be pressed on, at a cost of £500 000. The Colonial Office had submitted schemes for the development of Nyasaland and Tanganyika, and the proposals which had been authorised included the extension of the Lindi Tramway at a cost of £50 000. The Electricity Commissioners would be doing a service to the community if they could stimulate the progress of electricity development throughout the country. The railway companies, again, were now in possession of very large reserve funds running into some £130 000 000, compared with about a quarter of that amount before the war. Now that the amalgamation schemes were complete the railway companies could render very ready help by utilising their resources for the electrical developments which were becoming more and more necessary, and which must be undertaken at an early date.

Private Bills.

On August 1st the House of Commons agreed to the City and South London Railway Bill and the London Electric Railway Bill as amended by the Lords. A message was received from the Lords announcing their agreement to the Shropshire, Worcestershire and Staffordshire Electric Power Bill. On August 2nd similar intimation was received in regard to the Stoke-on-Trent Corporation Bill.

Adjournment of the House.

On August 2nd the House adjourned until Tuesday, November 13th.

Institution Notes.

Tentative suggestions have been made for the formation of an INSTITUTION OF PUBLIC LIGHTING ENGINEERS.

The INSTITUTION OF ELECTRICAL ENGINEERS is paying an official visit to the Shipping, Engineering and Machinery Exhibition on September 21st.

The autumn meeting of the INSTITUTE OF METALS will be held in Manchester from September 10th to 13th, when Sir Henry Fowler will deliver the second annual autumn lecture on "The Use of Non-Ferrous Metals in Engineering." During the meeting visits will be paid to various works, including those of the Metropolitan-Vickers Electrical Co.

The "Journal" of the INSTITUTION OF ELECTRICAL ENGINEERS, announces that Mrs. Ortmann, a great-niece of Sir Francis Ronalds, has presented to the Institution a painting of Sir Francis at work on the catalogue of the Ronalds Library, of which the Institution has the custody. A list is included in the "Journal" of twelve schools and colleges which have been approved under the scheme for national certificates and diplomas in electrical engineering drawn up jointly by the Board of Education and the Institution.

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Electricity Supply.

Extensions and Developments.

CHICHESTER City Council proposes to borrow £7 000 for cable extensions.

PLYMOUTH Corporation intends to spend £200 000 on electrical development work.

NORWICH Corporation contemplates the erection of a new power station at Thorpe, estimated to cost nearly £250 000.

MANSFIELD Town Council has received the sanction of the Electricity Commissioners to a loan of £3 000 for meters.

WILLESDEN Urban Council is recommended to borrow £25 000 for mains and feeders, and £1 000 for the provision of a transformer house.

GREENOCK Corporation has approved of the West of Scotland Advisory Board scheme for the improvement of the electricity supply in the district.

The LIVERPOOL Electricity Committee's scheme for the extension of the Lister Drive power station was approved by the Liverpool City Council last week.

DONCASTER Town Council has decided to extend the mains in order to supply electricity to the pumping station of the London and North Eastern Railway Co.

TUNBRIDGE WELLS Town Council has received from the Electricity Commissioners' sanction to a loan of £53 200 for extensions to the plant at the generating station.

BATH Town Council has applied to the Commissioners for a loan of £7 860 to cover excess expenditure on the installation of a turbo-generator, etc., and extensions to the engine room.

WIMBLEDON Town Council has received from the Commissioners sanction to borrow £10 000 to meet the estimated expenditure in connection with the installation of the fixed price lighting system during the ensuing two years.

Alterations in Charges, Proposed and Actual.

MAIDENHEAD Town Council has decided to reduce the charges for electricity for lighting to 8d. per kWh, and to 2½d. per kWh for power.

SOUTHWARK Council has decided to reduce its lighting charges from 7d. per kWh to 6d. per kWh for the first 1 200 kWh and to 5d. for the existing minimum.

EASTBOURNE Town Council has decided that no further reduction in the charge for electricity for private lighting can be made at present. The matter will again be considered in six months' time.

In our reference last week to the CROYDON Town Council's reduction in the price of electricity, it was inadvertently stated that the price for heating and cooking had been reduced from 1s. 0¾d. to 1s. 0½d. The reduction was, of course, from 1¾d. to 1½d.

Tapping New Areas.

LEIGH Town Council is recommended to borrow £37 572 for mains, services, etc.

ESTON Urban Council proposes to supply electricity to Lazenby, Lackenby and Wilton.

Residents of POTTERS BAR have petitioned the local Council to assist them in obtaining a supply of electricity.

PERTH Corporation Electricity Committee is considering the question of supplying electricity to the Gannochy housing estate.

BAILDON Urban Council has invited the Yorkshire Electric Power Co. to submit a scheme for the supply of electricity to the Council's area.

REIGATE Town Council has given instructions for a report to be prepared of the probable cost of giving a bulk supply of electricity to Horley and district.

FALKIRK Corporation has received sanction from the Commissioners to instal a 3 000 kW 3-phase 50 cycle turbo-alternator with the necessary boiler plant.

AYLESBURY Council has intimated its willingness to discuss with representatives of the Thame Council the question of a supply of electricity to Thame. A meeting has been arranged for August 17th.

Inquiries, Orders and Miscellaneous.

TIVERTON Town Council has applied for a special Order to enable it to erect a power station and to supply electricity in the district.

It is stated that the LONDON Electric Supply Corporation has applied for an Order to supply electricity for the electrified portions of the Southern Railway.

SOUTH SHIELDS Corporation has been recommended to consider the advisability of supplying electric cooking apparatus on hire or rental throughout the area of supply.

The application by KINGSTOWN (Ireland) Urban Council for a loan of £33 000 in connection with the proposed generating station was last week the subject of an inquiry by Mr. F. J. Allan and Mr. M. O'Riam. The inquiry was concluded.

The House of Lords on August 1st approved the special Order made by the Electricity Commissioners in respect of the urban districts of Matlock, Matlock Bath and Scarthin Nick, North Darley and Wirksworth, and the parishes of Middleton-by-Wirksworth, Cromford, Tansley, Alderwasley, Crich, Holloway and South Wingfield.

On August 2nd the House of Commons approved ELECTRICITY SPECIAL ORDERS in respect of (1) the urban districts of Coalville, Ashby-de-la-Zouch, Ashby Woulds, and Sheepshed, and certain parishes in the rural district of Market Bosworth, Leicestershire; (2) the urban district of Budleigh Salterton, Devon; (3) the urban districts of Matlock, Matlock Bath, and Scarthin Nick, North Darley, and Wirksworth, certain parishes in the rural districts of Ashbourne, Bakewell, and Belper, Derbyshire; (4) certain parishes in the rural district of Wycombe, and the urban district of Marlow, Buckinghamshire, and parts of parishes of Cookham and Bisham, in the rural district of Cookham, Berkshire; (5) the urban district of Formby, Lancs; (6) the constitution of the North Wales and South Cheshire Electricity District and establishing the North Wales and South Cheshire Joint Electricity authority; (7) amending the Banstead, Walton-on-the-Hill and Kingswood and the Chipstead and district electric lighting Orders.

The Mayor and Corporation of ALDERSHOT last week visited the Central Power Station, Stanhope Lines, on the 25th anniversary of the inauguration of the station.

The West of Scotland Scheme.

A scheme for the constitution of a joint Advisory Board for the WEST OF SCOTLAND ELECTRICITY DISTRICT will be considered at a conference in the City Chambers, Glasgow, on September 7th. Representatives of local authorities owning electricity undertakings, and of authorised electric power-producing companies, will attend. The proposed scheme provides for main transmissions at 33 000 V and 22 000 V, and secondary transmissions at 11 000 V, 66 000 V and 33 000 V, and for the extension of the Dalmarnock, Clyde's Mill, Yoker, Kilmarnock and Greenock generating stations. Proposed developments in Ayrshire involve the shutting down of the generating station at Ayr and the generation of all the energy for the county at Kilmarnock, and the utilisation of the waters of Loch Doon. Proposals for a scheme of development utilising the water power of the upper reaches of the River Clyde have been put forward, and preliminary negotiations have been opened between the Clyde Valley Electrical Power Co. and the promoters.

Personal Items.

Mr. A. H. HERBERT has succeeded Mr. H. J. BUTTERFIELD, resigned, as a director of the Oxford Wireless Telephony Co.

Appreciative reference to the services of Mr. J. S. D. MOFFET as tramways manager was made at last week's meeting of Belfast Corporation.

Mr. GORDON F. PERRY, chairman of the English Electric Co. of Canada, is visiting this country on business affairs. Mr. Perry, who is only 37 years old, is also chairman of the National Iron Corporation of Toronto. He is of the opinion that Canada has the largest *per capita* consumption of electricity in the world.

Mr. W. C. L. EGLIN, vice-president and chief engineer of the Philadelphia Electric Co., and Mr. GEO. P. ROUX and Mr. ERNEST HOPPING, of the same company, are at present on this side of the Atlantic with the object of looking into general power station practice in Great Britain and on the Continent of Europe.

Mr. A. H. JACKSON has resigned his position as traction representative to the English Electric Co. on being appointed sales manager of the electric traction department of the General Electric Co., Magnet House, Kingsway. Mr. Jackson, who was formerly traction representative to the British Westinghouse Co., and who received his technical training at the City and Guilds of London Technical College, under the late Prof. Silvanus P. Thompson, has had a wide experience in all branches of electric traction work, having been identified during the last 22 years with the Brush Electrical Engineering Co., the London Underground Railways, the British Electric Traction Co., the London County Council Tramways, the British Westinghouse Electric and Manufacturing Co. (now Metropolitan-Vickers Co.), and the English Electric Co. All communications to Mr. Jackson should be addressed in future to Magnet House, Kingsway, London, W.C.2.

Obituary.

Mr. Herbert E. Mitchell.

The death is announced of Mr. HERBERT E. MITCHELL, who died suddenly from heart failure at 13, Victoria Street, Westminster, London, S.W., aged 56 years. A member of the Institute of Electrical Engineers, he entered the profession in the late 'eighties, when, as chief assistant to Prof. G. Forbes, he was responsible for electrical installations at a number of public and other buildings in London and elsewhere. He prepared the original scheme for heating and ventilating the New County Hall, Westminster, and rendered valuable service to the Air Ministry during the war in connection with electrical installations at various aerodromes.

Mr. Charles E. Musgrave.

It is with great regret that we have to record the death, after a short illness, on August 3rd at a London nursing home, of Mr. Charles Musgrave, secretary of the London Chamber of Commerce. Mr. Musgrave, who was in his 63rd year, began life as a journalist, and entered the service of the London Chamber in 1882. He was appointed assistant secretary in 1909 on the retirement of Mr. Kenric B. Murray from that position. Both in connection with, and apart from, that office Mr. Musgrave was concerned in many important movements of a national and imperial character. A memorial service was held on Wednesday at the Church of St. Swithin, London Stone, E.C., and the funeral took place at Richmond Parish Church the same day.

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Imperial Notes.

AUSTRALIA.

Bulk Supply for Windsor, N.S.W.

WINDSOR (N.S.W.) ratepayers have approved the proposal of the municipal Council to obtain electricity in bulk from the Hawkesbury College. At present the supply is obtained from a local station, which is privately owned.

The South Australian Minister of Agriculture has approved the proposal of the PORT AUGUSTA Council to borrow £3 000 for electricity supply in the town. The Commonwealth Railway Department has undertaken to supply the power.

Municipal Schemes in Queensland.

CHARLEVILL (QUEENSLAND) COUNCIL has applied to the Government for an Order in Council authorising the borrowing of £10 500 for an electricity supply undertaking, but has been directed to make a fresh application later.

Representatives of CAIRNS (QUEENSLAND) Council have informed the Home Secretary (Mr. McCormack) that the Council intends to instal an oil fuel driven electrical plant. The capital required is £30 000, which, it is anticipated, can be raised without difficulty.

Damage to Pipes and Cables by Electrolysis.

For some time past the Victorian Railway Commissioners have received complaints of DAMAGE TO UNDERGROUND CABLES and metal pipes caused by stray currents from the railways. The Railway Commissioners state that, while they do not admit any liability, they are endeavouring to devise means of checking the loss of current from the railways. No provision for negative boosters was made in the design of the system, and the Commissioners are now considering the installation of this apparatus. The Victorian Electricity Commission will assist in finding a remedy for the trouble.

Foreign Notes.

EUROPE.

French Electricity Supply Developments.

The scheme of national electrification is being carried out so actively that in a few years' time, states the Paris correspondent of the "Engineer," there is every prospect of electrical energy being distributed over the greater part of the country, with a continuous system of high-tension feeders from Lille to the Pyrenees. The French are convinced that the scheme will provide them with a convenient and cheap form of power, and will permit of their realising a considerable economy in foreign coal. As to the cheapness, everything naturally depends upon the consumption, which must bring down the price to a level that will encourage the general use of current, but while it was claimed that the national scheme would cut the price by one-half, there is unfortunately no evidence yet of a reduction, despite the considerable amount of energy now available for distribution. There are close upon 9 000 kiloms. of feeders constructed or under construction for potentials of from 45 000 to 90 000 V and even up to 120 000 and 150 000 V. In the Dauphiné, the Massif Central and the Pyrenees, powerful hydro-electric plants have been installed, while in the North and the East the alternators are driven by heat engines. The distributing arrangements have been completed in nine principal districts, and the work of connecting them up in a national system has been started upon, so that the northern, central and southern systems will be able to depend upon each other and regulate the distribution in each district.

In view of the remarkable development of electrical enterprise, efforts are being made to widen the field for the consumption of current, and a company has just been formed by practically all the electricity companies in the Paris district to encourage the use of electric road vehicles.

Use of Hydro-Electric Power in Spain.

The development of HYDRO-ELECTRIC POWER has been well maintained in Spain, according to the last report of the Commercial Secretary to the British Embassy at Madrid. During the last twelve months the power utilised has been increased by 80 000 H.P., making an estimated total of 800 000 H.P. or one-tenth of the quantity available. The whole of the electrical energy produced is readily absorbed, largely owing to high cost of coal and freight. The Union Eléctrica Madrileña hopes soon to produce a further 14 000 H.P. at the new generating station at the mouth of the Jucar, on which 30 to 35 million pesetas have been spent, when the company will have a total load of 34 000 H.P. The Hydro-Eléctrica Española, which produces power for the Cooperativa, has failed to reach the figure (12 000 H.P.) contracted for, and although the Dos Aguas waterfalls have now been utilised, as the Molinar and De Villora lines have not sufficient capacity, the current will be used to supply Valencia, Cartagena, Alcoy, and Sagunto, and falls nearer to Madrid will have to be used.

The only important new company formed for carrying out hydro-electric works is Saltos del Río Ondarroa. The Hydro-Eléctrica Ibérica has progressed considerably with its installation on the Saltos del Cinca and the Cinqueta (Aragón); the Productora de Fuerzas Motrices is erecting plant on the Salto de Agua de Cledes (Lérida) for the production of 16 000 H.P.; the Catalana de Gas y Electricidad is constructing a 20 000 H.P. plant on the Argone falls; and the Cooperativa de Fluído Electrico de Barcelona is already constructing lines to carry 50 000 kW to supply Barcelona with power from the Segre, La Vansa, Cardoner and Agua de Vals Falls.

Tenders Invited and Accepted.

GREAT BRITAIN.

H.M. OFFICE OF WORKS, ETC., August 14th.—Heating equipment for Birkenhead Telephone Exchange. Specifications from Contracts Branch, King Charles Street, Westminster, S.W.1.

H.M. OFFICE OF WORKS, ETC., August 15th.—Heating apparatus for General Register House, Edinburgh. Specification from the Engineer, 4-5, Drumsheugh Gardens, Edinburgh.

MANCHESTER GUARDIANS, August 15th.—Electric service mains to Nurses' Home and Booth Hall Infirmary, Blackley, Manchester. Specifications from Mr. Hargreaves, Superintendent of Works, Union Offices, All Saints, Manchester.

ST. PANCRAS (LONDON) BOROUGH COUNCIL, August 15th.—5 000 kW steam turbine and 3-phase alternator, condensing plant, etc. Specifications, etc., from the Electricity Department, 57, Pratt Street, Camden Town, N.W.1.

SELBY WESLEYAN CHAPEL, August 18th.—Installation of electric lighting. Specifications from Mr. W. T. Blackburn, Brayton Road, Selby.

PONTYPRIDD URBAN DISTRICT COUNCIL, August 27th.—(*a*) About 2 000 yards three-core l.t. cable laid and jointed partly in existing conduits, and (*b*) about 2 000 yards' run of l.t. electric lighting overhead lines on wood poles. Specification, etc., from Mr. J. E. Teasdel, Generating Station, Treforest, Pontypridd.

EDINBURGH CORPORATION, September 3rd.—33 000 V overhead main transmission line. Specification from the Engineer and Manager, Electricity Department, Dewar Place, Edinburgh.

BRADFORD CORPORATION, September 6th.—One surface condensing plant, with auxiliaries, for a duty of 240 000 lb. of steam per hour (Contract R. 222). Specification, etc., from Mr. Thomas Roles, City Electrical Engineer and Manager, 45 to 53, Sunbridge Road, Bradford.

ESTHONIA.

REVAL TRAMWAY ADMINISTRATION. September 1st.—Tramway standards. Particulars from the Department of Overseas Trade.

HONG KONG.

GOVERNMENT OF HONG KONG (KOWLOON PENINSULA).—Lease of tramways to be constructed by the Government. The lessee must carry out electrical equipment of the track, provide or obtain current, rolling-stock, etc., maintain track work and equipment, and operate the service.

IRELAND.

DUBLIN CORPORATION, August 13th.—Cylinder, engine, crank chamber and turbine oils, for the Electricity Department. Specification, etc., from the Town Clerk, Exchange Buildings, Lord Edward Street, Dublin.

CLARE MENTAL HOSPITAL, August 14th.—(1) Two 50 H.P. suction gas engines, two suction gas plants, two direct-coupled 220 V dynamos, two dynamo shunt regulators, and one motor fan for gas plants; (2) one d.c. switchboard, motor generator and storage battery; and (3) wiring of buildings and overhead wiring to powerhouse.

The tender of Eric Richards for wiring the Tabernacle Church, ABERAYRON, at £107 has been accepted.

REIGATE TOWN COUNCIL has accepted the tender of Callender's Cable and Construction Co., for a transformer kiosk at Meadvale, at £130 10s.

SALFORD CORPORATION has accepted the tender of the Metropolitan-Vickers Electrical Co. for six 6 000 kVA single phase transformers at £3 350 each and one 6 000 kVA spare transformer at £3 285, and of British Insulated and Helsby Cables, Ltd., for three-core 33 000 V transmission cables, £24 380.

DARTFORD URBAN COUNCIL has accepted the following tenders: Johnson and Phillips, switchgear and cables, £729 7s. 6d.; cables for the supply to the West Main Sewerage Works, £2 305 19s. 10d.; switchboard control panel, £312; and truck-type switchgear, £184 10s. Seagers, Ltd., pipe work, £227. Brush Electrical Engineering Co., transformer, etc., £1 274; and gallery and air ducts, £280.

Business Items.

STEWART BROS. have commenced business as electrical engineers in Bridge Street, Dollar, Clackmannanshire.

The COUNTY ELECTRICAL AND WIRELESS STORES, LTD., 1, Broad Street Place, London, E.C., have opened a branch business at 1, South Street, Deal, with Mr. A. W. Bertie as manager.

The UNDERFEED STOKER CO., of Coventry House, South Place, London, E.C. 2, has removed its offices to Aldwych House, Aldwych, London, W.C.2. The telegraphic address is "Underfeed, London," and the telephone numbers Central 4026, 4027, and 4028.

On Monday next the RUNBAKEN MAGNETO CO., of Derby Street, Manchester, will open a new branch at 107, Northumberland Street, Newcastle-on-Tyne, under the charge of Mr. S. H. Flynne, one of the directors. The branch, which makes the firm's tenth branch service depot, will be fully equipped for magneto, dynamo, starter and accumulator repairs.

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Electric Traction.

Tramway Extensions and Developments.

DARLINGTON Town Council is again considering the proposed tramway extension to Houghton-le-Skerne.

DONCASTER Town Council is applying for permission to borrow £000 to construct a tramway track in Trafford Street.

The MIDDLESEX County Council has approved the construction of a double line of tramway along Broad Lane, The Hale and Ferry Lane from the High Road, Tottenham, at an estimated cost of £185 950.

The Minister of Transport has held an inquiry into an application by the LIVERPOOL Corporation for sanction to extend the tramways in the Woolton, Gateacre, Allerton, Garston, Clubmoor and Walton districts. There was no opposition.

EDINBURGH Tramways Committee recommends that electric tramways should be laid down between Seafield, Leith, and Portobello. In conjunction with the Musselburgh and District Light and Traction Co., the Corporation is now running through cars between Edinburgh and Port Seton.

Another step forward in speeding up LONDON's trams has been taken by the L.C.C., who have authorised the re-equipment with high-power motors of a further 200 tramcars. The order is to be placed jointly with the English Electric Co. and the Metropolitan-Vickers Electrical Co., and is said to amount to about £164 000. Delivery of the new equipment is to be made at an early date.

Fares, Receipts and Passengers.

EDINBURGH Corporation tramways received £13 785 from 1 817 380 passengers during the week ended July 28th.

On Monday the LONDON County Council trams carried 2¼ million passengers or 100 000 more than on last August Bank Holiday.

Receipts on IPSWICH Corporation tramways during the week ended July 28th totalled £898 as compared with £911 for the corresponding week last year.

While unable to make a general reduction in fares DONCASTER Tramways Committee proposes to introduce weekly tickets ranging in price from 4s. 6d. to 2s.

During the fortnight ended July 31st the traffic receipts of the MADRAS electric tramways were Rs.56 513, an increase of 14·8 per cent. on the corresponding period last year.

A LONDON County Council Committee reports that it is not desirable to issue season tickets on the tramways, as fares are already very cheap, and, further concessions are not possible.

Although the total revenue of EDINBURGH tramways for the year to May 15th last shows a decrease of £28 227, there was an increase in the total number of passengers carried of 5 674 368.

With an increase of 86 346 passengers compared with the corresponding week last year, receipts on LEICESTER tramways during the week ended July 28th were £7 763, as compared with £7 318.

GLASGOW Tramways Committee has decided to recommend the Corporation to restore the halfpenny fare, the charges proposed being ½d. for two stages, with a reduction of ½d. on every fare stage thereafter.

Owing to its success on the Lidget Green route, the weekly transferable pass system has been extended by the BRADFORD Tramways Department to the Thornton Allerton and Duckworth Lane routes for a trial period of two months.

Receipts on LONDON tramways controlled by the "Underground" group during the week ended July 28th totalled £41 714, a decrease of £5 380 on the corresponding week last year. The aggregate from January 1st to date shows a decrease of £109 574.

The recommendation of the HALIFAX Tramways Committee not to make a reduction in the existing tram fares and stages was referred back at the last meeting of the Town Council, the general feeling being in favour of tokens being issued at cheaper rates than those at present operative on the system.

DERBY Corporation tramways undertaking yielded a gross profit during the past year of £31 774, or £16 830 more than in the previous year. Capital expenditure being £130 000, this represented a return of 25 per cent. Receipts amounted to £115 199, an increase of £1 960, and ordinary expenditure to £83 425, a decrease of £14 870. From the renewals fund £20 000 was taken for the purchase of ten new cars.

Electric Railway Items.

Traffic receipts on the MERSEY RAILWAY for the week ended July 28th were £4 274, bringing the total receipts for the first 30 weeks of the year to £135 022.

The LONDON "Underground" group of tubes, trains and 'buses on Monday carried nearly six million passengers, a million more than on any previous holiday. Altogether over 1 850 000 car miles were run.

Foreign and Miscellaneous Traction News.

Tramway workers throughout NEW JERSEY are, states Reuter, striking for increased wages.

Recently EDINBURGH Town Council considered the acceptance of a tender by a Bristol firm for the construction of eight tramway car bodies. As the result of correspondence between certain trade union officials and the Town Clerk of Edinburgh, it was announced at a special meeting of the Tramways Committee that it was contended that a lower rate of wage was being paid in Bristol. A conference is to be held in Bristol to-day (Friday) regarding the matter.

Wireless News.

No Broadcast Report till End of Month.

It is understood that the report of the Committee on Broadcasting appointed by the Postmaster-General to inquire into the contracts between the Post Office and the British Broadcasting Co., and the general wireless position, has not yet been drafted. A fortnight ago the Postmaster-General said he was expecting the Committee's report "at any moment." It is improbable that the report will now be available before the end of the month.

Increase of Broadcast Reception Facilities.

Formally opening the new Manchester station of the British Broadcasting Co. last Friday, Lord Gainford said the Broadcasting Co. were confident that when the Government report on broadcasting was issued it would clear them of unfounded charges, and that their record of work would receive fair commendation. At the present time 66 per cent. of the total population of Great Britain were served within a thirty-mile radius, the radius within which a crystal set or single valve set could be used, and it should be within the means of most people to be able to purchase such sets. They recognised that there were to-day certain large centres of industrial population for which they had not yet catered, and they had informed the Postmaster-General that they were prepared to consider establishing relay stations, and that ten of these would increase the percentage of 66 to 75 per cent. of the population.

They hoped the Government Committee would recommend in their report the use by the British Broadcasting Co. of greater wave-band to avoid interference between different stations, and they also hoped for an extension of the hours during which they were permitted to transmit.

Wireless Exhibition in Glasgow.

Arrangements have been made for holding a Scottish National Radio Exhibition in Glasgow next month. The show, which will be held in St. Andrew's Hall, will be open from September 3rd to 8th inclusive, and will be held under the auspices of the wireless trade in Glasgow. The organisation of the show is in the hands of the Radio and General Publicity Co., Glasgow and Manchester. An outstanding feature of the Exhibition will be novel demonstrations of broadcasting and of wireless apparatus.

Wireless Amateurs Mobilising.

In future wireless amateurs in all parts of the country, however remote, will have a definite voice in the affairs of the whole amateur wireless movement in Great Britain. This, in effect, is the object of a new step which is being taken by the Radio Society of Great Britain. Under the proposed arrangement, which is fully described in this week's "Wireless World," the country will be divided into four sections, each of which will appoint its representative to sit on the central committee.

Broadcast Time Service.

Every listener-in may rest assured that the time signals broadcast from the British Broadcasting Co.'s new stations will be of the most accurate nature. For some time past the Birmingham station has been equipped with a system of "Pulsynetic" electric impulse clocks supplied by Gent and Co., Ltd., Faraday Works, Leicester, and now, owing to the success of this system, it has been decided that all new stations at Aberdeen, Bournemouth and Manchester shall be fitted with Pulsynetic electric clocks for time signal announcements. Each installation has a master clock, from which the time signal is given and from the beat of whose pendulum the announcer counts the seconds. In addition three secondary dials, driven by the master clock, indicate uniform and accurate time in the other important rooms in the station.

Broadcasting in the U.S.A.

On April 1st of last year the number of broadcasting stations in operation in the United States numbered only 137. This meant that there were large areas in the country where broadcasting could be received only from stations at a great distance. The situation now, however, is much different, there being over 500 broadcasting stations licensed at the present time. These stations are so well distributed over the whole country that there is no place, with the exception of one point in the south-western section, which is farther than 150 miles from a good broadcasting station. In fact, about nine-tenths of the area of the country and probably 95 per cent. of the population is within 100 miles of a broadcasting station.

Wireless News in Brief.

It is stated by the "Cape Times" that the CAPE TOWN City Council is considering a scheme of municipal wireless broadcasting, and that in this connection Sir David Graff has offered to erect at his own expense a 6 kW Marconi broadcasting station.

Two new wireless transmitting sets which are to be installed at Scotland Yard are the nucleus of a system of wireless communication now being contemplated by the METROPOLITAN POLICE. It is understood that the officials concerned are in favour of the installation of wireless receiving sets in all the metropolitan police stations.

We are asked to state that the protective device for squirrel-cage motors described on p. 679 of our issue of June 22nd is manufactured by the Elektriska Aktie Bolaget Eck, of Parille, Sweden.

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Electricity Supply in South Africa.

Work of the Newly-appointed Commission.

H.M. Senior Trade Commissioner in South Africa (Mr. W. G. Wickham) has forwarded to the Department of Overseas Trade a memorandum concerning the formation and functions of the Electricity Supply Commission, which states that the Electricity Act, 1922, is the only co-ordinating legislation that has been passed by the Union Parliament to regulate the supply and control of electricity. Up to 1922 each province had its own legislation, and, except in the Transvaal, that legislation related particularly to the regulation and control of municipal electrical undertakings. The Transvaal Power Act of 1910 provided, *inter alia*, for the regulation and control of all undertakings supplying electricity for sale. Such undertakings had to be licensed and their prices were regulated and controlled.

Duties of the Commission.

The Union Electricity Act, 1922, follows the lines of the Transvaal Power Act of 1910 in relation to the control and licensing of private electricity undertakings, for which purpose an Electricity Control Board is constituted under the Act: but, in addition, the Act provides for the establishment of an Electricity Supply Commission, whose functions are three-fold, i.e.:—(1) To investigate new or additional facilities for the supply of electricity and for the co-ordination and co-operation of existing undertakings so as to stimulate the provision of a cheap and abundant supply of electricity; (2) to advise provincial administrations in regard to electric lighting schemes, etc., promoted by local authorities; and (3) to establish, acquire, and operate power stations of its own for the supply of electricity for State, municipal, industrial, and other purposes.

Before it can establish or acquire a power supply undertaking, the Commission must apply to the Control Board for a licence in the same way as a private company. It must also submit its report and proposals to the Government for approval, and upon approval of the scheme by the Government the Governor-General authorises the Commission to raise the necessary loan.

The Electricity Supply Commission, consisting of one full-time member and two part-time members, was appointed by the Union Government on March 1st last. The chairman and full-time member of the Commission is Dr. H. J. van der Bijl, and the part-time members Messrs. R. Niven and J. R. Fulton, both of Johannesburg. The headquarters of the Commission will be in Johannesburg, where it opened its offices on May 1st last.

Important Electrical Schemes.

Several electrical schemes are already engaging the Commission's consideration. An investigation is proceeding in regard to the electrical power requirements and potentialities of the Witbank area. Witbank is the centre of the Transvaal goldfields and an eminently suitable area for the generation and distribution of electricity on a large scale.

A new power station is required at Durban for municipal purposes. The Commission has commenced negotiations with the Durban Municipality and has offered to build a large station there to provide for municipal and railway and harbour requirements in the Durban area, the electrification of the main line between Durban and Pietermaritzburg, and industrial and other purposes along the railway route.

Railway Electrification.

The Railway Administration has under construction at Colenso, in connection with the electrification of the railway line between Pietermaritzburg and Glencoe Junction, a large power station which will contain five turbo-alternator sets, each having a normal capacity of 12 000 kW, but capable of carrying 15 000 kW for short periods, and as much as 20 000 kW for two minutes at a time. The intention is that the Commission shall take over the station and the transmission lines in connection therewith, and in the event of the Durban power station being built by the Commission the stations at Durban and Colenso will be linked up and worked in unison.

Wide Powers of Commission.

The Commission has very wide powers under the Act. Once proposals for the establishment or acquisition of a new power supply undertaking have been approved by Government, the Commission is free to function on business lines without Government intervention and subject only to the provisions of the Act and the powers exercised by the Control Board, which stands in the same relation to the Commission as it does to a private power company.

Each station established or acquired by the Commission has to be worked as a separate undertaking, all profits arising therefrom, after meeting operating, interest, renewal, and amortisation charges, to be used towards reducing prices and stimulating the use of electricity. The Commission is a business undertaking, intended to combine the elasticity and freedom of action of private enterprise with the advantages of a national institution as regards the facility for raising capital, the elimination of private profits, and the development of the use of electricity for domestic, industrial, and farm purposes.

Books Received.

"Der Glimmschutz." By Dr. G. I. Meyer. (Leipzig and Berlin: B. G. Teubner.) Pp. 61.

"Alternating Currents: Their Theory and Transmission." By E. T. Larner. (London: Crosby Lockwood and Son.) Pp. 198. 6s. net.

Legal Intelligence.

Dutch Electric Lamps.

Further B. T.-H. Litigation in Scottish Courts.

In the Bill Chamber of the Court of Session last week Lord HUNTER heard counsel in a note of suspension and interdict at the instance of the British Thomson-Houston Co., against Charlesworth, Peebles and Co., mechanical and electrical engineers and merchants, 134, St. Vincent Street, Glasgow, to interdict the respondents from removing or causing to be removed outwith the jurisdiction incandescent electric lamps presently in the respondents' possession or under their control which the complainers said infringed their letters patent.

The complainers stated that the respondents did not manufacture electric lamps or tungsten wire filaments for such lamps. They were, however, selling agents to the Naamlooze Vennootschap Popes Metaaldraadlampenfabrik, a company manufacturing in Holland incandescent electric lamps. The respondents had imported for sale within the jurisdiction incandescent electric lamps manufactured by the Dutch or other foreign companies, and containing tungsten filaments embodying the improvements described in the complainers' specification filed relative to the letters patent granted to them. As the result of actions raised against the respondents and the Dutch company, the complainers had obtained interdict against them, including, *inter alia*, interdict against the export of lamps, and had also obtained decree of delivery of all lamps constructed in infringement of the letters patent referred to so far as in the respondents' possession or under their control.

They believed and averred that the respondents were in course of removing or causing to be removed from the jurisdiction lamps which were in their possession, and which infringed the complainers' letters patent, and the complainers submitted that they were entitled to the delivery of these lamps.

In their answers the respondents stated that the lamps imported and sold by them did not infringe the alleged letters patent of the complainers. They explained that they were advised and decided to reclaim against the interlocutor of Lord Blackburn finding that the patent was infringed, and that they had informed the complainers' agents that a reclaiming note would be duly lodged.

Pending a final judgment in the Court of Session, the respondents were following their ordinary course of business and maintaining the *status quo*. They had not returned the lamps to Holland or dealt with them otherwise than in the ordinary course of business. They offered to give an undertaking to deal with the lamps on these lines, but the complainers declined to accept any qualification which would permit despatch to the North of England or Ireland in the ordinary course of business. In any event, they stated, the complainers would not become entitled to delivery of any of the lamps in question. On the other hand, the restraint craved by the complainers would cause a serious dislocation of the respondents' business and business connections and entail heavy loss to the respondents.

Lord Hunter granted interim interdict, subject to the complainers finding caution, which they were agreeable to do.

The Liverpool Meeting of the B.A.

Programme Includes Papers of Electrical Interest.

In addition to Sir Ernest Rutherford's presidential address on "Electrical Structure of Matter," a number of papers of electrical interest will be read at the Liverpool meeting of the British Association from September 12th to 19th. The closing day's programme of Section G (Engineering), includes the majority of these, the contributions including papers by Prof. E. W. Marchant, on "A Method of Improving the Wave Shape of Alternators," and on "Triple-Frequency Currents in the Earth Connection of Three-Core Cables"; by Mr. F. H. Clough, on the "Electric Propulsion of Ships"; by Mr. R. L. Morrison, on "Conversion from Alternating Current to Direct Current by Means of Mercury Arc Rectifiers"; by Dr. T. F. Wall, on "Squirrel-Cage Induction Motors with High Starting Torque and Low Starting Current in the Line"; and by Mr. J. Scott-Taggart, on "Improvements in Wireless Receiving Apparatus particularly for Broadcast Reception."

The sectional proceedings on September 14th include a paper on "Rail Transport," by Lt.-Col. A. E. O'Brien, chief electrical engineer of the L.M. and S. Railway and a visit to the works of the British Insulated Wire Co. On September 17th, Mr. J. Parry will read a paper on the "Conservation and Control of Water Resources." Other contributions will include papers by Capt. J. A. Slee, on "Recent Applications of Wireless Telegraphy to the Mercantile Marine," and by Dr. H. Mawson, on "Analytical and Experimental Investigations Relating to Water Turbines." The report of the Committee on Complex Stresses which will be presented on September 18th, will include papers by Prof. L. N. G. Filon, on "Graphical Determinations of Stress from Photo-electric Observations," and by Prof. B. P. Haigh, on the "Thermodynamic Theory of Mechanical Fatigue and Hysteresis in Metals."

Bound copies of Volume II. of "The Cost Accountant," the official journal of the Institute of Costs and Works Accountants, containing numerous articles on costing and works accounting in various industries, are now available. Priced at 30s. post free to non-members, and to members 25s. post free, they are obtainable from the office of "The Cost Accountant," 38, Grosvenor Gardens London, S.W.1.

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Companies' Reports, Dividends, etc.

BENN BROTHERS.—The net profit of Benn Brothers for the year ended June 30th amounted to £25 436, and there is an available balance with £11 068 brought forward of £36 503. The directors have allocated £10 000 to general reserve, raising it to £22 375, and the proposed dividend for the year is 17½ per cent., less tax, leaving £10 133 to be carried forward. A sum of £7 565 has been added to capital account by the continuance of the practice of allotting shares to members of the staff. Reference is also made to the recent formation of a subsidiary company under the name of Ernest Benn, Ltd., thus dividing the business into two distinct parts—periodicals and books.

CONSOLIDATED ELECTRICAL CO.—The income for the year ended March 31st, 1923, was £3 124. General charges absorbed £1 460 and income tax £814, leaving £850 plus £1 238 brought forward. In view of the continuance of heavy depreciation in the company's investments and the serious decline in income, the directors considered it advisable to withhold the payment of the preference share dividend due in respect of the year ended March 31st, 1923. The investments are taken in the balance-sheet at cost, but, as mentioned above, are subject to considerable depreciation. Owing mainly to the loss of revenue from the company's telephone investments, the disproportion between income and expenses has become very pronounced and raises the question whether the company can continue its existence with advantage to the shareholders. Under the circumstances the directors will endeavour at the forthcoming meeting to elicit the views of shareholders as to the desirability or otherwise of winding up with a view to ultimate distribution of the assets. The annual meeting will be held at Worcester House, London, E.C., on August 14th, at noon.

Supply and Lighting.

WESTMINSTER ELECTRIC SUPPLY CORPORATION.—The directors recommend an interim dividend at the rate of 4s. 6d. per share, less tax for the half-year ended June 30th, payable on September 1st. The interim distribution last year was at the same rate, the final dividend of 7s. 6d. per cent., making 12 per cent., compared with 10 per cent. for the three previous year.

CHARING CROSS, WEST END AND CITY ELECTRICITY SUPPLY CO.—The directors have declared an interim dividend of 5s. per share on the ordinary shares of the West End undertakings for the half-year ended June 30th, 1923. Warrants will be posted on August 15th. The interim distribution last year was at the same rate. In June last 16 000 ordinary shares were offered to the shareholders at the price of £7 10s. per share in the proportion of one new share for every five shares held. The new shares will participate in the final dividend for this year, but do not participate in the interim now declared.

THE YORKSHIRE ELECTRIC POWER COMPANY.—The report for the half-year ended June 30th last states that the sale of electricity has again largely increased, this being mainly due to the demands from new consumers. The profits also show a satisfactory increase. Interim dividends at the rate of 6 per cent. per annum for the six months ended June 30th, 1923, will be paid on the shares issued prior to 1923. The issue in April last of £250 000 of ordinary shares of £1 each at 23s. per share was applied for more than three times over by the shareholders of the company. The interim dividend on these shares will be calculated to June 30th, 1923, from the date of allotment and first due date of instalment on the amounts due and paid (excluding premium) on those dates.

MERSEY POWER CO.—The board has determined, in exercise of the power reserved under the trust deed, to redeem the whole of the outstanding balance of the 7½ per cent. mortgage debenture stock on March 1st, 1924, at the rate of 102 per cent. The payment will be made by the Liverpool branch of the Westminster Bank, 22, Castle Street, Liverpool, and the certificates for the debenture stock must be sent to the bank at that address after February 28th, 1924, and not later than March 21st, 1924, with a discharge endorsed. A form of discharge to be endorsed on the debenture stock certificates will be sent to the registered holders thereof in due course. The half-year's interest due on September 1st next will be paid in the usual course, and the annual drawing with regard to the stock to be redeemed on December 31st, 1923, will also take place.

ELECTRICAL DISTRIBUTION OF YORKSHIRE, LTD.—The report for the half-year ended June 30th last states that there has been a satisfactory increase in the demand for electricity and a substantial addition to the number of consumers. An interim dividend at the rate of 7 per cent. per annum (free of tax) will be paid for the six months ended June 30th, 1923. The development of the company's business and decreased costs, the report continues, have enabled the directors to reduce the price of supply to consumers in all those districts where the tenure is long enough to justify the anticipation of a reasonable return on additional capital expenditure on extensions contemplated in those districts. At meetings of shareholders held on March 6th and 27th, 1923, the nominal capital of the company was increased from £150 000 to £250 000. Inquiries as to when further capital will be required have been received. The time for this has not yet arrived, but it is expected that an issue will be made to the shareholders early next year.

Cable, Telegraph and Telephone Companies.

W. T. HENLEY'S TELEGRAPH WORKS CO.—The directors have declared a dividend on the preference shares at the rate of 4½ per cent. per annum, less income tax, for the half-year ended June 30th last; also an interim dividend on the ordinary shares of 1s. per share, less income tax, both to be paid on September 1st next.

ENFIELD CABLE WORKS, LTD.—In their report for the year ended June 30th, the directors recall that the name of the company has been changed by the omission of the word "Ediswan." The Edison Swan Electric Co., Ltd., are no longer represented on the board, and have contracted to sell their shareholding. The profit for the year, before charging directors' fees and commissions, interest on bank loan, and corporation profits tax, is £43 646, while £4 223 is brought forward. After paying directors' fees and commissions, interest on bank loan, and corporation profits tax, there remains £34 147. It is proposed to pay a dividend of 10 per cent. on the ordinary shares, which will absorb £20 205, and to write £2 998 off preliminary expenses, being the balance of such expenses incurred prior to the preference share issue of last June. This will leave a balance of £10 943, which it is proposed to carry forward. A considerably increased business has been done, and the prospects for the current year promise still further expansion both in volume and in rate of profit.

Traction Companies' Results.

CITY OF BUENOS AIRES TRAMWAYS CO.—Payable on August 16th, an interim dividend of 1s. 3d. per share (5 per cent. per annum), less tax, has been declared for the three months ended June 30th.

BRISTOL TRAMWAYS AND CARRIAGE CO.—Declaration is made of an interim dividend for the half-year ended June 30th, at the rate of 3 per cent. (less tax), on the ordinary shares. A year ago a dividend of 3 per cent. was declared, free of tax.

New Companies.

BROWN AND ZILLWOOD MOTORS, LTD. Private. Cap., £1 500 in £1 shares. Electrical engineers, etc. Reg. office: 34, Earl Street, Westminster, London, S.W.

WEBBER AND MEECHAM, LTD. Private. Cap., £500 in £1 shares. Electrical, radio and general engineers, etc. Reg. office: 62, Wardour Street, London, W.1.

TRUST ELECTRICAL ACCESSORIES MANUFACTURING CO., LTD.—Private. Cap., £500 in £1 shares. Manufacturers, importers and exporters of and dealers in electrical goods and accessories. Reg. office: 169, City Road, London, E.C.

TRAGGOH LAMP CO., LTD. Private. Cap., £1 000 in £1 shares. Manufacturers of and dealers in all kinds of dynamos, electrical motors, batteries, generators of electricity and electric lighting and starting sets and apparatus for motor cars, etc. Reg. office: 14, Butts Court, Leeds.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"The Decoration of Furniture"; "The History of Woodwork in England"; "Retail Advertising."

THE CHEMICAL AGE.—"Chemical Conditions in Factories and Workshops"; "Chemical Preservatives in Food."

THE EUROPEAN COMMERCIAL.—"Special Film Industry Section"; "The Treatment of Foreign Creditors' Claims in Rumania"; "Improvement in Russian Trade Returns."

THE FRUIT GROWER.—"The Thinning of Commercial Apples"; "Scilly Isles' Bulb Industry"; "International Co-operation in Pest Control."

THE GAS WORLD.—"Meeting the Gas Consumers' Needs"; "Co-operation between Gas Companies"; "Tar Distillation."

THE HARDWARE TRADE JOURNAL.—"Stirring-up Trade—Some Suggestions for Retail Hardwaremen"; "Standards for Electro-Plate"; "Alternative Methods of Machining."

Forty Years Ago.

"The Electrician," August 11th, 1883.

YORK.—The Council of the Yorkshire Fine Art and Industrial Institution, at a meeting held on the 1st inst., passed the following resolution in connection with the exhibition held recently:—"Resolved that the council expresses its satisfaction at the very effective manner in which Messrs. Crompton and Co. lighted the great hall and grounds with their electric light during the week commencing July 16th, on which occasion a grand soirée was held, and honoured by the presence of H.R.H. the Prince of Wales."

* * *

ARMY AND NAVY HOTEL, WESTMINSTER.—This installation has just been completed by Messrs. Holmes and Vaudrey on account of the Liverpool Electric Supply Co., and was worked successfully throughout for the first time on Tuesday. It consists of 180 Swan high-resistance lamps distributed through the reception rooms and hall, the large coffee room being brilliantly lit by 72 lamps suspended in the interior of four large crystal glass chandeliers. The whole of the circuits are controlled from a switchboard in the hotel office. The dynamo and engine are placed in the basement within the building, a ten horse-power horizontal steam engine being used to drive a Schukhert-Brush dynamo. The current is stored in 55 Faure-Sellon-Volckmar storage batteries, enabling the engine to be run during the whole of the day. Messrs. Woodhouse and Rawson are sub-contractors for the wiring.

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Reference Index to Recent Wireless Publications.

R.000. RADIO COMMUNICATION (GENERAL)

J. B. Taylor. Communication by High Frequency Waves (*General Electric Review*, 26, pp. 61–64, January, 1923). R.000.

B. E. Jones. A solution of the Licence problem (*Amateur Wireless*, 2, pp. 485–486, April 14th, 1923). R.007.

H. P. Maxim. The Hearings on the White Bill (*Q.S.T.*, 6, pp. 23–27, February, 1923). R.007.

Important Litigation (*Q.S.T.*, 6, pp. 38–39, February, 1923). R.007.

The New Radio Regulations (*Wireless Age*, 10, pp. 40–43, May, 1923). R.007.

The Second National Radio Conference (*Q.S.T.*, 6, pp. 12–15, May, 1923). R.007.

P. Rague. La Semaine des Postes, Télégraphes et Téléphones—Report of the Congress at Paris (*Génie Civil*, 82, p. 471, May 19th, 1923). R.007.

Wireless Telegraphy and the Treaty of Versailles (*Wireless Weekly*, 1, p. 364, May 16th, 1923). R.007.

Controversy on the Meissner Patents (*Radioélectricité*, 4, pp. 163–164, May, 1923). R.008.

G. W. O. Howe. The Marconi-Mullard Valve Patent Litigation (*Electrician*, 90, pp. 500–501, May 11th, 1923). R.008.

The Mullard Valve—The Result of the Marconi-Mullard Appeal (*Amateur Wireless*, 2, p. 454, April 7th, 1923). R.008.

The Interdependence of Science and Engineering (*Electrician*, 10, p. 506, May 11th, 1923). R.010.

N. W. McLachlan. Some Pioneer Wireless Research (*Wireless Review*, 1, pp. 26–28, June 2nd, 1923). R.010/354/385.

Radio Inventions Still Wanted—Some of the things on which Amateurs and Experts should concentrate to-day (*Wireless Review*, 1, pp. 239–241, July 21st, 1923). R.010.

A. N. Goldsmith. Why Kilocycle (*Q.S.T.*, 6, pp. 32–33, June, 1923). R.030.

W. O. Ballard, Jr. Elements of Radio-Telephony (*Electrician*, 91, p. 8, July 6th, 1923).
Book review. R.050.

O. Gutton. The three-electrode valve (*La Nature*, 21, supplement, p. 88, March 17th, 1923).
Book review. R.050.

G. Malgorn. Radiotelegraphy and Radiotelephony within reach of all (*Radioélectricité*, 4, p. 190, June 1st, 1923).
Book review. R.050.

J. Remaur. Elementary treatise on radio telegraphy and telephony, and the construction of receiving stations (*La Nature*, 51, supplement, p. 116, April 7th, 1923).
Book review. R.050.

J. Roussel. How to receive wireless telephony (*La Nature*, 21, supplement, p. 168, May 26th, 1923).
Book review. R.050.

Portable Wireless Publicity (*Electrician*, 90, p. 630, June 8th, 1923). R.051.

The Deivey Decimal Classification of Radio Subjects (*Bureau of Standards Circular*, No. 138). R.055.

E. Coursey. A Woman's Radio Club (*Wireless World and Radio Review*, 12, p. 324, June 9th, 1923). R.060.

R.100. RADIO PRINCIPLES AND THEORY

O. Lodge. The Ether of Space, and the General Structure of the Universe (*Wireless Review*, 1, pp. 7–8, June 2nd; pp. 45–47, June 9th, 1923). R.100.

J. A. Fleming. Electrons, Electric Waves and Wireless Telephony (*Radio News*, 51, pp. 16–19, July, 1923; pp. 146–149, August, 1923). R.100.

P. J. Risdon. Relativity and Wireless (*Wireless Review*, 1, pp. 15–17, June 2nd; pp. 49–52, June 9th, 1923). R.100.

J. J. Thomson. The Discovery of the Electron (*Wireless Review*, 1, pp. 167–169, July 7th, 1923). R.100.

L. Bouthillon. Electromagnetic waves (*Radioélectricité*, 4, pp. 221–224, July 1st, 1923). R.110.

M. Latour. Long Waves and Short Waves (*Radioélectricité*, 4, pp. 194–196, June 15th, 1923). R.110.

K. F. Lindman. On interference of electromagnetic waves produced in a three dimensional resonator system (*Jahrbuch der drahtlosen Telegraphie*, 19, pp. 220–222, March, 1922). R.111.

G. H. Daly. The Problem of "Blind Spots" (*Wireless Review*, 1, pp. 208–209, July 14th, 1923). R.112.

G. W. O. Howe. The radiation of wireless waves (*Electrician*, 90, p. 511, May 11th; pp. 614–615, June 8th, 1923). R.112.

E. P. Peck. Relative fields of Space Radio and Carrier Current (*Electrical World*, 81, pp. 1 092–1 093, May 12th, 1923). R.112/116.

F. von Vogel. Wireless transmission of energy (*Jahrbuch der drahtlosen Telegraphie*, 19, pp. 197–205, March, 1923). R.112.

W. R. Burne and J. A. Cash. Fading—A new Aspect (*Wireless World and Radio Review*, 12, pp. 510–513, July 21st, 1923). R.113.

H. de A. Donisthorpe. The Ionised Strata (*Wireless Age*, 10, p. 61, June, 1923). R.113.

H. Eberhard. Reception minima at large radio stations (*Jahrbuch der drahtlosen Telegraphie*, 19, pp. 205–209, March, 1922; *Telefunken Zeitung*, 5, p. 113, January, 1922). R.113.

P. P. Eckersley. Fading (*Wireless World and Radio Review*, 12, pp. 298–299, June 9th, 1923). R.113.

T. Heiligtag. On the causes of errors in radio direction finders (*Jahrbuch der drahtlosen Telegraphie*, 21, pp. 77–100, February, 1923). R.113.

R.200. RADIO MEASUREMENTS AND STANDARDISATION.

R. Bown. Radio Transmission Measurements (*Electrician*, 80, pp. 645–648, June 15th, 1923). R.201.

E. H. Chapman. The Measurement of Wireless Quantities (*Modern Wireless*, 1, pp. 450–453, July, 1923). R.201.

W. Glitsch. The Measurement of Small Capacities (*Physikalische Zeitschrift*, 23, pp. 544–548, December 15th, 1922). R.220.

R. Ettenreich. Experimental comparison of different types of windings (*Jahrbuch der drahtlosen Telegraphie*, 19, pp. 308–310, April, 1922). R.225/230.

M. D. Hart. A Bridge Method for determining Dielectric Losses at Wireless Frequencies (*Journal of the Institution of Electrical Engineers*, 61, pp. 697–700, June, 1923). R.240.

C. N. Hickman. Alternating Current Resistance and Inductance of Single-layer Coils (*Bureau of Standards*, Scientific Paper No. 472). R.225/230.

B. Phelps. Antenna Resistance Measurement (*Q.S.T.*, 6, pp. 37–38, January, 1923). R.241.

A. Leontiewa. Discharge Potentials with High-frequency Oscillations (*Jahrbuch der drahtlosen Telegraphie*, 19, pp. 222–223, March, 1922). R.262.

L. W. Austin. Receiving Measurements and Atmospheric Disturbances at the United States Naval Radio Research Laboratory, Bureau of Standards, Washington, January and February, 1923 (*Proceedings of the Institute of Radio Engineers*, 11, pp. 187–191, June, 1923).
Measurements in Lafayette and Nauen signals. R.270.

M. Baumler. Parallel-Resistance Method of Measuring Signal Strength (*Jahrbuch der drahtlosen Telegraphie*, 20, pp. 268–277, October, 1922). R.271.

A. D. Cowper. The Measurement of Signal Strength (*Modern Wireless*, 1, pp. 330–332, June, 1923). R.271.

S. Kruse. The Reinartz Modulascope (*Q.S.T.*, 6, pp. 7–9, June, 1923). R.275.

G. J. Meyer. Simplified Voltage Test for Insulating Materials (*Elektrotechnische Zeitschrift*, 44, pp. 10–11, January 4th, 1923). R.281.

J. Mould. Variation of Dielectric Constant with Frequency and Energy Loss in Standard Dielectrics (*Beama Journal*, 12, pp. 337–344, June, 1923). R.281.

N. W. McLachlan. Uses of Iron in Radio Telegraphy (*Wireless Review*, 1, p. 80, June 16th, 1923). R283.

R.300. APPARATUS AND EQUIPMENT.

M. Wolf. Coil Data for Accurate Design of Wavemeter and Receiver Inductances (*Wireless Age*, 10, pp. 63–64, May, 1923). R.300/382.

The French Radio Industry at the Salon de l'Aeronautique (*Radioélectricité*, 4, pp. 18–20, January, 1923). R.300.

The Royal Society's Conversazione (*Wireless Review*, 1, p. 187, July 7th, 1923). R.306/300/582.

P. R. Coursey. The Calibration of a Variable Condenser (*Wireless World and Radio Review*, 12, pp. 201–203, May 19th; pp. 272–274, June 2nd; pp. 346–348, June 16th; pp. 410–411, June 30th, 1923). R.307/220.

W. H. Eccles. Studies from a Wireless Laboratory (*Nature*, 112, p. 11–14, July 7th, 1923; *Electrician*, 90, pp. 502–504, May 11th, 1923). R.307.

The National Physical Laboratory—Wireless Telegraph Progress—Measuring Dielectric Losses (*Electrician*, 91, p. 12, July 6th, 1923). R.308/201/240.

C. F. Elwell. Wireless Towers and Masts (*Modern Wireless*, 1, pp. 299–302, June, 1923). R.320.

P. W. Harris. Some Experiments with Aerials and Earths (*Modern Wireless*, 1, pp. 437–439, July, 1923). R.320/326.

R. Hirsch. The Construction of the Antennae for High-power Stations (*Telefunken Zeitung*, 28, July, 1922; *Jahrbuch der drahtlosen Telegraphie*, 21, pp. 134–137, February, 1923). R.321/326.

P. W. Harris. Outdoor Experiments with Radio (*Wireless Weekly*, 2, pp. 4–6, July 18th, 1923). R.323.

S. R. Winters. Burying the Antenna in a Well (*Wireless Age*, 10, p. 69, July, 1923). R.323/324.

Four Loops and a Nation-wide Radio Service (*Wireless Age*, 10, pp. 57–58, July, 1923). R.324/530.

J. Snyder. Directive Telegraphy (*Wireless Age*, 10, pp. 63–65, July, 1923). R.325.

L. C. Young Multiple-Tuned Antennas (*Q.S.T.*, 6, pp. 15–17, May, 1923). R.328.

The Doule Tube (*Scientific American*, 128, p. 427, June, 1923). R.330.

Electron Tube Detector Unit for Radio Reception (*Scientific American*, 128, p. 389, June, 1923). R.330.

English 10-Kilowatt Valves (*Génie Civil*, 82, p. 144; February 10th, 1923). R.330.

New Development in Tubes (*Radio News*, 5, p. 31, July, 1923). R.330.

The 1 000-Kilowatt Magnetron, made by the General Electric Co. (*Génie Civil*, 82, pp. 379–380, April 21st, 1923). R.330.

Concerning Waves. Of especial interest to those beginning to use valves (*Wireless Weekly*, 1, p. 538, June 6th, 1923). R.330.

The Cossor Valve (*Wireless World and Radio Review*, 2, p. 579, July 21st, 1923). R.330.

R.400. RADIO COMMUNICATION SYSTEMS.

F. W. Dunmore. Bureau of Standards explores short-wave region (*Q.S.T.*, 6, pp. 75–77, July, 1923). R.402/324.

F. W. Dunmore and F. H. Engel. Short Wave Directive Radio Transmission (*Radio News*, 5, pp. 128–130, August, 1923). R.402.

Experiments with very short wavelengths (*La Nature*, 51, supplement, p. 109, April 7th, 1923). R.402.

G. Marconi. Signals along Invisible Beams (*Wireless Review*, 1, pp. 3–5, June 2nd, 1923). R.402.

Wireless Telegraphy (*Jahrbuch der drahtlosen Telegraphie*, 21, pp. 58–76, February, 1923). R.402.

Receiving short wavelength signals on a frame aerial with the help of a double heterodyne (*Radioélectricité*, 4, pp. 13–14, January; pp. 138–140, April, 1923). R.402/760.

J. Roussel. Practical reception of short wave Radio-telegraphy and Telephony (*La Nature*, 21, pp. 129–132, March 3rd, 1923). R.402.

Short Radio Waves (*Radio News*, 5, p. 127, August, 1923). R.402.

H. D. Arnold and L. Espenschied. Transatlantic Radio Telephony (*Electrical World*, 82, p. 21, July 7th, 1923). R.412.

J. A. Fleming. Problems in Telephony, Solved and Unsolved (*Electrician*, 90, pp. 642–643, June 15th, 1923; *Wireless Review*, 1, pp. 103–106, June 23rd, 1923). R.412/094.

Regular Transatlantic Radiotelephone trials (*La Nature*, 51, supplement, p. 117, April 14th, 1923). R.412.

E. W. Marchant. Methods of reducing interference in wireless receiving sets (*Wireless World and Radio Review*, 12, pp. 426–431, June 30th; pp. 463–465, July 7th; pp. 496–498, July 14th, 1923). R.430.

R.500. APPLICATIONS OF RADIO.

J. K. Bolles. Artic Explorer to Communicate with Amateurs (*Q.S.T.*, 6, pp. 9–10, June, 1923). R.500/545.

Navigation by Wireless (*Amateur Wireless*, 2, p. 439, April 7th, 1923). R.510/402.

M. Egan. The Development of Aircraft Wireless (*Broadcaster*, 2, pp. 48–50, July, 1923). R.520.

H. F. Towler. Another Wireless Aid to Aviation (*Wireless Weekly*, 1, pp. 707–708, June 27th, 1923). R.521.

Radiotelegraphy on the coast of the Azores (*Radioélectricité*, 4, pp. 89–92, March, 1923). R.530.

Transatlantic Radio Methods—Gain in Accuracy (*Electrical World*, 82, p. 5, July 7th, 1923). R.530.

Wireless Telephone Copenhagen to Bornholm (*Electrician*, 90, p. 547, May 18th, 1923). R.530.

G. O. Squier. A Method of Transmitting the Telegraph Alphabet Applicable for Radio, Land Lines, and Submarine Cables (*Journal of the Franklin Institute*, 195, pp. 633–640, May, 1923). R.531.

New Alphabet for Radio and Land Lines (*Radio News*, 5, p. 11, July, 1923). R.531.

Table of Radio Transmission throughout the World (*Radioélectricité*, 4, pp. ix.–xi., July 1st, 1923). R.531.

A Motor Car de Luxe (*Wireless Weekly*, 1, p. 709, June 27th, 1923). R.533.

R.600. RADIO STATIONS (DESCRIPTIONS AND EQUIPMENT.)

B. R. Cummings. Radio Transmitting Sets for the Mexican National Radio System (*General Electric Review*, 26, pp. 172–277, March, 1923). R.610/509.

High-Power Radio Station at Herzogstand (*Electrical World*, 81, p. 1 425, June 16th, 1923). R.610.

Eilvese (*Telefunken Zeitung*, 5, pp. 26–32, January, 1923). R.611.

E. Reinhard. The high-power Argentine radio station, Monte Grande (*Telefunken Zeitung*, 5, pp. 16–22, January, 1923). R.611.

Telefunken at Bandoeng (*Telefunken Zeitung*, 5, pp. 22–23, January, 1923). R.611.

Telefunken Stations under Construction (*Telefunken Zeitung*, 5, pp. 40–46, January, 1923). R.611.

The London Wireless Broadcasting Station (*Beama Journal*, 12, p. 5, January, 1923). R.612/550.

The Telefunken Station at the Waalhaven Aerodrome (*Telefunken Zeitung*, 5, pp. 35–37, January, 1923). R.612.

The transmitting station at the Ecole Superieure des Postes, Telegraphes et Téléphones (Paris) (*La Nature*, 21, p. 65, supplement, March 3rd, 1923). R.612/550.

Leviathan to have most modern radio installation (*Radio News*, 5, p. 107, August, 1923). R.613.

R.700. RADIO MANUFACTURING.

The manufacture of head-phones and variable condensers for radio-telephony, in the United States (*Génie Civil*, 82, pp. 191–192, February 24th, 1923). R.700.

Radio Manufacturers and the Public (*Electrician*, 90, p. 521, May 11th, 1923). R.700/550.

Selling Wireless Service (*Electrical Industries*, 23, p. 980, July 4th, 1923). R.700.

The Wireless Retailers' Association (*Electrical Industries*, 23, p. 970, July 4th, 1923). R.700.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

CANNON, W. J., AND CO., 26, King Street, Margate, electrical engineers. £37 0s. 8d. June 26th.
EMMETT AND CO., 249, Goldhawk Road, Shepherd's Bush, electrical engineers. £20 11s. 1d. June 23rd.
HARRISON, —, (a firm), 88–9, Princes Street, Southend, electrical engineers. £17 3s. 6d. June 4th.
PORTER TURK AND SON, LTD., Bartholomew Works, Newbury, electricians. £17 3s. 6d. June 25th.
SOUTH-WESTERN ELECTRIC CO., 9, Merton Park Parade, S.W., electrical engineers. £25 15s. 6d. June 15th.
STAR-DELTA ELECTRICAL AND WIRELESS SUPPLIES, 333A, Oxford Road, Manchester, electrical engineers. £10 16s. June 28th.
WALKER, William, 82, Newington Green Road, electrical engineer. £22 6s. 10d. June 14th.
WESTERN MANUFACTURING CO., 104, Euston Road, N.W., electrical engineers. £14 12s. 9d. June 18th.
WRIGHT, ROBERT, AND CO., 34–6, Oxford Street, W., electricians. £18 6s. 10d., May 29th; £21 5s. 2d., June 20th; and £44 14s. 10d., June 22nd.

Receiverships.

RADIO APPLIANCES, LTD. E. J. Bell, of 17, Queen Victoria Street, E.C., was appointed receiver and manager on July 20th, under powers contained in debentures dated April 9th, 1923.
WILLESDEN ELECTRIC, LTD. W. R. Clemens, of Alderman's House, Alderman's Walk, Bishopsgate, E.C., was appointed receiver and manager on July 23rd, 1923, under powers contained in debentures dated November 16th, 1922.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

COATES AND CO. (SHEFFIELD), LTD., electrical engineers. Registered July 5th. £10 000 debentures (filed under section 93 (3) of the Companies (Consolidation) Act, 1908), present issue £2 450; general charge (subject to £6 500 first debentures). *Nil. June 6th, 1922.
HULL ROAD MOTOR AND ELECTRICAL ENGINEERING CO., LTD., Hessle. Registered July 27th, £3 500 debenture, to Branch Nominees, Ltd., 15, Bishopsgate, E.C.; general charge.
MACARTNEY, McELROY AND CO., LTD., London, E.C., electrical engineers. Registered July 24th, £15 000 debentures (filed under section 93 (3) of the Companies (Consolidation) Act 1908), present issue £10 000; general charge. *Nil. June 5th, 1922.

Satisfactions.

EDMUNDSONS' ELECTRICITY CORPORATION, LTD., London, S.W. Satisfaction registered July 27th, £18 000, registered May 8th, 1914.
HULL ROAD MOTOR AND ELECTRICAL ENGINEERING CO., LTD., Hessle. Satisfaction registered July 27th, £1 500, registered January 15th, 1923.
SCARBOROUGH ELECTRIC SUPPLY CO., LTD. Satisfaction registered July 25th, all moneys, etc., registered May 10th, 1921.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

CHESTERTON, Harold Ewart, electrical engineer, 13, Perry Road, St. Michaels, Bristol. Creditors were called together recently, when a statement of affairs was submitted which showed ranking liabilities of £1 476, all due to unsecured creditors, and fully-secured creditors £470, leaving net assets £201, or a deficiency of £1 275. The assets consisted of: stock-in-trade, £166, expected to produce £111; book debts, £150, estimated to realise £96; furniture, £20; and fixtures, etc., £1 5s. It was stated that up to March, 1922, the debtor had acted as the district manager for a well-known firm. In October, 1920, he purchased the present premises for £650, paying £150 down and leaving the balance on mortgage. The turnover for the seven months ended July last was about £600 with a gross profit of £100. The expenses had been heavy for the turnover, and the trading had resulted in a loss during the period of £372. A resolution was passed confirming the deed already executed to Mr. J. D. Taylor, C.A., Baldwin Street, Bristol, while a committee of three of the principal creditors was appointed. The following are creditors:—Metropolitan-Vickers, Ltd., Manchester, £60; Western Electric Co., Ltd., Woolwich, £181; Underwood (Manchester), Ltd., Manchester, £71; Blanchard Lamps, Ltd., London, £638; Compression Starter, Co., Ltd., Stockport, £20; Guiterman and Co., Ltd., London, £43; Calphos Electric Co., London, £40.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Winding-up Petition.

MITCHELL'S ELECTRICAL AND WIRELESS, LTD. A petition for winding-up has been presented by J. Stone and Co., Ltd., and is to be heard at the Royal Courts of Justice, Strand, London, W.C.2, on October 16th.

Company Winding-Up Voluntarily.

TAUNTON ELECTRIC TRACTION CO., LTD. T. Bower and P. M. Rossdale, appointed liquidators. Meeting of creditors, 88, Kingsway, London, W.C.2, on Friday, August 10th, 1923, at 11 a.m.

Bankruptcy Information.

WHITEHOUSE, John Henry, 61, Martin Street, Morriston, in the county borough of Swansea, electrical engineer. First meeting, August 16th, 11 a.m., Official Receiver's Office, Government Buildings, St. Mary's Street, Swansea. Public examination, August 10th, 11 a.m., Town Hall, Swansea.

Notices of Dividends.

COX, Charles John (trading as C. J. COX AND CO.), electrical and automobile engineers, at Pontefract Road, Castleford, in the county of York. First and final dividend of 3s. per £, payable August 20th, 9, Central Bank Chambers, Leeds.
PILBROW, Frederick Arthur, 7B, Stoke Road, Gosport, Hants, electrical engineer, trading as H. AND J. WEST. First and final dividend of 2s. 5½d. per £, payable August 7th, Official Receiver's Office, 87, High Street, Portsmouth.
ROTHWELL, Peter, 64, Higher Bridge Street, Bolton, trading (with Peter Ashworth Rothwell, a minor), as P. A. ROTHWELL AND CO., electrical engineer. Dividend of 1s. per £ (second and final instalment of composition), payable, August 8th, Official Receiver's offices, Byrom Street, Manchester.

Prices of Metals, Chemicals, etc.

TUESDAY, August 7.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£67 10 0	—	£1 0 0
Electro Wirebars	„	£72 0 0	—	15s.
H.C. Wire, basis	per lb.	10 5/8d.	—	½d.
Sheet	„	10½d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2 3/8d.	—	½d.
Brass 60/40—				
Rod, basis	„	7½d.	—	—
Sheet, basis	„	10d.	—	—
Wire, basis	„	10½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 14 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
Lead Pig—				
English	„	£25 5 0	—	10s.
Foreign or Colonial	„	£24 0 0	—	7s. 6d.
Tin—				
Ingot	„	£181 10 0	—	£3 12 6
Wire, basis	per lb.	2s. 5d.	—	½d.
Aluminium Ingots	per ton	£120 0 0	—	—
Spelter	„	£31 5 0	—	£0 6 3
Mercury	per bottle	£10 0 0	—	—

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2½d.
„ (Roll-Brimstone)—„ £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. „ £26 per ton, £7 10s.
Boric Acid (Crystals). „ £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 3d.; plantation 1st latex, 1s. 3d. to 1s. 3½d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

198 522 J. ROBINSON, H. L. CROWTHER and W. H. DERRIMAN. Wireless apparatus (24/4/22.)
198 538 W. A. FORSTER. Locking-devices for incandescent lamps. (5/5/22.)
180 670 AUTOMATIC TELEPHONE MFG. CO. Telephone systems. (25/5/21.)
198 551 E. E. MOORE. Relay for use in telegraphy. (24/5/22.)
198 572 FULLERS UNITED ELECTRIC WORKS, LTD., and L. FULLER. Galvanic batteries. (21/6/22.)
198 575 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Filaments for incandescent lamps. (23/6/22.)
182 489 F. H. WEURMAN. Leading-in tubes for electric installations. (4/7/21.)
198 589 A. W. KNIGHT. Inductance coil mounting for wireless telegraphy, etc. (14/7/22.)
198 608 L. PEXTON and G. L. WHITE. Portable electric lamp. (20/9/22.)
198 609 METROPOLITAN-VICKERS ELECTRICAL CO. (WESTINGHOUSE ELECTRIC AND MFG. CO.). Electric ovens. (20/9/22.)
188 320 E. L. GRUNENWALD. Direct and synchronous electromagnetic control for telegraphic apparatus. (3/11/21.)
198 614 S. S. WHEELER. Starting-switches for a.c. motors. (25/10/22.)
192 053 BROWN, BOVERI ET CIE AKT.-GES. Mercury-vapour rectifiers. (19/1/22.)
194 681 E. HAEFELY ET CIE AKT.-GES. Insulating-tubes. (9/3/22.)
198 632 H. BARON (ALDENDORFF, F.). Automatic telephone exchange system. (28/2/22.) (Divided Application on 195 439. Addition to 188 689.)
198 714 E. VEDOVELLI. Transformers. (9/12/21.)
172 957 R. BOSCH AKT.-GES. Magneto-electric ignition apparatus. (13/12/20.)
198 722 E. VIZ and M. MEINHARDT. Production of thermo-induction currents. (10/1/22.)
198 726 LANCASHIRE DYNAMO AND MOTOR CO. and R. S. MCLEOD. Electric motors. (4/2/22.) (Addition to 175 355.)
198 739 H. C. BRAUN. Electric cables or conductors. (1/3/22.) (Cognate Application, 14 622/22.)
198 740 T. R. STANCOMBE. Combined electric cooker and water-heater apparatus. (2/3/22.)
198 742 G. V. TWISS. Means for supporting and insulating conductors of overhead lines of comparatively low voltage. (2/3/22.)
198 755 J. F. BROOM. Electric burglar-alarm systems. (6/3/22.)
198 757 MARCONI'S WIRELESS TELEGRAPH CO., E. W. B. GILL, and J. H. MORRELL. Generation of high-frequency electric oscillations. (6/3/22.)
198 765 J. T. MACGREGOR-MORRIS and F. R. F. RAMSAY. Means for obtaining polar diagram of alternating current. (7/3/22.)
198 769 METROPOLITAN ELECTRIC TRAMWAYS, LTD. and L. B. HEWITT. Electric vehicles. (8/3/22.)
198 772 R. AMBERTON. Electricity meters. (8/3/22.) (Cognate Application, 11 363/22.)
198 776 RELAY AUTOMATIC TELEPHONE CO. and E. J. C. ROUSSEAU. Automatic telephone systems. (8/3/22.)
176 796 T. H. NAKKEN. Discharge tubes for use in converting sound waves into light variations. (9/3/21.)
198 788 A. REYROLLE & Co. and R. W. BILES. Protective arrangements for circuits. (10/3/22.)
198 799 BARON CLIFFORD OF CHUDLEIGH (W. H. CLIFFORD). Appliances for increasing audibility of telephones, gramophones, etc. (13/3/22.)
198 800 L. W. WILD and E. P. BARFIELD. Electric furnaces. (13/3/22.)
180 982 SOC. ANON. LE CARBONE. Electric cells. (3/6/21.)
190 101 SOC. ANON. LE CARBONE. Wet electric cells. (9/12/21.)
198 811 W. H. GWYNN. Glass electrodes for high-frequency circuits.
198 847 M. J. RAILING, T. TAYLOR and F. J. HOLTON. Electric switches. (30/3/22.)
182 767 SOC. D'ETUDES POUR LIAISONS TELEPHONIQUES ET TELEGRAPHIQUES A LONGUE DISTANCE. Long-distance telephone installations. (8/7/21.)
198 868 J. T. THOMPSON. Overhead constructions for carrying conductors. (22/4/22.)
198 872 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.) Electric heating-units. (25/4/22.)
180 332 BRITISH THOMSON-HOUSTON CO. Radio-receiving systems. (18/5/21.)
198 893 G. ELLISON and J. ANDERSON. Oil-insulated switchgear, etc. (19/5/22.)
198 898 L. W. WILD and E. P. BARFIELD. Electric furnaces. (22/5/22.)
198 911 PITTSBURGH TRANSFORMER CO. and S. HORELICK. Polyphase transformers. (14/6/22.)
198 913 S. T. HOSKEN. Electrically-operated illuminated signs for advertising, etc. (16/6/22.) (Cognate Application, 28 571/22.)
181 726 LANDIS AND GYR AKT.-GES. Recording-meters, particularly applicable to electricity meters. (20/6/21.)
198 923 WARD LEONARD ELECTRIC CO. and F. H. BULLINGER. Regulating-apparatus for dynamos. (7/7/22.)
198 927 F. H. EELES and H. M. EDWARDS. Thermal switch adapter or coupling-unit for incandescent lamps. (11/7/22.)
198 932 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electric heating-units. (24/7/22.)
198 933 J. P. SCOTT. Electrodes. (25/7/22.)
198 936 M. BUCHHOLZ. Safety devices for electrical apparatus. (5/8/22.)
198 950 PHILIPS' GLOEILAMPENFABRIEKEN and DR. G. HOLST. Electric rectifiers. (11/9/22.)
198 963 GENERAL ELECTRIC CO., LTD. (HALL SWITCH AND SIGNAL CO.). Sockets for incandescent lamps. (31/10/22.)
198 978 E. S. HEURTLEY. Submarine telegraphy. (1/9/22.) (Divided Application on 32 159/21.)
174 082 E. GRANAT. Synchronous electric distant control apparatus. (14/1/21.)
175 275 PHILIPS' GLOEILAMPENFABRIEKEN. Gas-filled electric discharge tubes with independent discharge. (9/2/21.)
199 068 A. E. MCCOLL, C. C. GARRARD, W. WILSON and A. H. RAILING. Protective systems for a.c. circuits. (13/2/22.)
175 769 O. KURZ. Means for supporting overhead conductors. (7/3/21.)
191 358 O. and A. NEUMANN. Accumulators. (5/1/22.)
199 074 ENGLISH ELECTRIC CO. and C. F. BARNHOLDT. Control of electrically-propelled vehicles. (17/2/22.)
199 076 H. D. PYNE. Telephone instrument apparatus and attachments. (6/3/22.)
199 080 R. M. BEARD. Electric lamp fittings. (9/3/22.)
199 088 C. W. KAY. Current-collecting apparatus. (9/1/23.)
199 101 WESTERN ELECTRIC CO. Printing-telegraph receiver. (13/3/22.)
199 106 A. NEGROMANTI. Electrically-heated fabrics. (13/3/22.) (Addition to 173 205.)
199 109 S. J. WATSON and A. O. HINCHLIFF. Commutator bars. (13/3/22.)
199 110 R. LENNER, P PARVOPASSU and G. GALLO. Infusible electrothermic safety devices. (13/3/22.)
199 115 PLANTATION RUBBER MANUFACTURING CO. and M. M. DESSAU. Devices for attachment to the mouthpieces of telephone transmitters and other sound-transmitting instruments. (14/3/22.)
199 118 METROPOLITAN-VICKERS ELECTRICAL CO., A. P. M. FLEMING and R. S. and W. WHITELEY. Electrical insulating-cylinders. (14/3/22.)
177 161 J. M. MILLER. Thermionic valve amplifiers. (15/3/21.)
199 122 E. C. R. MARKS (W. H. BENNETT). Telephone mouthpiece disinfectant. (14/3/22.)
199 135 D. C. CROWE. Electromagnetic relay. (16/3/22.)
199 142 BRITISH POWER RAILWAY SIGNAL CO. and J. ASHTON. Switch point detecting and like apparatus. (16/3/22.)
177 170 A. BADERNA. Cut-outs. (17/3/21.)
199 150 R. DELL. Controlling railway signals of electric light type, whereby the "danger" indication is extinguished when the "clear" indication is illuminated without breaking the circuit to the lamp giving the "danger" indication. (18/3/22.)
199 165 C. L. PRATT and L. J. HOOPER. Electric switches. (23/3/22.)
178 462 BUREAU D'ORGANISATION ECONOMIQUE. Cooling of electrical apparatus. (13/4/21.)
199 192 BRITISH THOMSON-HOUSTON CO. and E. F. W. ALEXANDERSON. Radio transmitting systems. (13/4/22.) (Addition to 178 992.)
199 201 ENGLISH ELECTRIC CO. and W. E. M. AYRES. Protective devices for electrical machines. (20/4/22.)
199 212 CALLENDER'S CABLE AND CONSTRUCTION CO. and E. WARBRICK. Electric hand-laundry irons. (5/5/22.)
199 214 J. W. COX. Electrical energy supply systems. (6/5/22.)
180 317 AUTOMATIC TELEPHONE MFG. CO. Telephone systems. (18/5/21.)
199 233 H. P. REES. Wireless wave-length indicators. (23/5/22.)
199 238 A. C. HUSKINSON. Electric condensers of continuously variable capacity. (24/5/22.)

APPLICATIONS FOR PATENTS.

July 23rd.

18 836 A. W. SHARMAN. Apparatus for reception of radiotelegraphic signals.
18 841 A. CAMPBELL. Apparatus for measurement of frequency of alternating electric currents.
18 848 J. H. GREEN and P. A. JAMES. Device for controlling electric circuits.
18 850 A. MARR. Flexible tubes for telephones, etc.
18 855 C. W. CLARABUT. Adjusting device for wireless telephonic, etc., apparatus.
18 875 W. T. GLOVER AND CO. and C. J. BEAVER. Joint box for electric cables.
18 877 C. W. PRANCE. Carrier for telephone instruments.
18 883 WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO., INC.). Electric insulating materials.
18 884. WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO., INC.). Coated cores.
18 885 F. H. NORRIS. Electric motors.
18 887 W. D. HOUSE. Radio telephony.
18 903 E. P. BARFIELD, J. P. D. COLEMAN and L. W. WILD. Electric heating elements.
18 906 and 18 907 METROPOLITAN-VICKERS ELECTRICAL CO. and K. BAUMANN. Mounting guide blades for elastic-fluid turbines.
18 908 G. W. P. HIGGINBOTHAM. Electric switches.
18 909 E. W. MCKINLEY and M. A. SHEA. Electric switch.
18 913 M. RICHARDSON. Wireless telephonic receiving apparatus.
18 937 A. W. SHARMAN. Amplifiers for radiotelegraphy, etc.

July 24th.

18 942 W. H. MASSY. Switch gear.
18 965 BROOKHIRST SWITCHGEAR, LTD., and J. A. HIRST. Switchgear for electric motors.
18 972 E. J. BATY. Manufacture of variable condensers.
18 987 WRIGHT AND WEAIRE, LTD., A. ROTHSCHILD and J. G. WRIGHT. Insulating stand for electric coils.
18 990 A. MARX. Electro-centrifugal separator. (3/8/22, France.)
18 991 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.).—Automatic reclosing circuit-breaker systems.
18 992 BRITISH THOMSON-HOUSTON CO. (CIE FRANCAISE THOMSON-HOUSTON). Oil immersed electrical apparatus.
19 001 AKT.-GES. BROWN, BOVERI ET CIE. Apparatus for limiting short circuit current of d.c. dynamos. (25/7/22, Sweden.)
19 002 E. Y. ROBINSON. Vacuum electric tube devices.
19 008 IGRANIC ELECTRIC CO. and CUTLER-HAMMER MFG. CO. Resistance control apparatus.
19 019 SOC. FRANCAISE RADIO-ELECTRIQUE. Printing telegraphs. (29/3/21, France.)
19 029 HOLMES AND JAMES, LTD., and H. E. SUTHERLAND. Electric fuse boards, etc.
19 030 HOLMES AND JAMES, LTD., and H. E. SUTHERLAND. Hinges, etc., for electric fuse casings, etc.

July 25th.

19 052 J. L. BAIRD. System of transmitting views, etc., by telegraphy.
19 101 SACHSENWERK LICHT U. KRAFT AKT.-GES. Electric asynchronous machines.
19 117 H. J. ROUND. Means for supporting diaphragm of telephone transmitter, etc.
19 118 J. BETHENOD. Centrifugal regulators for electric motors, etc. (25/7/22, France.)

July 26th.

19 129 S. B. BIGNOLD. Wireless telegraph, etc., receiver.
19 144 A. G. BROWN. Apparatus for manufacture of electric cables.
19 148 A. ALLEN. Ear caps of telephones.
19 153 L. H. PADDLE. Regenerative circuits for wireless telegraph apparatus, etc.
19 158 G. W. MCKINLEY and M. A. SHEA. Electric sign.
19 171 WESTERN ELECTRIC CO. Selective transmission of electric waves. (26/7/22, U.S.)
19 174 W. B. SAYERS. Apparatus for observation of magnetic induction, attraction and repulsion.
19 180 E. A. BRENNAN. Aerial lead-in fittings, lightning arresters and earthing devices for wireless telegraph apparatus.
19 191 WATSON AND SONS (ELECTRO-MEDICAL), LTD., and G. PEARCE. Energy supply plant for X-ray production.
19 217 SOC. ANON. DES ATELIERS DE SECHERON.—Junction plugs for multiple conductor electric cables. (12/8/22, Switzerland.)

July 27th.

19 236 J. R. HOULT. Electrical plug device.
19 248 J. LACEY. Trolley pole safety appliance for electric trams, etc.
19 272 ELECTRICAL IMPROVEMENTS, LTD., and J. R. BEARD. Electric distribution systems.
19 276 H. J. CLARKE and O. J. CLARKE. Dynamo electric machines.
19 284 R. DUMAS. Electric motors.
19 301 H. T. CULLIFORD and W. E. HUMPHRIES. Insulators for wireless aerials, etc.
19 302 W. E. HUMPHRIES. Erection of wireless aerials.
19 305 METROPOLITAN-VICKERS ELECTRICAL CO. Electric potential dividers.
19 316 FERRANTI, LTD., and A. H. HIGGS. Electric transformers.
19 332 D. E. BARNETT. Terminals for electric apparatus.

July 28th.

19 345 F. H. PHILPOTT. Variable resistance for electric current.
19 350 A. R. ANGUS. Electric current amplifying device.
19 357 and 19 358 F. AND A. PARKINSON, LTD., and W. A. BENGER. Induction motors.
19 370 WALSALL HARDWARE MFG. CO. Clamping device for electric cables.
19 382 H. BOHLE. Electrically heated water systems.
19 383 H. BOHLE. Electric heating and cooling systems.
19 387 and 19 388 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Electric switches.
19 397 F. PORSCHE. Dynamo electric driving sets for motor vehicles. (29/7/22, Austria.)
19 405 BRITISH ELECTRIC TRANSFORMER CO. and E. ELLWOOD. Electric kettles, etc.
19 411 J. N. HEWETT. Tubing for electric lighting, etc.

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282 **Makers of Electric Cable since the beginning of Electrical Transmission.**

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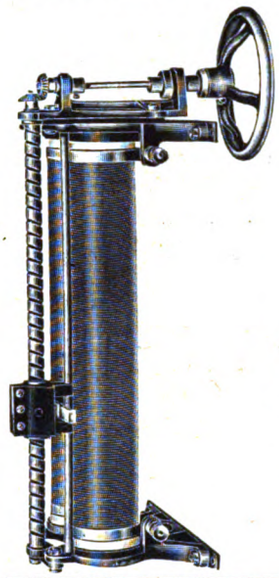

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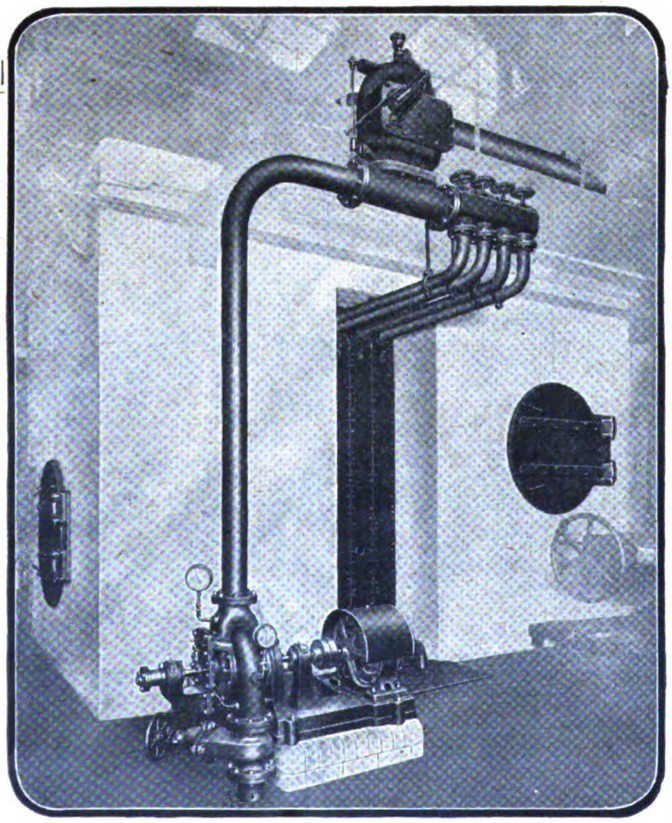

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Notes of the Week.

Dealing with the "Curbstoner."

MEMBERS of the Electrical Contractors' Association will be interested in the statement that recently appeared in "The Electrical World" that 60 per cent. of the wiring in America is done by "curbstoners," or those who are not really part of the electrical industry because they do not belong to any Association. The Contractors' Association knows better than we do the position of the "curbstoner" in this country and whether we are better or worse off than America in this respect. But whether it be in this country or in America he is a problem that has got to be tackled. If it is not, a large amount of harm will be done to the electrical industry. For these small contractors obtain in the aggregate a considerable quantity of jobbing, and by using shoddy material and bad workmanship not only are called in again and again with advantage to themselves, but end in getting the electrical industry and electricity supply a bad and undeserved name. This is a great pity, for all contractors, however small, could do much by education and propaganda to convince the public of the advantages of using electricity in the home. In the consideration and discussion of their new trading policy the Contractors' Association would do well to consider this matter and to enlist the assistance of station engineers to bring about improvements where improvements are sorely needed.

Manufacturer and User—Their Relationship.

WE recently heard a manufacturer of electrical apparatus make the remark that the success of his firm had largely depended on the acceptance of advice of the user in the construction of its products. This is the sort of remark that sounds well enough in an after-dinner speech, but the more it is examined the more its fallaciousness becomes clear. Some time ago we published an entertaining article by Dr. ROSENBERG, in which he ascribed the backwardness of the British electrical industry to the egotism, though he used a fearsome looking German word, of the consulting engineer. We should expect the same backwardness to be a characteristic of any firm which made a practice of accepting the advice of the user. Why this should be so is clear. The user is not one, but many, and as the old Latin tag says, *tot homines, quot sententiæ*, about electrical apparatus as about anything else. Modern electrical manufacture depends for its success on reproduction methods. The use of these would be impossible without some form of standardised production, and standardised production is a corollary to standardised design. This is not to say that the advice of the user is never of any value, but it can best be applied indirectly through such a body as the British Electrical Research Association, where conflicting opinions and ideas can be discussed and passed on in a diluted form to the manufacture. Strychnine in small doses is a tonic, in large doses a deadly poison. The moral is not hard to apply.

An Impossible Situation.

WE understand that the Association of Consulting Engineers and the Association of Municipal Electrical Engineers have been putting their heads together. On the one hand it has been suggested that when consulting work is available on a municipal electricity supply undertaking only members of the Association of Consulting Engineers should be recommended to undertake it. On the other hand it has been put forward that consulting engineers should refuse to meet Electricity Committees unless the borough electrical engineer is present. We believe that absolute agreement has not been reached on these two points, but they open up an interesting field for discussion. Moreover, they form an example of the unwisdom of trying to reform one injury without taking into account all factors in the case, and especially without taking human nature

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into account. Presuming that both suggestions are agreed to, more than one interesting but unlooked for situation may arise. Several more or less eminent consulting electrical engineers do not belong to the Association of Consulting Engineers. Are they to be boycotted? Neither the Committees nor the engineers concerned may wish for this. But the only other alternative seems the forced enlistment of the neglectful gentlemen into the Association. On the other hand, the consultant may have been called in because the engineer and his Committee have disagreed. Such situations do arise. Human nature being what it is, the Committee will hardly appoint the consultant whom their engineer recommends, and then where do the Association of Consulting Engineers come in? They stay outside. The situation is not without its poignancy. It is certainly not without its difficulties. Those concerned would do well to leave it alone, and trust to time to heal the wound they are attempting to cure.

The Personal Factor in Business.

SPEAKING in London, the other day, at the annual general meeting—the 27th, by the way—of Benn Brothers, Ltd., Sir ERNEST BENN, the chairman, gave expression to views which will, we think, be endorsed by business men generally. Business and politics, which, of course, have their peculiar relationships, may and do act and react on each other, but that does not lessen the truth that they are as distinct as light and darkness. "Our fortunes," declared Sir Ernest, "are in our own hands. Outside and political influences have far less power to damage commerce and industry than is generally supposed. We hold the belief that our own personal work is the only thing on which we can rely and if trade cannot be done in the Ruhr—well, we must find it somewhere else." The world to-day seems to be a little uncertain as to where it stands and as to its real needs, "but," said Sir Ernest, "our experience shows that there is no uncertainty as to the need for technical information and industrial and scientific research." These two forces are able to bear free British trade forward to conquests in new markets, while a sense of reliance on personal effort will strengthen our hands in the work of consolidating and expanding them. Along such a path is healthy progress and certainty, as opposed to the too often stultifying influence of politics and the thing called State-aid, but which is usually in reality nothing else than State interference.

Trade Union Policy.

THE "Times" is to be congratulated on starting a "silly season" topic which is not silly at all, but of the greatest importance to all connected with British industry—in other words, to the whole population of the country. In two articles which appeared last week Mr. P. J. PYBUS, managing director of the English Electric Co., considers trade union policy and the effect of that policy on our commercial development. Trade unions, it is generally admitted, have come to stay, and though their existence can be of great benefit not only to their members, but to employers of labour, they are at present suffering from the results of a mistaken policy and from internal and external dissensions which greatly detract from their efficiency. We are now experiencing an example of both these kinds of misunderstanding, one of which seeks to replace present leadership by something more communistic, and the other to make the public suffer for an inherent weakness in the trade union movement. That weakness resides in the dual organisation which has grown up: an organisation by crafts or trades and an organisation by industries. Moreover, some industries suffer from foreign competition and some do not, while neither craft nor industrial unions are complete in themselves. All these things naturally lead to rivalry and discontent, which Mr. PYBUS quite rightly considers must sooner or later develop into a pitched battle.

Payment by Results—the Solution.

THE object of these articles—and it is for that reason that they should be closely studied—is to put all information on the table, and so seek to discover whether that battle cannot be avoided. We believe with Mr. PYBUS that the revolutionary spirits are in a minority and that the great majority of workers desire peace. That peace, he considers, will come more quickly and more surely by supporting the craft rather than the industrial union. What trade unionism wants is higher wages and better conditions of work, and it is in relation to the former of these that the chief objections to the industrial union arise. To strengthen the craft unions and to extend the principle of payment by results should therefore be the object of everyone, as by so doing British industries will be able to turn out better goods than the foreigner at a lower price. That this solution will not receive universal commendation is evident from the comments of the "Daily Herald." It naturally blames capitalism for all the present discontents, and maintains that industrial unionism with its large ideas on the welfare of the worker is rather to be encouraged than discouraged. We do not agree with our contemporary when it says that behind all Mr. PYBUS's arguments lies the desire for lower wages, but we do feel that the very idea of payment by results is distasteful to the worker owing to the ill-considered action of many employers in the past. If the desirable end which he foreshadows is to be brought about, rate-cutting must be impossible, and some scheme of prosperity-sharing must take its place. When everyone recognises that it is to their advantage to pull their whole weight all the time, not only will trade improve, but many of our present industrial problems will have found an automatic solution.

A Warning for Employees—and Employers.

AN important point and one that is not universally appreciated is brought out by Mr. G. S. RAM, the Senior Electrical Inspector of Factories, in his annual report for 1922. The point is that a mere warning to a man working near electrical apparatus of the danger he is likely to run through contact with unguarded wires is not sufficient to absolve the employer from blame. In this connection Mr. RAM cites a concrete case which actually occurred in Scotland, where a prosecution was dismissed in the first place on the grounds that there would have been no danger to the workman if he had taken reasonable care, and that he had been warned of the danger. In this case the man had to work immediately below the unguarded trolley wires of an electric crane, with which he came into contact and was killed. On appeal the Court held in effect that the regulations are not limited in their application to the case of a careful workman, but include protection for those who may forget some precaution or act in such a way as to bring them into contact with danger, which, if they had been fully alive to its presence, they might possibly have avoided. It is thus made quite clear that a mere warning cannot be considered a sufficient compliance with the requirements of the Regulations, which would be frustrated if it were.

Horses, Electric Vehicles, and London Traffic.

A daily contemporary has signalised the gradual return of the horse to the streets of London, and has quite rightly noted that this will make the present traffic confusion worse. The change is said to be due to the fact that even with petrol at its lowest figure the horse is often the most economical form of transport. But, as pointed out by Mr. C. G. CONRADI in a paper read before the Institution of Mechanical Engineers in 1919, though its first cost is low (a point which is probably responsible for the change we have noted), in all spheres of operation it is more expensive and less efficient than motor traction. The only practical means of speeding up traffic, he adds, is to eliminate the horse, and speeding up is just what is urgently required at the moment. On the other hand, the

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electric vehicle has the advantages of low energy cost, of consuming no power when at rest, of being possible to operate by unskilled labour, of high reliability, of cleanliness, of freedom from fire risks, and last, but not least, of short overall length. We, therefore, suggest that those contemplating any change from the motor vehicle, when the conditions in London's streets make it difficult and uneconomical to use, should turn their attention to the electric vehicle and that electrical engineers should do their best to encourage the further use of this form of traction. The cost of traffic delay amounts to millions of pounds sterling a year. Some method of reducing this expense would be well worth while.

Recent Developments in Lighting.

While there have not recently been any revolutionary advances in lamps and lighting appliances—nothing, for instance, so striking as the introduction of the gasfilled lamp—steady progress is being made, especially in connection with reflectors and apparatus for distributing the light. The principle, "light on the object, not in the eye," is now being more widely followed, though there are still too many instances of glare—notably in shop-windows. But it may fairly be said that the number of offences becomes continually less. It is probable that when the recommendations of the Home Office Departmental Committee on Lighting in Factories and Workshops are embodied in the next Factory Act, a useful influence in diminishing glare in industrial lighting will be able to exert its full force. For it is obvious that the requirements can be most easily met by adopting modern reflectors, such that the filament falls well inside the enclosing surface. If this is done, the lighting units can be used in any position, and it is usually unnecessary to trouble about the more detailed recommendations in regard to imperfectly screened sources.

Screening Essential.

The very bright filament of the gasfilled lamp admittedly requires careful screening, and judicious selection of positions for the lamps is essential. But, somewhat paradoxically the coming of the gasfilled lamp, with its bright filament, has, in many installations, been favourable to the elimination of glare. For the high candlepower available enables lamps to be mounted much higher up than in the past, and the development of modern industrial lighting reflectors is also favourable to this "overhead" system of lighting. There are already distributed throughout the country many excellent installations of this type, affording incomparably better illumination than most factories enjoyed in pre-war days. It is also common knowledge that there is a marked gain in efficiency by using the larger candle power gasfilled lamps in place of a larger number of smaller units. For instance, to take a somewhat extreme case, a single 1 500 W lamp would yield approximately 50 per cent. more light than ten lamps each of 150 W.

General Rise in Level of Illumination.

The new methods have been accompanied by a general rise in the level of illumination provided. Whereas at one time an average illumination of about 3 foot-candles in a factory would have been considered relatively good, there are now many factories where 10 foot-candles, and even more, are provided. This steady increase in the amount of light provided has been the subject of much comment. There are some who argue that it is due primarily to the fact that greater candle powers are available, that the economic limit has been reached, and that such high illuminations involve waste. To our mind this is a mistaken impression. Experience has shown that higher values of illumination have been well repaid by the resulting greater ease of work. We are still far below the intensity of light available in the daytime. Mr. GASTER, in his recent lecture before the Royal Society of Arts, pointed out that in most factories efficient modern lighting can be provided at a cost of only about 1 per cent. of the wages bill. There is little doubt that this relatively small expenditure on good lighting is well repaid by benefits in the form of greater safety, better health and more efficient work. But there is need of statistical information to show in concrete form the nature of these benefits.

Some Significant Results.

Some significant results were arrived at in recent researches of the Industrial Fatigue Research Board, wherein it was shown that the output in the silk, cotton and linen-weaving industries was 5 to 12 per cent. less by artificial light than by daylight. It may be conjectured that we have still some distance to go before the full benefits of good daylight illumination are reproduced in artificial light. Some instructive experiments on the relation between lighting and output have also been made in the United States—notably by the Edison Co. in Chicago, who were able to induce manufacturers to have records of work taken both by the original lighting and by the greatly improved conditions subsequently introduced. Outputs in many departments were increased by as much as 20 per cent.

General Principles Now Established.

The general principles of good lighting are now fairly well established, but there are still numerous problems to be worked out in connection with various industrial processes, each of which requires individual treatment. There is an equally good field for research in connection with the higher branches of decorative lighting. In important public buildings the lighting usually costs but a small fraction of the total expenditure. Several recently erected buildings, dealt with in discussions before the Illuminating Engineering Society, have been very well lighted. The new Port of London building has been mentioned as an example; but there are still buildings being put up throughout the country where proper care is not being devoted to the lighting. Conditions in schools have also been worked out in some detail. The report of the committee of the Illuminating Engineering Society, fully endorsed in the report of the Chief Medical Officer of the Board of Education in 1913, doubtless had a favourable effect on methods in elementary and secondary schools. But it is notorious that the lighting conditions in some of the public schools are inadequate, and that some of the great schools with the oldest traditions suffer most in this respect.

Shop-Window Lighting Improving.

Another field where there has been material progress during recent years is shop-window lighting. Most of the leading stores now utilise concealed methods, and it is mainly the smaller traders who have to be discouraged from putting unscreened lights in their windows. Here, again, the general level of illumination has advanced greatly, and most progressive merchants regard this increase as well justified. Some striking experiments described before the American Illuminating Engineering Society showed that an increase from 15 to 40 foot-candles increased the "drawing power" of the window by 33 per cent., while with 100 foot-candles the drawing power was doubled. In special cases a rise in illumination to 2 000 foot-candles has even been discussed, which would make the window a striking object, even during the daytime.

We may sum up by saying that there has been steady technical progress in lighting during the last ten years. These advances still continue. The chief need at the moment is more widespread propaganda, and especially concrete data illustrating the benefits of good illumination. Supply companies and manufacturers could do a great deal to make the evidence on this point, accumulated at meetings of the Illuminating Engineering Society, and the conclusions reached in their discussions, more widely known to the general public.

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Long Distance Radio Reception in India.

By P. J. EDMUNDS, B.A.

This Paper contains the results of observations carried out by the Wireless Experimental Section of the Indian Posts and Telegraphs Department in connection with the reception in India of special traffic from the English stations at Carnarvon and Leafield. It was not possible to arrange a continuous series of scientific measurements, but most of the high-power stations in Europe have been kept under daily observation since November, 1921, and

TABLE I.

1	2	3	4	5	6	7
Station	Wave Length	Great Circle distance from Karachi	Metre-amperes	Power radiated	Calculated Field Strength*	Observed Field Strength
	Metres λ	Kilometres d	hI	Kilowatts P	Microvolts per Metre E_c	Microvolts per Metre E_o
St. Assise UFT	14 300	6 140	85 000	70	33	70
Lyons YN	15 100	5 900	37 500	10	16	27
Leafield GBL	12 300	6 410	18 000	3·4	5·5	14
Carnarvon MUU	14 200	6 580	27 000	5·1	7·7	17
Rome IDO	10 700	5 230	20 000	5·3	12·2	20
Lafayette LY	23 400	6 430	81 000	19	27	68

* $E = 120\,000\,\pi \frac{hI}{\lambda d} \epsilon^{-\cdot 0475 \frac{d}{\sqrt{\lambda}}}$

it is possible to draw some fairly definite conclusions which are of interest in the general problem of long-distance radio communication.

Details of Apparatus.

The receiver used practically throughout consisted of a coil aerial, 2 metres by 3 metres, tuned with a suitable condenser and coupled inductively to a secondary circuit which was connected to a seven-valve high-frequency amplifier and detector (Marconi pattern 55D). Heterodyne was effected by an independent oscillator placed near the set. Signals were then amplified by a single-valve note-magnifier fitted with low-frequency regenerative tuning. This arrangement is extremely convenient for general observation owing to ease of adjustment and, although the high-frequency circuits were not very selective, interference between different stations could be completely eliminated in practice by the adjustment of the low-frequency tuning.

The coil aerial ultimately chosen contained nine turns only having an inductance of some 600 microhenries. This was in series with a small coupling coil and required a comparatively large capacity for tuning. With this arrangement signals were as good as those obtained with many more turns, although the e.m.f. induced in the latter is much greater, being proportional to the number of turns. It can be shown that the power developed with a small number of turns is as great or even greater when full advantage is taken of the low resistance possible in this case. In fact, observations made with a single turn of copper strip showed only a small reduction in signal strength which could be explained by the unavoidable loss in the large tuning condenser required (as much as a microfarad). With the nine-turn frame, however, the condenser loss was certainly small and the arrangement was found very convenient owing to ease of adjustment, constancy in operation and absence of stray capacity effects. The frame could be rotated about a vertical axis and reliable bearings could be taken by means of a pointer and scale.

For measuring field strengths a small valve transmitter capable of generating 1 A of high-frequency current was fitted into an efficient screening box and induced current into a coil 1 metre square. The current in this frame was measured by means of a thermocouple. The whole of this apparatus was installed in a small building about 100 metres away from the receiver in the line of the stations under observation (the high-power European stations are all in the same direction from Karachi within a few degrees). Both the buildings were of rough masonry, without electrical fittings, and were located on dry sandy soil near Karachi. In operation the transmitter was adjusted to the same wavelength as the sending station by making the heterodyne notes identical. The strength of the transmitter was then adjusted to give the same intensity in the receiver as the sending station. From the measured current and dimensions the field strength can be calculated. The operation is somewhat lengthy, but admits of considerable accuracy provided the station continues transmitting for sufficient time. In particular, the state of the receiver is entirely eliminated as the two fields under comparison are identical in the immediate neighbourhood of the receiver.

Field Strengths.

The field strengths observed are given in Table I and represent fair average values for the period of the day from 6 hours to 10 hours G.M.T. This period corresponds to the earlier period of daylight over the whole distance between transmitting station and receiver and was found to be the most regular throughout the day. These strengths may be called "normal" field strengths. During the latter part of the day signals are liable to interruption by atmospherics. At night signal strength varies, is usually greater, and, when the whole path is in darkness, may rise to two or three times the "normal" value. This effect is, as usual, more noticeable on shorter waves. Thus Leafield, which can rarely be read during the day on 8 750 metres, often becomes stronger on this wave than on 12 300 metres during the night. Near sunset and sunrise

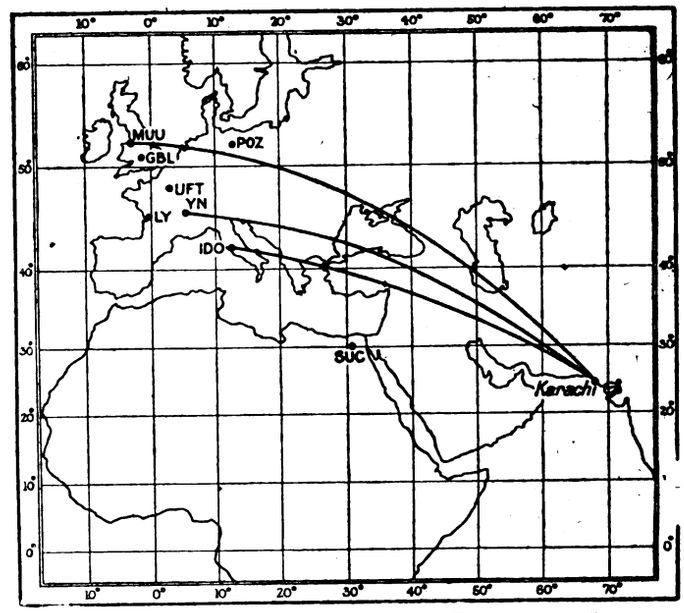

FIG. 1.—DIRECTIONS OF WAVES FROM ENGLAND TO INDIA.

at receiver, signal strength sometimes fades to a very low value. These effects are by no means regular from day to day. In Table I are also given the field strengths calculated by the Austin-Cohen formula* and the data used for the calculation.

It will be seen that the observed strengths are two to three times those calculated. This is in general agreement

* "Proceedings of the Institute of Radio Engineers," Vol. X, No. 3, June, 1922.

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with the results obtained by the French cruiser "Aldebaran" in the Indian Ocean. It was suggested by Austin* that the largeness of the latter results was partly due to a kind of concentration or focussing effect due to the Red Sea. In this case the waves should appear to come from the southern end of the Red Sea, but the observed directions give no evidence of any such effect. The directions agree well with those calculated from the great circles and the path of the waves passes well north of the Red Sea (Fig. 1). It would appear rather that the absorption coefficient is smaller for these distances and wavelengths than that used in the Austin-Cohen formula. A great part of the path lies over dry sandy areas where the conductivity of the upper layers of the earth is very small. Now for perfect conductivity and perfect insulation the absorption due to the earth's surface would be zero and there must therefore be some degree of conductivity for which the absorption loss is maximum. It would appear that fertile country covered with vegetation is of a medium conductivity, giving a loss greater than a better conductor such as sea-water on one hand or a poorer conductor, such as dry desert, on the other. American high-power stations can frequently be read during the morning at Karachi, though later in the day signals are weaker and are usually unreadable at Karachi owing to atmospherics. The field strength of Long Island (WQL) on approximately 19 500 metres was found to be 13 microvolts per metre at 6 hours G.M.T. on January 17th, 1923. Assuming 100 000 metre-ampères and distance 11 600 km., the Austin-Cohen formula gives a value of 3·2, but at this time about half the path of the wave was in darkness and the strength could not be called normal.

Aural Observations.

Aural observations were also carried out at other places in India, notably at Delhi and near Simla, though arrangements were not made for measurements of field strength. The normal field strengths were of the same order, being slightly weaker in Delhi and slightly stronger in Simla. The latter place is situated in the lower ranges of the Himalayas about 25 miles in the direct line from the plains. The receiver was located on the top of a hill about 6 000 ft. above sea-level with valleys some 2 000 to 3 000 ft. lower in practically all directions in the immediate neighbourhood. Between north and east the mountains rise to some 20 000 ft. at a distance of 40 to 80 miles. It was found that although signals were on the whole stronger than at Karachi conditions were less stable. Atmospherics were stronger, and there were many more occasions when local conditions rendered reception impossible.

Directions of European Stations.

Numerous observations were made of the apparent directions of European stations. During daylight bearings over the whole path were consistently the same as those calculated from the positions within one degree, which was the probable accuracy of the method employed. As usual, great variation was observed at night, commencing soon after nightfall at the receiver. When the transmitter was in darkness and the receiver in light, the effect was rare. The following is an interesting example: On September 15th, 1922, strong signals were heard from several European stations shortly before 15.20 G.M.T. No signals were then observed until about 15.30, when Carnarvon and St. Assise, both approximately on the same wavelength, were heard very faintly over about 20 degrees of rotation of the frame in a direction which was roughly at right angles to the normal and true direction. This effect lasted about ten minutes, after which signals gradually increased and were normal, both as regards strength and direction, by 15.50. This effect could be produced by two rays of equal intensity reaching Karachi from two slightly different directions, with a phase difference of approximately half a period. At this time the twilight band was approximately half-way between England and India and the above explanation is more feasible than the supposition that the wave had been turned through a right angle by some distant reflector.

* L. W. Austin, "Journal of the Franklin Institute," April, 1922.

Atmospheric Effects.

Conditions in India as regards atmospherics have a seasonal regularity, and, although at certain times of year they are severe for long periods, they are singularly slight at other times. In fact it is the writer's experience that during the cold weather average conditions in India on long wavelengths are considerably superior to those experienced at any time of the year in England. It is therefore convenient to divide the year into two periods, first, the period during, and immediately preceding, the South-West Monsoon, that is, May to August inclusive, during which atmospherics are very severe for the greater part of the day; second, the cold weather period, from October to March, during which they are generally slight. The months April and September are transition months. As regards direction, it is found at Karachi that there is usually a fairly definite minimum in a direction about

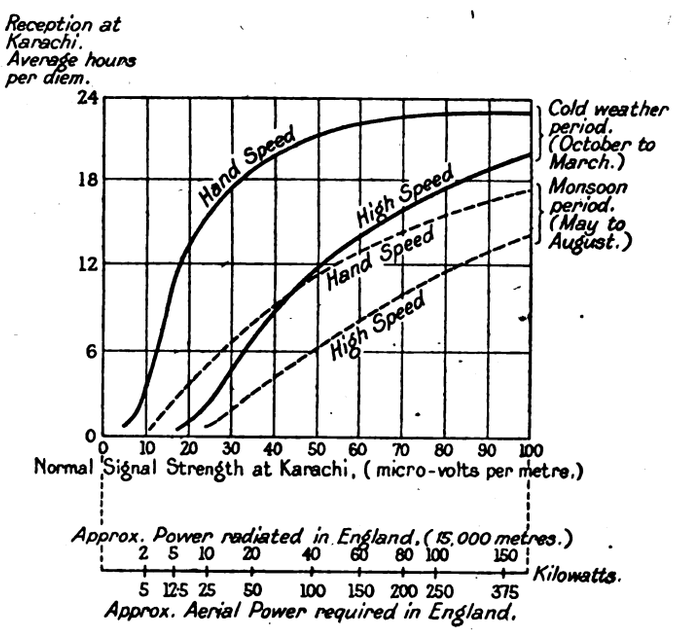

FIG. 2.—NUMBER OF POSSIBLE HOURS OF RECEPTION PER DAY.

north-west—south-east, so that reception of stations in Western Europe, whose direction is roughly north-west, is facilitated by the use of frame aerials. This directional effect is not observed with the "click" type of atmospheric. It was not found possible to estimate the severity of atmospherics by a count, as has been done elsewhere, owing to their rapid sequence. The best way of indicating the strength of atmospherics is by stating the signal strength necessary for reception and this quantity differs for aural reception at hand speed and automatic at high speed. Thus the apparatus used was sufficiently sensitive to read signals of a few microvolts per metre field intensity, though it would practically never be possible to do so owing to atmospherics. During the best periods, 10 to 15 microvolts per metre give fair aural reception, about 35 being required for automatic. During the monsoon period, however, there are intervals of several hours in which it is impossible to receive 100 microvolts per metre even aurally. The general deductions from observations are shown in Fig. 2, which gives the number of hours' reception to be expected during every twenty-four hours for signals of a given "normal" intensity, allowance having been made for increase of signals at night and the fading periods. It is based on practical tests with various types of apparatus.

Power Required.

From Table I it is possible to form some estimate of the "metre-amperes" required in England to produce a given

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"normal" field strength at Karachi and Fig. 2 then gives an estimate of the probable traffic. To calculate the power required to produce the assumed "metre-amperes" requires knowledge, first, as to what proportion of gross power at the transmitter is put into the aerial in high-frequency form and, second, the proportion of the latter radiated. The first factor varies somewhat with the type of station, but 50 per cent. is a rough approximation. As regards the second factor, the proportion of power radiated in existing stations is very low, as may be seen from the fifth column in Table I. These have been calculated from the formula

$$P = 1{\cdot}6\left(\frac{hI}{\lambda}\right)^2$$

where P is the power radiated in kilowatts,
where h is the effective height in metres,
where I is the aerial amperes,
where λ is the wavelength in metre,
hI is then the "metre-amperes."

As an example, Leafield, which is believed to be fitted with a 250 kW arc, radiates only 3·4 kW out of a probable 120 kW in the aerial, that is, less than 3 per cent. This station is, however, handicapped by its low masts. Bouvier* and other authors agree in figures of about 10 per cent. on 15 000 metres and 5 per cent. on 20 000 metres for existing stations. Recently, however, great improvements have been made in the design of the earth connection. The earth screen of Eckersley†, the multiple earth of Meissner‡ and the multiple aerial connection of Alexanderson§ show great promise, though it is difficult at present to decide on their respective merits. At New Brunswick the total aerial resistance was reduced from 3·8 Ω to 0·5 Ω by the Alexanderson method. Meissner deduces from experiments on model aerials that it will be possible to obtain an aerial efficiency of about 40 per cent. at Nauen, and Bouvier states that by an application of the same principle the aerial resistance at St. Assise has been reduced from 1·9 Ω to 0·54 Ω. The resulting aerial efficiency is 35 per cent. and a further improvement is expected. We can thus expect to obtain an aerial efficiency of about 40 per cent. on 15 000 metres in future stations. In this case an aerial power of 500 kW, corresponding to a gross power of about 1 000 kW, should give a normal field strength at Karachi of over 100 microvolts per metre. The lower scale of kilowatts on Fig. 2 has been calculated on this basis.

Institution of Electrical Engineers.

Coopers Hill War Memorial Prize.

Founded by members of the Royal Indian Engineering College, Coopers Hill, in commemoration of members of the College who fell during the War, the COOPERS HILL WAR MEMORIAL PRIZE is awarded annually by the Institution of Civil Engineers, and triennially in turn by the Institution of Electrical Engineers, the School of Military Engineering, Chatham, and the School of Forestry, Oxford.

The prize, which consists of a bronze medal, a parchment certificate of award, and a money prize of the value of about £25, is awarded for the best paper on a professional subject selected by the Council making the award.

One of the triennial awards falls this year to the Council of the Institution of Electrical Engineers, who have selected for the subject of competitive monographs, "An Historical and Critical Survey of Atmospheric Electricity and Protection against Lightning." Papers submitted for the above purpose should reach the Secretary of the Institution not later than December 31st, 1923. The I E.E. award for 1923 is limited to corporate members of the Institution who were under 30 years of age on January 1st, 1923.

* P. Bouvier, "Radioélectricité," November and December, 1922, Vol. III, Nos. 11 and 12.

† T. L. Eckersley, "Journal of Institution of Electrical Engineers," October, 1921.

‡ A. Meissner, "Jahrbuch der Drahtlosen Telegraphie," November, 1921, Vol. 18, No. 25.

§ E. F. W. Alexanderson, "Proceedings of the Institute of Radio Engineers," August, 1920, Vol. 8, No. 4.

Reviews.

Der Funkentelegraphische Wetterund Zeitzeichendienst. By H. THURN. (Berlin: H. Krayn.) Pp. 82. 2s. 4d. net.

Wireless telegraphy at the present time serves not only for the transmission of commercial messages, but also for the dissemination of general news intelligence and scientific information in the form of weather reports and time signals. This little volume, by a German telegraph official, in describing the development and scope of modern meterological and time signal radio services, serves as a timely reminder of the value and importance of this branch of the art.

The work is divided into two sections, twenty-five pages being allocated to weather reports, and thirty-seven pages to time signals. The subject of weather reporting is dealt with first of all from a historical aspect, and it is interesting to note that the author credits the London "Daily Telegraph" with being the first newspaper to make use of radio weather reports. The writer discusses the broadcasting of weather reports from ships at sea and from coastal wireless stations, and gives a full description and particulars of radio weather services organised in Germany since the war. The final section of this portion of the book deals with services external to Germany, and includes useful tables giving particulars and times of such services.

Passing on to the subject of time signal services, the author, after a brief historical survey, deals first of all with the various international regulations regarding time signals, and follows with a description of the development of time signal services in Germany during and after the war. In this section he gives technical details of apparatus and methods adopted for transmission of such signals, and follows with a description of receivers and recording apparatus which have been developed for this work.

The work concludes with a list of world stations sending time signals, and may be regarded as a useful contribution to literature on the subject. E. H. SHAUGHNESSY.

Direct Current Machinery. By HAROLD PENDER, Ph.D. (London: Chapman and Hall). Pp. 340. 15s. net.

That there still exists a tremendous gap in the literature of electrical engineering between technology and machine design is brought home more forcibly than ever on turning over the pages of this book. Naturally, the author will be found to base many of his arguments on the present day practice of the A.I.E.E., which, however, can easily be adapted to our own standards by any thoughtful reader. From beginning to end the book abounds with problems which bring out fully the various points dealt with.

The author opens with an excellent chapter dealing with definitions and fundamental principles, an outstanding feature being the clarity of expression, as indeed may be truthfully said of the volume as a whole. In dealing with the magneto-motive force of a current the author adopts the modern view of introducing the factor 4π as a natural factor, which certainly helps the student over one of the most difficult stiles in the path of the magnetic circuit. In chapter II there is one diagram (Fig. 8) which is outstanding in the clear way it shows the link between the ring and drum types of armature windings, always a point difficult to visualise; also it is pleasing to note that the importance of the various types of insulating material is dealt with, a thing that is more noticeable by its absence in most of the advanced text books dealing with the design of electrical apparatus.

That difficult subject, commutation, is dealt with in a most able manner, and in such a way that no student should fail to grasp the various phases which one meets with in practice. After a careful study of the flux distribution due to both the armature and field ampere-turns and its effect on the brush position, the author proceeds to correct these curves by the introduction of what he calls the armature demagnetising factor, and builds up therefrom, by means of a graphical construction, the external characteristics of the various types of d.c. machines.

The closing chapters deal fully with the operating characteristics of both generators and motors, mention being made of particular applications and the modifications necessary in the design, especially with regard to motors for traction service. Many useful points relating to test-house practice make an excellent finale to a book which should find a wide field of usefulness.

J. W. SIMS.

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Pupin Cable Measurements with Valve Oscillator.

By A. H. DE VOOGT (Engineer of the Dutch Telegraph Service).

In nearly all countries the telegraph administrations nowadays are occupied with telephone cables and the problems relating to telephony worked on loaded cable circuits. The ever-increasing demand for many and safe telephone circuits between towns makes it necessary to replace, or at least to complete, the overhead telephone route systems by an underground cable system composed of a number of Pupin loaded circuits, the quality of which does not depend upon weather conditions. These cables, before being accepted from the companies, have to be measured carefully by the administration, whose task it is to see if the guaranteed conditions have been fulfilled, especially as regards attenuation characteristics and cross-talk of the different circuits, and further to look after the degree of equality of circuits of the same type. The requirements of the telephone administration as regards values of the cable constants stimulate the production by the cable manufacturers of highly efficient circuits and very uniform and carefully made cables; on the other hand, the cable manufacturers endeavour to produce as economically as possible. There is thus a very useful contest between both parties, and consequently a healthy development of telephone technics.

It being of importance to know the behaviour of Pupin cable circuits for a long range of frequencies ($\omega=3\,500$ to $\omega=17\,000$), a generator giving alternating current of as pure a sine wave form as possible is necessary in order to make any bridge or compensating measurements on this circuit. For this purpose the Franke machine with compensating method, as well as the valve oscillator with Wheatstone bridge arrangement, is much in use. The former method is a compensating device by which the impedance (with ends free, closed, or closed by a characteristic impedance) is directly found and read as the number of ohms of an ohmic resistance, whereas the angle is directly read from a scale on the machine, being the angle (in "electrical" degrees) by which one of the armatures has to be rotated for silent conditions in the receiver.

Advantages of the Franke Machine.

The measurements obtained with the Franke machine method are very trustworthy and useful for controlling the values or some of the values obtained by the Wheatstone bridge measurements, as the latter are now and then subjected to serious erroneous influences caused by parasitic capacities of the bridge circuits. The Franke machine, besides, gives the impedance measured in an easy form for use in the formulæ and for extreme values of angle or modulus without difficulty and with accuracy; moreover, the machine makes it possible to find the currents and voltages by which the measured values were obtained. On the other hand, it is difficult to maintain the frequency delivered by the machine at an absolute constant value; and to raise the frequency above $\omega=7\,500$.

In certain cases it might be necessary (as will be stated later) to be sure about the frequency within one period per second, and for this reason the inconstancy of the Franke machine may be rather annoying. For instance, in the case of a free and closed end impedance test being made, a slight change in frequency in the time between the two observations may cause serious mistakes in the calculation of the attenuation constant.

In this respect the modern valve oscillator is a much better generator of alternating current, and has the advantage of giving an absolute constant frequency, which can be adjusted to a wide range of frequencies very accurately. One can be so sure about the frequency of this oscillator that it is possible, e.g., first to make a series of free-end impedance tests for several frequencies and afterwards to measure the closed-end impedances by absolutely the same frequencies. This method saves much time,

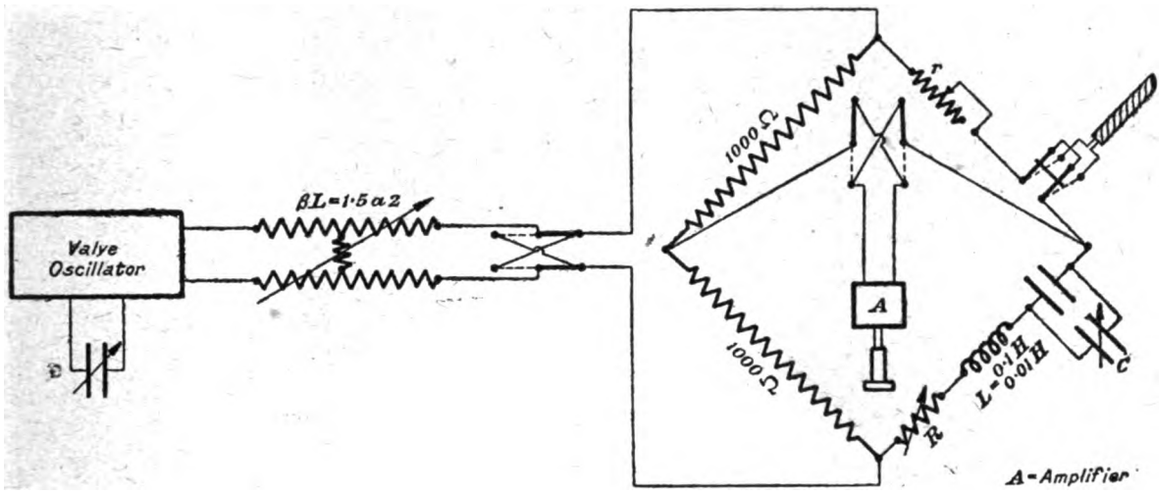

FIG. 1.

as the connections at the far end of the cable circuit have to be changed only once during the whole test.

The Wheatstone bridge measurements give the real and imaginary values of the impedances in a more or less implicit form, and therefore all calculations are more complicated and troublesome.

Characteristics of the Valve Oscillator.

The alternating current of the valve oscillator, as is known, is produced by a circuit with capacity and inductance connected to a valve and brought into an oscillating condition by a reaction between grid and anode circuit of the valve.

The frequency delivered is determined by the amount of capacity and inductance in the oscillating circuit. In most cases the capacity can be regulated continuously, and the inductance is either fixed or variable in steps. As the energy of the oscillation depends upon the quotient of inductance and capacity between certain limits, it is clear that as a constant test current or voltage is generally desired it would be advantageous if inductance and capacity could both be varied continuously, as is done in some oscillators. In case the inductance is variable in steps, care must be taken at the moment when an amount of inductance is switched in or out, there being a possibility that at these points discontinuities will occur in the curves taken. Considering the accuracy of the frequency delivered and the calibration of the oscillator, it is obvious that in the first place it is important that the relative frequency value, i.e., the value associated with a definite adjustment of the oscillator must be accurate, so that

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during the time of test one can be sure of always getting the same frequency with a given setting of the oscillator. In the second place, the absolute value of the frequency must be as exact as possible in order to have the opportunity to compare the different values acquired by different tests on several cables with each other. In this case, of course, it is only necessary to know that the values are obtained by a frequency of, say, 800 or so, whereas *during* a test on a cable any inaccuracy of the frequency intervals taken may give irregularities in, say, a characteristic impedance curve taken, which are actually not present.

Determination of Oscillator Frequency.

The absolute frequency of the oscillator can be found experimentally by observing the number of beats per second produced by interference of the sound waves from a tuning fork and a telephone connected to the valve circuits. Several frequencies can be found in this way, situated in the neighbourhood of the frequency of the tuning fork. When a second valve oscillator is on hand, beats can be produced between the sound waves of both oscillators, and in this way it is possible to calibrate an oscillator for ranges of 770 to 830 per second, based on the

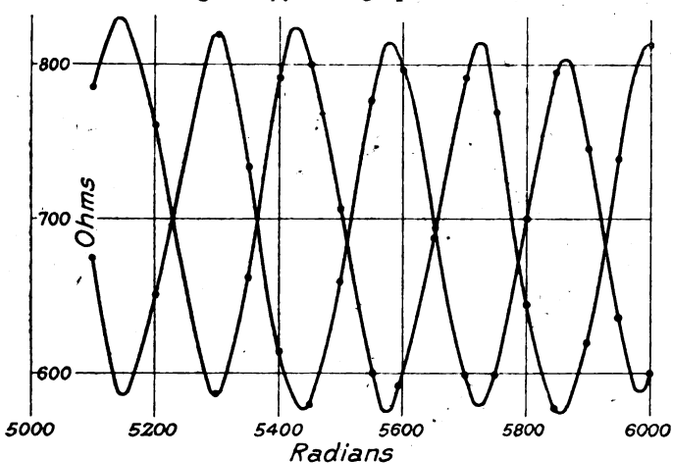

FIG. 2.

fundamental frequency of 800 given by a tuning fork; a range of 970 to 1 030 based on a tuning fork 1 000, etc.

From these values the rate of change of the frequency per unit difference of capacity can be found, and by inter- and extra-polation other values of valve adjustments for adjoining frequencies are obtained.

Another method is to calculate capacity values by applying the law that the capacity varies inversely proportional to the square of the frequency, taking one fundamental frequency, of, say, 1 000 (obtained from a tuning fork), as a starting point to higher and lower values. For long ranges the tables obtained this way are not very exact, as the unavoidable and unknown self-capacity of the inductance coils spoils the quadratic rule. Therefore, it will be useful to calibrate the oscillator if possible not only by calculation, but by checking some frequencies by tuning forks and beat experiments. The capacity will certainly have to be calculated up to five decimals exactly, as in the oscillator made by H. W. Sullivan (London) giving a frequency of 1 200 with a capacity of 0·10126 mf which changes the frequency one period per second for every 0·00017 mf; at a frequency of 2 000 the rate of change for one period is 0·00003 mf, being less than 0·1 per cent. of the actual capacity value for this frequency.

Necessity for Accurate Calibration.

As the result, the condensers of the valve have to be calibrated carefully. Suppose, for instance, that a variable condenser of 0·001 mf is available, and the other values are obtained from a condenser-bank in which values of 0·2 mf are present, these latter values must be accurate to within 0·1 per cent.; otherwise by switching over, a mistake of more than one period per second will result.

It was stated that the calibration of the oscillator for absolute frequencies does not remain correct for a long time. The replacing of a new bulb in the oscillator, new batteries, a different arrangement of apparatus, etc., are all factors which have influence on the frequency of the oscillator. The best thing then is to take the calculated capacities from the tables as if they were correct and afterwards to control some fundamental frequencies with tuning forks to see how far the frequency, indicated by the table, was wrong. As a matter of fact, the mistake cannot be very serious.

A Sensitive Frequency Measurement.

A very sensitive frequency measurement can be made with a Wheatstone bridge arrangement as shown in Fig. 1.*

When the switch is in the position indicated in the diagram, three arms of the bridge contain ohmic resistance; in the fourth arm there is ohmic resistance (adherent to the inductance-coil) as well as inductance and capacity. The latter is continuously variable, and can compensate the inductance if the condition $\omega^2 LC = 1$ is fulfilled, i.e., for a definite frequency delivered by the valve oscillator. In this case the fourth arm of the bridge is also reduced to an ohmic resistance, and a very sensitive minimum-adjustment in the receivers is obtained.

L can be made 0·1 or 0·01 henry, and tables are made for frequencies and capacities.

First the capacity is brought on the required value for a given frequency, then the capacity of the valve oscillator is changed until silent conditions in the receivers are obtained; thereupon the cable is switched in, and now ω and C are varied again to obtain a minimum sound in the phones. ω gives directly the real component of the impedence measured and from $\left(\omega L - \frac{1}{\omega C}\right)$ the positive or negative imaginary value of the impedance is calculated.

For this method calibration tables for the valve-oscillator are unnecessary because before each test a frequency test is made. The accuracy of the frequency adjustment can be as high as 0·1 or 0·01 of a period!

Determining Influence of Incalculable Factor.

The high sensitiveness of the frequency bridge arrangement allows one to determine the influence of incalculable factors on the frequency given by the valve; among others the capacity influence of the observer, the load on the oscillator, etc. The latter factor, the load on the oscillator, which may vary considerably with free-closed-end measurements on short cable circuits and which is liable to alter the frequency unduly makes it unavoidable to insert an artificial line of $\beta l = 1{\cdot}5$ or 2 between bridge and oscillator. This, again, makes it necessary to amplify the current going to the receivers (Fig. 1), and in doing so a very accurate cable measuring arrangement is finally reached. Commutators will have to be inserted in oscillator and receiver leads; commutating either one, the other or both must cause little or no difference in the readings. Care must also be taken to avoid any direct action from the oscillator on the receivers and amplifiers.

It is, generally speaking, preferable to measure Pupin cables with a current of the magnitude of the normal telephone currents from the order of no more than 0·5 mA. It was found that on Pupin cables loaded with iron wire coils as well as on such cables loaded with iron dust coils, when the currents reaches values above 1 mA the constants of the cable begin to change, whilst below 1 of 0·5 mA there is practically no change in these constants. Strong valve oscillations are from this point of view inadmissible; moreover, large and heavy batteries are needed, which makes the transport very difficult. Tungsten valves can be used with dry batteries for the anode current; accumulators or direct current mains are necessary for oxyd-kathode-valves.

The artificial line can assure the low current mentioned above. It was possible to study, with the aid of the

* Küpfmüller.—"Telegraphen und Fernsprechtechnik," 1919, Nr 8.

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frequency bridge, the influence of the temperature on the tuning forks, and it was found that a difference of 20 deg. to 40 deg. C. detuned the forks not more than two periods.

Fig. 2 gives a part of the free and closed end impedance test on a long submarine Pupin cable with 82 coils and 0·0078 km. attenuation. From Fig. 2, it is obvious that for the calculation of the attenuation constant, one must be careful to keep the frequency absolutely constant, as a change of 15 radians can give a difference of about 30 O in the impedances. A direct attenuation measurement is possible when two cable circuits can be looped so that the beginning and end of the circuit are obtainable in one room. The valve is connected to the beginning of the circuit shunted by a potentiometer fitted with two symmetrical sliding contacts, which are connected via the receivers to the end leads of the circuit; in this way the quotient of input e.m.f. and free end e.m.f. is directly found because the e.m.f. at the end of the circuit is, for silent conditions, compensated by a fraction of the input e.m.f. It will be necessary, however, in order to obtain an absolute minimum to vary the frequency slightly until a point is reached where the phase-difference of the input and free-end e.m.f., is zero or 180 deg. In fact, in that case and for that frequency the imaginary part of $\gamma l = \beta l + j\alpha l$ † is zero, and the quotient read from the potentiometer, therefore, will be equal to the hyperbolic cosine of βl; βl can then be found in tables.

Electricity Supply in Belfast.

Official Inauguration of the New Harbour Power Station.

Electricity supply in Belfast, the capital of Northern Ireland, may be said to date back to August, 1870, when a provisional order was granted to the Corporation. It is interesting to note that in contradistinction to many towns the inauguration was not due to private enterprise, but that after some delay supply was begun under municipal auspices in January, 1875. Two years later a second station was built for supplying the tramways and the ordinary load, and when the tramway system generally was taken over in 1904 this station was largely extended. In 1911 it became evident that this station in East Bridge Street was inadequate to meet future requirements and various schemes were being considered in 1914 when war broke out. The question became urgent in 1917 when the shipyards were demanding more and more energy, and as a result the Director of Electrical Power Supplies approved the acquisition of a new site near the Harbour. Work was begun on this station in September, 1919, and it was officially inaugurated by the Governor of Northern Ireland, the Duke of Abercorn, on Wednesday, August 15th, 1923.

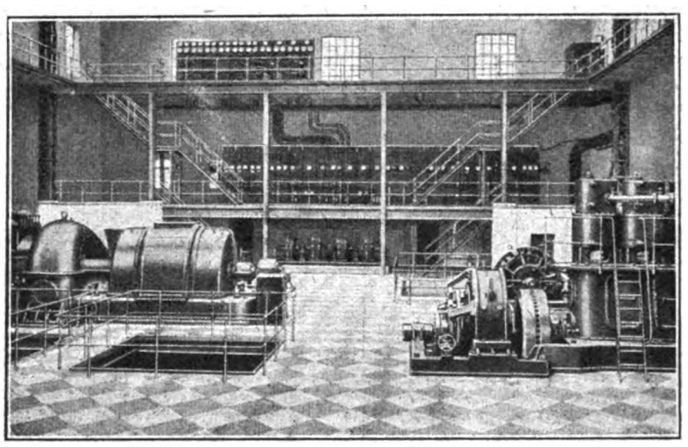

FIG. 1.—TURBINE ROOM AND SWITCHBOARD GALLERIES.

To meet the shipyard demands two 6 000 kW sets were erected on a temporary site some 800 yards away from the Harbour station, and these have been transferred to the new station.

The site on which the Harbour station is built covers 20 acres and contains ample provision for future developments. There is an abundant supply of water for condensing purposes, and coal can be unloaded direct from ship to bunker. The present capacity of the station is 24 000 kW, but in November last the Council decided to extend the station, and a second 12 500 kW turbo-alternator is now on order, and this, with the boiler plant installed, will bring the station capacity up to 34 000 kW. The site is, however, capable of further development to the extent of at least 150 000 kW.

The necessary condensing water is taken from the Musgrave Channel and passes through reinforced concrete ducts to the circulating pump house. Provision has been made on the intakes for automatic screens to remove suspended matter from the water, if at a later date this is found necessary.

Coal can be unloaded at the station wharf direct from the ship. On this wharf two grab cranes are provided (Fig. 3), each having a capacity of 60 cub. ft. These grabs discharge into hoppers, which feed the coal crushers and coal conveyers, each of which have a capacity of 40 tons per hour. Two conveyers are at present installed, and provision has been made for a third. The coal is conveyed to the weighing machines and is there picked up by a second line of conveyers of the same capacity, which convey it to the reinforced concrete storage hopper, which has a capacity of about 2 000 tons.

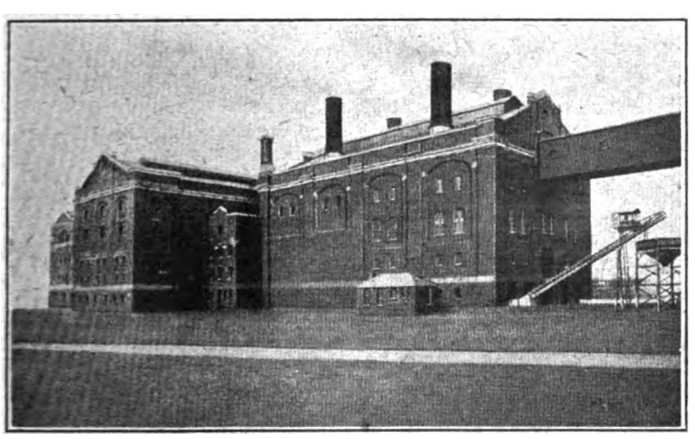

FIG. 2.—BUILDING AND STRUCTURE FROM MUSGRAVE CHANNEL.

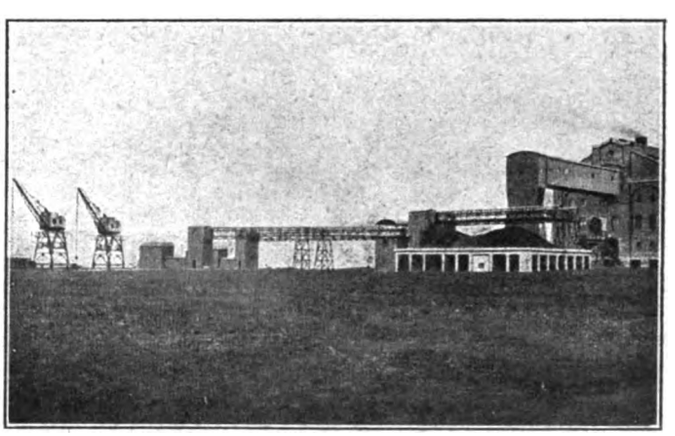

FIG. 3.—COAL HANDLING PLANT.

† $j = \sqrt{-1}$.

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From this storage hopper the coal is conveyed by two conveyers to the boiler house bunkers. The boiler house contains four bunkers of parabolic design, each having a capacity of 120 tons. From the boiler house bunkers the coal passes down through weighing apparatus to chutes, which discharge the coal into the boiler grate hoppers.

Boiler House.

The ground floor of the boiler house (Fig. 4) is divided longitudinally into three sections, the ash handling plant being

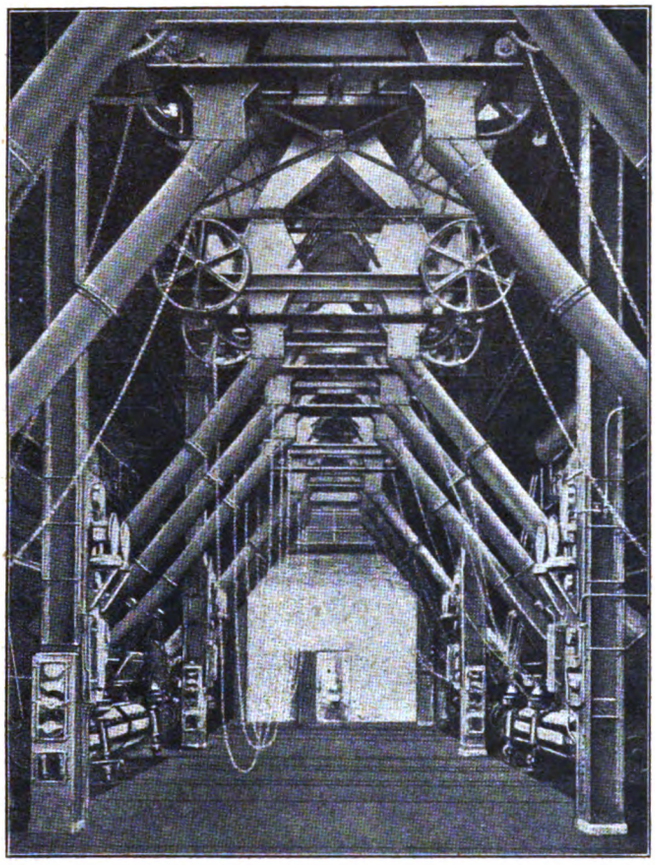

FIG. 4.—GENERAL VIEW OF BOILER ROOM.

contained in the wings, and the forced draught plant and stoker drive in the main aisle.

The first floor is the firing and operating level. The economisers and induced draught fans are placed on the floors above the boilers, in the wings of the building, and from a higher level in the middle aisle are slung the coal bunkers already referred to.

The boiler house contains eight marine type Stirling boilers, arranged in two rows of four. Each boiler unit has three mechanical stokers, super-heater, economiser and forced and induced draught fans. One chimney is provided for each pair of boilers. The normal output of each boiler is 55 000 lb. of steam per hour, at a pressure of 235 lb. per sq. in. gauge (650 deg. F. total temperature).

The feed pumps, together with the hot wells, are housed in an annexe between the boiler house and engine room, and consist of two electrically-driven pumps, each having a capacity of 20 000 galls. per hour, and one steam turbine-driven pump of the same capacity per hour.

Turbine House.

The turbine room (Fig. 1), the main dimensions of which are: length, 157 ft.; breadth, 75 ft.; height, 71 ft., contains at present two 6 000 kW and one 12 500 kW turbo-alternators, with condensing plant and all auxiliaries; two 500 kW rotary converters for station purposes; one 500 kW steam engine d.c. generator, also for station use, in the event of failure of rotary converters; balancer booster on floor level under the first gallery at the permanent end of building; l.t. switchboard on the first gallery, and h.t. control board on the second gallery. A 50-ton crane spans the turbine room.

Turbo-Alternators.

Nos. 1 and 2 turbo-alternators have a maximum continuous output of 7 500 kVA at 6 600 V and run at a speed of 3 000 revs. per min. No. 3 has a maximum continuous output of 15 625 kVA at 6 600 V, and runs at a speed of 1 500 revs. per min. The periodicity of the system is 50 cycles per sec.

The condensers in connection with the two 6 000 kW sets have each a cooling surface of 11 000 sq. ft. and are supplied with 9 000 galls. of water per minute. The condenser for the 12 500 kW set has a cooling surface of 20 500 sq. ft., and is supplied with 16 500 galls. of water per minute, the guaranteed vacuum in all cases being 29 in. of mercury.

The switch house and pump room is a two-storey building with basement and is situated on the south-west side of the turbine house. The basement and first storey contains the circulating water pumps and ducts for all condensers. The waterways from the Musgrave Channel run along each side of the basement, the centre portion being made watertight, and forms the circulating pump chamber. By a special arrangement of sluice gates the flow of water in the ducts can be reversed—i.e., the inlet can be made outlet and *vice versa*, according to the flow of the tide. A 5-ton crane spans the middle portion of the room which forms the pump chamber. The first floor houses the reactances and auxiliary equipment, and these are connected between the busbar sections.

On the top floor is the main 6 000 V switchgear (Fig. 5) for all generators and feeders comprising three alternator switches, feeder switches, and two sectionalising switches.

Storage Battery.

A 440 V "Tudor" battery, consisting of two sections, each having 122 cells, has been installed in the basement of the turbine house, under the switchboard gallery. This battery has a capacity equal to running up the auxiliary plant of one of the generators in the case of a total failure of supply. It will be used for all trip circuits, and the whole of station lighting can be switched on to it.

A high-tension transmission system is now being laid throughout the city, and this will supply sub-stations in each

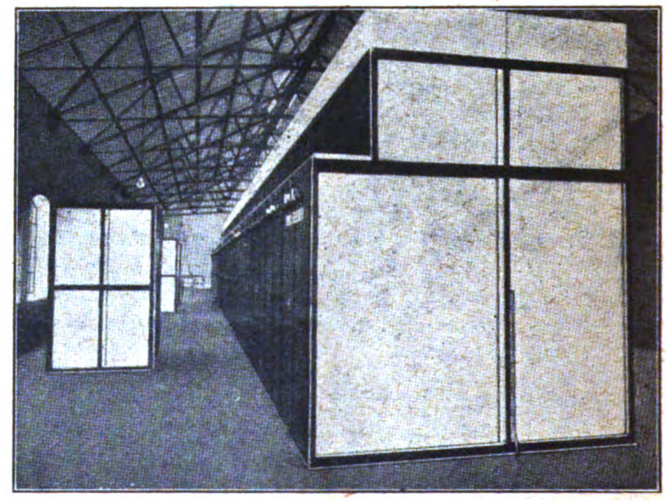

FIG. 5.—GENERAL VIEW OF SWITCH HOUSE.

load area, which will feed the existing d.c. network. Large power consumers will be supplied direct from the h.t. system, and pressure reduced to 400 V by step-down transformers on site. All main feeders are protected by the Merz-Hunter system of protection.

The principal contractors for the plant supplied were:—

Boiler House Equipment.—Boilers, the Stirling Boiler Co.; ash handling plant, the Underfeed Stoker Co.; coal handling plant, Fraser and Chalmers, Ltd.; coaling cranes, Sir W. G. Armstrong, Whitworth and Co.; vacuum flue cleaner, British Vacuum Cleaner Co.

Turbine House Equipment.—6 000 kW turbo-alternators, the British Thomson-Houston Co.; condensing plant, Worthington, Simpson; 12 500 kW turbo-alternators and condensing plant, the Metropolitan-Vickers Co.; booster balancers, the British Thomson-Houston Co.; 500 kW rotaries, the Metropolitan-Vickers Co.; station transformers, the English Electric Co.

Switchgear.—E.H.T. main and auxiliary switchgear and control boards, the Metropolitan-Vickers Co.

We have to thank Mr. Johnstone Wright, city electrical engineer, for the details upon which this article is based and for the photographs with which it is illustrated.

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Important Steelworks Electrification.

Particulars of the New Plant.

Among the most important steelworks reconstruction carried out in this country for many years is that now being undertaken by the Consett Iron Co., who are modernising their steelworks and plate mills. The work on the coke ovens and steel furnaces is well advanced, and the orders have now

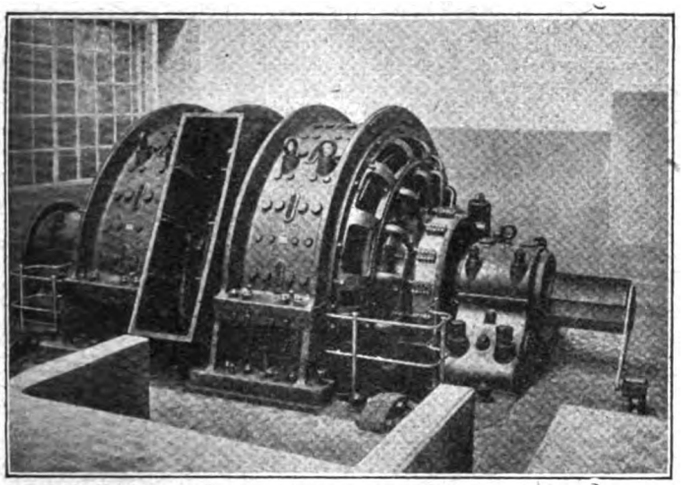

FIG. 1.—TYPICAL VIEW OF THE MILL MOTORS.

been placed for the new mill buildings, rolling mills and electrical drives.

This reconstruction involves the provision of four entirely new mills, consisting of a 40 in. slabbing mill, a 42 in. plate mill, a 32 in. light plate mill, and a chequer plate mill.

As might be anticipated, the whole of the plant will be electrically driven, and as the slabbing and plate mill are of the two-high reversing type, the drives will be on the Ilgner system.

The main reversing motors direct coupled to the mills will be duplicates, and will each consist of a double-armature motor designed for a maximum power of 14 000 H.P. between any speed of ± 50 to 100 revs. per min. A typical view of the mill motors is shown in Fig. 1.

The Ilgner Sets.

The flywheel Ilgner sets supplying the mill motors will again be duplicates, and will each consist of a 2 500 H.P. three-phase induction motor coupled to two variable voltage generators and a built-up steel flywheel, 48 tons in weight and 11 ft. 3 in. in diameter. The synchronous speed of the sets will be 600 revs. per min.

Under normal working conditions it is proposed to couple the two sets mechanically together, end-to-end, so that full use of the equalising effect of the two flywheels will be rendered

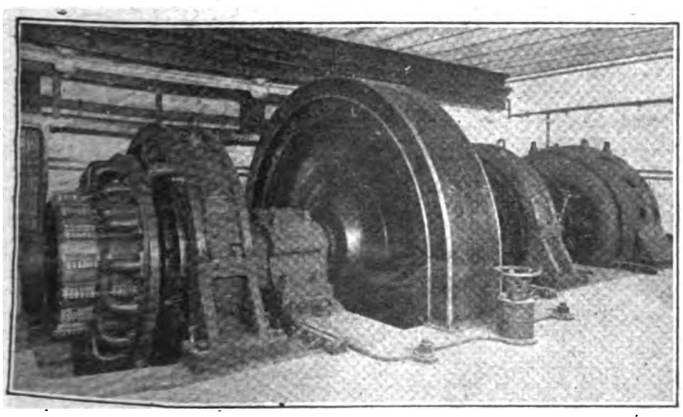

FIG. 2.—A TYPICAL FLYWHEEL MOTOR GENERATOR SET.

available for steadying the load demand from the station. Fig. 2 shows a typical flywheel set in which the arrangement of the machines is clearly shown.

Flywheel Arrangements.

By introducing the flywheel between the two variable voltage generators, the power transmitted from the flywheel passes in two directions, thus avoiding excessively heavy shafts. The length of the set is reduced to a minimum by the avoidance of any flexible couplings, the whole set being carried by five bearings.

The light plate mill is of the three-high type, and will be driven by a continuous running induction motor with a normal output of 2 500 H.P., 240 revs. per min. A flywheel of approximately 35 tons in weight, will be coupled between the motor and the pinion housing, this latter acting, in addition, as a reduction gear to give a suitable speed on the mill.

The chequer mill will consist of a single two-high stand of rolls, and will be driven by a three-phase induction motor of 750 H.P. running at 240 revs. per min. a flywheel 20 tons in weight, 8 ft. 6 in. in diameter, being interposed between the motor and the gearing.

The type of induction motor for the light plate mill and chequer mill is shown in Fig. 3.

The new mills will be of Davy Bros.' manufacture, whilst the electrical plant will be supplied by the ENGLISH ELECTRIC CO., whose experience of rolling mill work is well known. The two reversing drives now to be supplied will make the reversing mill equipments built by this firm 15 in number.

Power Supply.

To provide the necessary power the Consett Co. have on order two 3 000 kW generator sets, of which the turbines and condensers will be built by Belliss and Morcom, Ltd., and the alternators and condensing plant motors will be of the

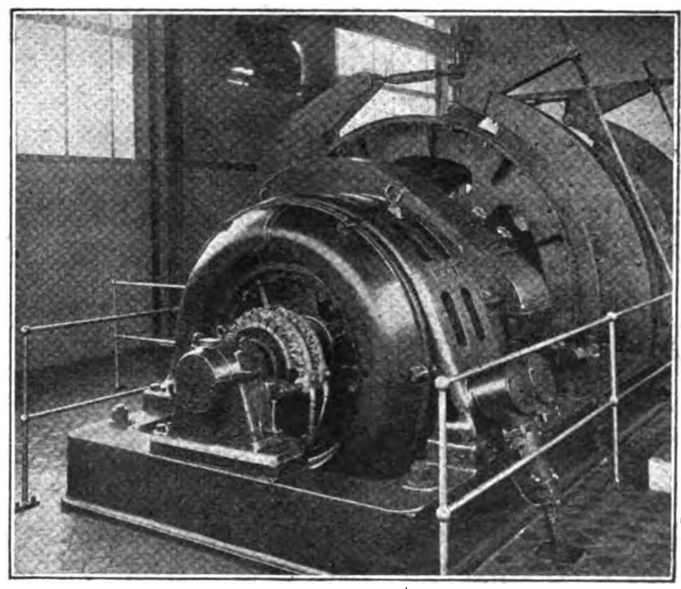

FIG. 3.—INDUCTION MOTOR FOR THE LIGHT PLATE MILL AND THE CHEQUER MILL.

English Electric Co.'s manufacture. Power will be generated at 3 300 V, 40 cycles, three-phase, the periodicity being chosen so that additional power can be drawn from the mains of the Newcastle Electric Supply Co., and the County of Durham Electric Power Supply Co., when desired, or conversely any surplus power can be delivered into the Power Co.'s mains.

City and Guilds of London Institute.

Forty Years of Electrical Engineering Instruction.

It is interesting to learn from the report of the City and Guilds of London Institute for the year 1922 that the number of students taking electrical engineering courses at the Central and Finsbury Technical Colleges has been gradually falling off during the past twenty years. The first of these institutions started in 1885-86 with thirteen electrical students, a number which rose continuously with one check to 160 in 1904-05. From this peak it fell off as gradually to 77 in 1913-14, when an alteration in the curriculum took place. At Finsbury 87 students took the electrical course in 1884-85 and the number reached 106, though not progressively, in 1892-93. After a fall it jumped to 101 in 1899-1900, and except for one year remained over 100 until 1904-05. Since then it has oscillated somewhat, though the general tendency has been to decrease. In 1917-18, doubtless owing to the uncertainty as to the future of the college, it was as low as 27, while in 1921-22 it was 37. It is interesting to note that there is much greater steadiness in the civil and mechanical engineering department at Finsbury, while at the Central the number increased steadily from 14 in 1885-6 to 289 in 1911-12.

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Merchandise to Sell and Profit By.

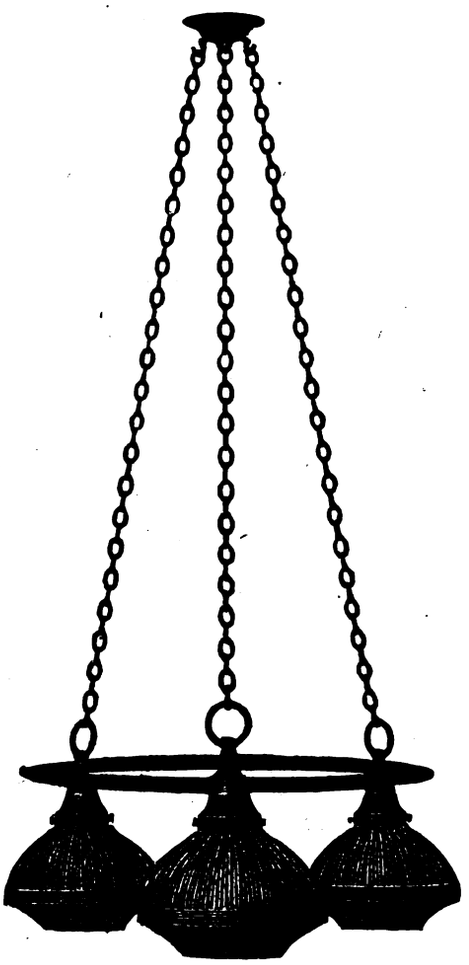
In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

Holophane Fittings for Church Lighting.

By the publication of the new catalogue of Holophane glassware and fittings, HOLOPHANE, LTD., have set a commercial reviewer a hard task. The purpose of these columns is to offer the best lines of "merchandise to sell and profit by," but the Holophane catalogue is so full of good things that they should all be shown and commented on. Space, however, forbids, but we purpose making selections from the catalogue, and referring to them from time to time in this column.



A NEW HOLOPHANE FITTING.

This week we illustrate a cluster fitting which requires more than the cursory glance which the severity of the design is likely to prompt. This severity has a purpose—that purpose being church lighting. The Holophane Co. know the requirements in this field, and the contractor should know that business in church lighting is far removed from saturation point. In our comments on other apparatus we have stressed the need for the more active development of this market. We shall be told that churches have no money to spend, but that is not an answer.

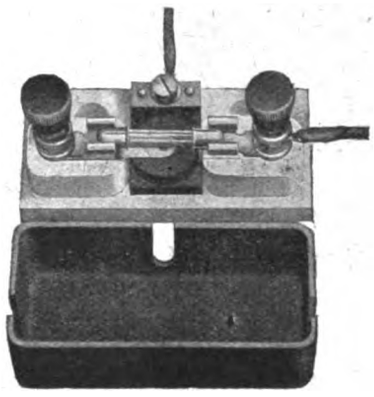
"Cosmos Fans"—A Lesson for the Future.

The weather has no respect for these columns of "merchandise to sell and profit by," and it is probable, in fact almost a certainty, that by the time this note is in print, the heat wave will have passed. Many retailers will still be regretting their lack of courage in not ordering stocks early in the season. However, the mistakes of the past are the lessons for the future, and we do not despair that in the very near future many manufacturers will be booking and delivering fans to retailers in the middle of April. It would be interesting to know how much turnover even a selected few retailers lost because of the fact that they had neglected to put a few fans "on the shelf." But manufacturers are determined that there shall be no flagging in their efforts to help the retailer, and the METROPOLITAN-VICKERS ELECTRICAL CO. are as determined as any. Owing to their stocks, with resulting service, together with their compelling publicity, there is no risk in hazarding that "Met-Vicks" have had a splendid season. Retailers with courage and vision shared this success, and those who did not will learn the lesson for the future. That lesson is, "as a man buys, so shall he sell."

A Market the Storm Created.

The recent storm which set all England agog, made a market for a simple protective device for wireless receiving sets, and all enterprising retailers will "jump in" with the right device at the right price to satisfy the demand. Such a device is the "Cosmos" protective device manufactured by METROPOLITAN-VICKERS ELECTRICAL CO. It is listed at 10s., which is the right price, and the brief description which we take from the manufacturer's leaflet No. 6691, will convince our readers that it is also the right device.

The device avoids the necessity of earthing the aerial by hand, which would otherwise be necessary in order to ensure safety,



RADIO PROTECTIVE DEVICE.

after each occasion on which the apparatus has been used. Moreover, when the protective device is used, it is quite safe to "listen-in," even during a severe thunderstorm. The device consists of a spark gap made up of a pair of carbon blocks separated by a perforated mica disc. This gap is connected between the aerial and earth terminals. Each of the carbon blocks is fitted with a plug of flexible metal, which melts in the case of a heavy discharge, thus ensuring definite and reliable earthing of the aerial, and thorough protection of the instrument.

The device is mounted on a base of the best quality British porcelain, deeply recessed at the back so as to obtain extremely high insulation. This is a very important point, since the poor insulation of the bases of many of the earthing devices in common use causes considerable loss of signal strength. All metal parts are nickelled.

G.E.C. Multiple Connectors.

The GENERAL ELECTRIC CO. manufacture the multiple connector which we illustrate. This device has been designed for connection

"GECOPHONE" HEADGEAR DISTRIBUTION BOX.

to a receiving set or low frequency amplifier, up to six pairs of head or hand telephones in series. Briefly described, it consists of a polished mahogany case with ebonite top fitted with stud switch,

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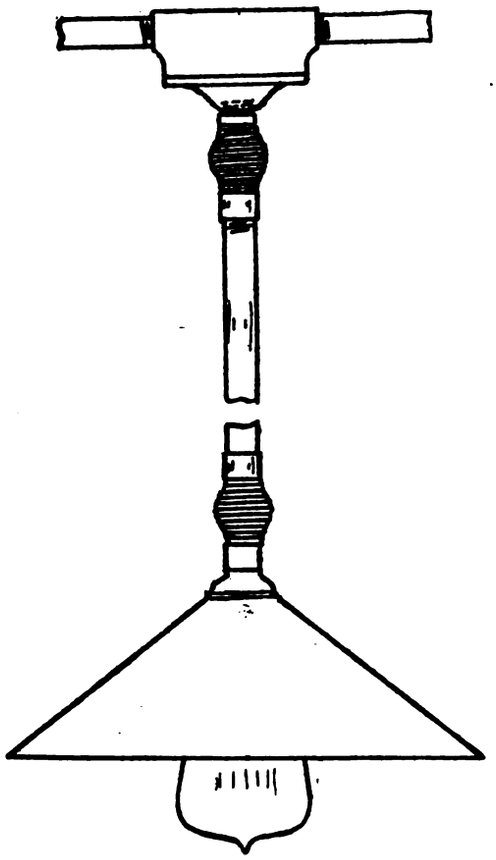
controlling six pairs of sockets numbered from 1 to 6. The position of the switch indicates the number of pairs of telephones in circuit—e.g., position 1 connects up the first pair, position 2 the first two pairs, and so on. The size is 8¼ in. by 4 in. by 3¼ in. high overall. The list price is 20s., and the appeal of this new device to the "wireless public" will be obvious. Progressive retailers will therefore not hesitate to order stocks. The device is an example of the unflagging determination of the G.E.C. to offer the retailer "something different."

An Anti-Vibratory Device.

There are certain situations which demand the use of an anti-vibratory device. It is therefore useful to have recorded on the purchasing cards the name of T. FRANCIS AND SONS, who are the manufacturers of the "Ainscow" anti-vibrator, which we illustrate.

This particular anti-vibrator consists of two brass screwed connections and a specially shaped spring, and is a robust and sound



THE "AINSCOW" ANTI-VIBRATOR.

article designed to stand rough treatment. The brass parts are turned out of solid rod and the spring, which is of best tempered steel, will stand a large extension without distortion. The device may be used as a suspension for large industrial fittings and reflectors instead of the usual hook and ring and allows the fittings to be in metallic contact with the tubing so that it can be easily earthed.

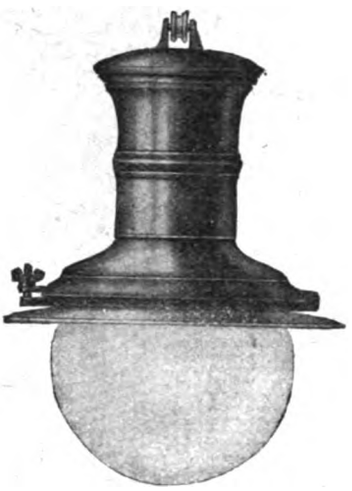
The "Ella" Converter.

We have several times laid stress on the market there is for simple apparatus for accumulator charging, and it is for this reason that we call attention to the "Ella" converter, which is marketed by LIONEL ROBINSON AND CO. at a list price of £5 12s. 6d.

It is a compact form of converter with one moving part rotating in two plain bearings. It can be directly connected to any d.c. supply with pressures from 100 to 250 V. The machine weighs 15 lb., and measures approximately 6½ in. by 5¾ in. by 8¾ in. It is finished in black enamel with gold lines. The converter comprises a field frame mounted on a cast-iron base with four holes for the holding down of screws. The high voltage and low voltage commutators are of substantial design with deep wearing surfaces. Large size carbon brushes are supplied with insulated adjustment springs. The high voltage terminals are fitted with a length of flexible cord and adaptor; the output on the low voltage side is 5 A at 9 V.

Quality and Design for 57s.

The buying index should record that ENGINEERING AND LIGHTING EQUIPMENT CO. are manufacturers of lanterns. We illustrate a simple lantern (probably familiar in design, but none the less serviceable and weatherworthy), which is but one of the large range which this company offers. It is important to know where to purchase this class of merchandise, because it is often that a job is lost because lanterns and fittings are either too expensive, or it may so happen that they are too cheap for the job. A nice balance is what is wanted, and to obtain it it is very necessary to know just where lanterns can be bought. The lantern which we illustrate is



THE "ALBAN" LANTERN.

known as the "Alban" and with clear or opalescent globe is listed at 57s. The same lantern can also be supplied with a glazed hexagonal attachment instead of the usual globe. With this combination the list price is 73s.

A Reply to Sceptics.

The day will come when retailers will plan their merchandising with a fervour of spirit and faith that will shake the world—certainly the electrical world. To-day we have too many sceptics. Particularly is this so with wireless apparatus, and the feeling of many is that the bubble has burst. Time, however, will prove them wrong, and therefore we shall continue to give prominence in these columns to wireless apparatus. We shall continue to advise retailers as to

THE SIEMENS LOUD SPEAKER.

those lines which, in our opinion, are amongst the best to be included in a merchandising programme for wireless.

We illustrate a loud speaker manufactured by SIEMENS BROS. AND CO. The endorsement of a piece of telephone apparatus with the name of Siemens is the hall mark of quality, and for this reason a description of this loud speaker, for purposes of argument, is not necessary. For technical reasons, however, a brief description will be of service. The speaker is made in three types—viz., 120 O, 2 000 O, 4 000 O. Each instrument is complete with a horn 16 in. in height, finished in a pleasing manner, and designed to give the best acoustic results. The low resistance type, used in conjunction with a Siemens telephone transformer, is particularly recommended, as this arrangement overcomes the trouble inherent in high resistance receivers, due to body capacities effects, and permits of a more robust winding being employed in the loud speaker.

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Municipal Electricity Finance.

General Reduction in Working Costs.

As already noted in previous reviews of municipal electricity department finances for the year ended March last, substantial net profits have been largely due to the considerable economies that have been effected in the cost of production. This feature is again noticeable in the accounts to which allusion is made below.

Developing Sales of Domestic Appliances.

In Scotland the GLASGOW undertaking shows a net surplus on the year's operations of £9 507, which, being transferred to the reserve fund, brings that total to £69 066. The revenue account records a decrease of income from all sources of £157 836, due to the concessions granted to consumers last year, the decrease on the average price received being ·437d. per kWh. On the other hand, the working expenditure shows a decrease of £142 318, which cannot be regarded otherwise than satisfactory when it is considered that 13 462 212 kWh more were generated this year than last year.

There is a noticeable increase in the number and variety of appliances installed for the consumption of electricity other than lighting in domestic and business premises. In domestic premises there are over 21 000 appliances, equivalent to a demand of 19 700 kW, and in business premises over 11 000 pieces of apparatus, equivalent to a demand of 15 800 kW, or a total of over 32 000 appliances with a demand of 35 500 kW. This is a class of business which should be encouraged, particularly in domestic premises. Domestic consumers are a stand-by to any electricity undertaking, and everything should be done to develop the use of current for purposes other than lighting. The quantity of electricity sold to private consumers during the year was 138 730 895 kWh, as compared with 128 655 216 kWh, an increase of 7·83 per cent.

Dundee and Carlisle.

At DUNDEE, where substantial reductions in charges were made last year, the undertaking has a balance of £31 453 remaining after meeting all working expenses and standing charges, while the profit on the CARLISLE electricity works amounted to over £7 000, the best figures recorded for some years.

A successful year's working at ACCRINGTON provided gross revenue of £81 377, which, after meeting gross expenditure of £35 345, left a net revenue of £46 032. After meeting all charges there was a net profit of £17 169. Reduced generation costs, which appear at £26 143, against £36 078, were mainly responsible for reducing working expenses by £10 203.

Eastbourne's Good Year.

A net profit of £18 315, against £9 454 in 1921-22, was made by the EASTBOURNE undertaking on a gross profit of £42 143, as compared with £29 869. Sales of energy totalled 3 926 099 kWh, an increase of 21 per cent., as compared with 15 per cent. for last year and 12 per cent. for the year before. The cost per kWh sold fell from 2·72d. to 2d., and the actual generating costs from 2·13d. to 1·49d. The past year has therefore shown excellent progress, and it is interesting to note that the percentage increase in revenue from private lighting was 11·95 per cent., notwithstanding that the charge was reduced by ½d. per kWh. As the borough treasurer points out in his report, this is to some extent accounted for by the fact that the cheapening of an article increases its use.

Stepney Breaks Records.

A record year in practically every respect resulted in a net profit of £65 645 on the STEPNEY electricity undertaking. The report discloses the fact that further substantial reductions have been effected in the cost of fuel, wages and repairs, and the progress of

(Continued in next column.)

Illuminated Road Destination Signs.

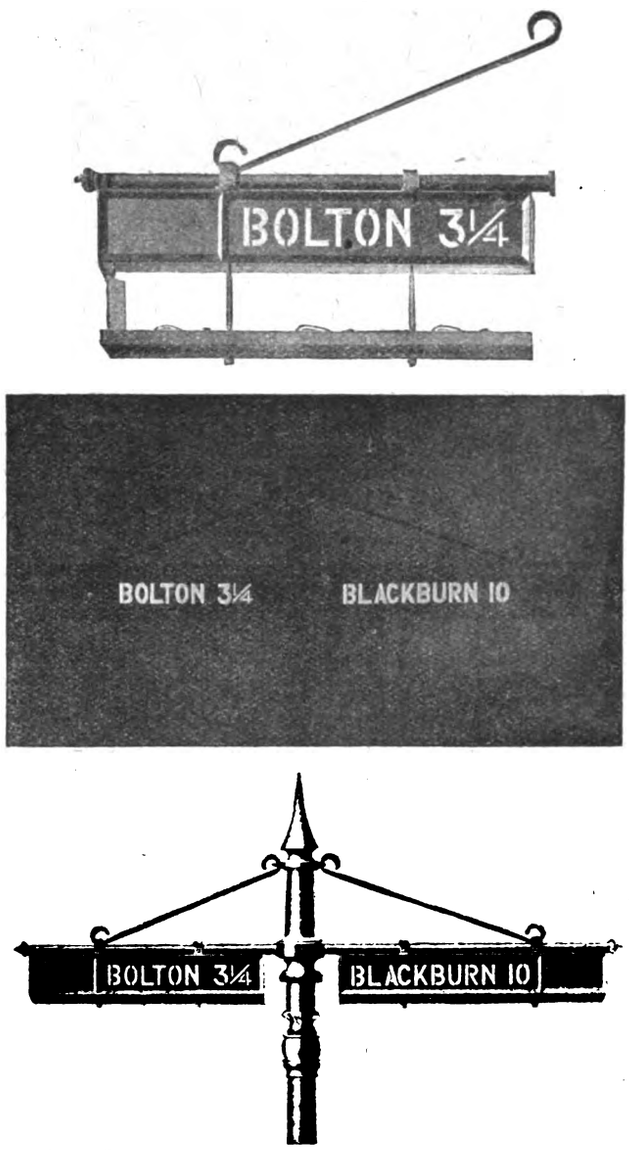
British Electrical Firm's Novel Device.

Sir Henry Maybury of the Roads Department, Ministry of Transport, speaking at the recent Urban District Councils' Association Conference at Llandudno, urged the use of illuminated signs for the use of travellers at night. "There was," he said, "£1 500 000 available for local authorities, and authorities who wished to embark upon schemes should send their applications at once."

Avoiding Delays.

Everybody who has done any travelling at night by road has often experienced the annoyance and delay caused by having to stop and use a flashlight or a match at a corner in order to read a finger-post. It has been a sore point with motorists and other users of the roads that the public bodies concerned have been more or less indifferent to the growing demand for an effective method of designating the roads by night as well as by day.

The signpost in general use today is often very indistinct even by day and, of course, cannot be seen at all by night. The BRITISH THOMSON-HOUSTON CO. have recently produced a sign which is claimed to be a distinct improvement on existing types. The sign is permanent and the lettering stands out quite clearly by day, while at night the letters are illuminated from the inside. One has already been erected on the Bolton-Blackburn road and the local authority concerned is to be congratulated on an innovation, which bids fair soon to become general throughout the country.



TOP: ILLUMINATED ROAD SIGN WITH BOTTOM LOWERED FOR CLEANING AND LAMP REPLACEMENTS. CENTRE: SIGN AS SEEN BY NIGHT. BELOW: SAME SIGN BY DAY.

Light Diffusion.

Since the universal use of such a sign would be appreciated by all users of the roads, a brief description will not be out of place. The sign is made of copper, and can be attached to the usual type of post or any other convenient support. It is exceedingly strong and consists of a massive copper box, the only movable part of which is the bottom. The letters are cut by stencil and backed with opal glass. A novel feature is the diffusion of the light, so that the whole of the lettering is evenly illuminated. As a rule in this type of sign bright spots appear immediately in front of the lamps, but in this case the lighting is absolutely uniform.

From the centre illustration it will be seen how clearly the words stand out when illuminated; they can be read at night at the same distance at which they become distinguishable in daylight.

The bottom, though not wholly detachable, contains the lamps, and is so made that it can be readily drawn down without disturbing the remainder of the sign or the wiring. This gives free access to the whole of the inside of the apparatus for the purposes of cleaning, renewal of lamps, etc.

(Continued from preceding column.)

the undertaking is further illustrated by the record number—1 380—of new services connected and the 4 873 804 kWh sold to consumers in the borough over and above those sold in this respect in the previous financial year. There is, too, a record income and a record return on capital, despite a reduction in the cost of production and in the price charged to consumers.

Big Surplus at Brighton.

On a gross profit of £66 144 as compared with £61 328 a year ago, the BRIGHTON electricity undertaking has a surplus, after providing for interest and sinking fund payments, of £27 808, more than £4 000 in excess of the previous year's figure. Of this amount it has been arranged that £15 000 shall be apportioned to the reduction of the rates.

Sales of energy rose from 11 408 003 kWh to 13 329 706 kWh and the average price obtained per kWh on the total supply was 3·1d. compared with 3·05d. The number of consumers rose by 1 103 to 10 347.

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Reinforced Concrete Telegraph Poles.

Results of Some Interesting Tests.

The results of some interesting tests which were recently carried out on a reinforced concrete telegraph pole have been sent us by F. W. BRADSHAW AND CO. The pole was of the "boom" type, and the test was undertaken after 90 days' maturing. The overall length of the pole was 30 ft., of which 25 ft. were out of the ground. It was designed for a 6 cwt. coupling load and 2 cwt. working load. After 30 days' maturing the weight of the pole was 6¼ cwt.; on the day of the test it was probably 6 cwt. For the purposes of test a post was placed in the ground and its foot inserted within a concrete casting made in halves and bolted together. The spaces between the outside of this casting and the sides of the hole in the ground were packed tightly with bricks.

The test rope was applied and made fast at a point 23 ft. above the ground level and carried horizontally over a pulley fixed to another telegraph post erected about 35 ft. in front of and away from the post to be tested.

The post was tested at right angles to the line of overhead wires, i.e., in the direction of greatest wind stress.

Weight Applied. cwt.	Deflection from Vertical. in.	Weight Applied. cwt.	Deflection from Vertical. in.
1	¾	5	13½
1¼	1⅛	5¼	14¼
1½	2	5½	15⅜
1¾	2¾	5¾	16½
2	3½	6	17¼
2¼	4	6½	19½
2½	5	7	20½
2¾	5½	7½	22¼
3	6¼	8½	26
3¼	7¼	9¾	The coupling bolts of the foot casting snapped and the ground gave way by reason of the leverage upon it. Post gave no signs of breaking.
3½	8¼		
3¾	9		
4	10		
4¼	10¾		
4½	11¾		
4¾	12¼		

(*a*) At 2½ cwt. a slight movement of the post at ground line appeared.

At 4¼ cwt. the bodily movement of the post in the earth was ⅛ in. at ground line, at 5¼ cwt. the movement appeared to be 3/16 in. at ground line.

(*b*) At 6 cwt. (i.e., the expected breaking point) no permanent set had taken place, but very faint hair cracks became visible.

The loads were now gradually released and the deflections noted were as below:—

Weight. cwt.	Deflection. in.	Weight cwt.	Deflection. in.
6	17¼	2	11
5	17¼	1	5½
4	16¾	Zero	1*
3	16½†		

The weights were again applied up to 9¾ cwt., at which point the ground gave way, but no set or crack appeared in the post, and on releasing the load the post resumed practically its normal condition.

Forty Years Ago.

"The Electrician," August 18th, 1883.

THE BUSHMILLS ELECTRIC RAILWAY.—The Lord Lieutenant of Ireland has signified his intention of visiting county Antrim, Ireland, on the 14th of next month, for the purpose of inaugurating the Electric Railway connecting Bushmills and the Giant's Causeway, which has been constructed by Messrs. Siemens Bros.

* * *

ROYALTY AND THE TELEPHONE.—A telephone from Ballater to Balmoral is being erected by Messrs. Tasker, Sons and Company, of Sheffield. The poles are placed along the north side of the turnpike road, and cross the Dee near the suspension bridge at Crathie to Dr. Profeit's and on to the Castle. A wire is carried from thence to Abergeldie, crossing the Dee near the Cradle. The telephone will be ready for use by the arrival of Her Majesty, which is arranged for the 25th inst.

* * *

ELECTRIC HEAD LIGHT.—A commission appointed in Bavaria to test the electric lighting apparatus for locomotives invented by H. Sedlaczek, of Vienna, has reported that, on a cloudy night, the light made it possible to distinguish objects on or near the track, including the colour as well as the form of signals, at a distance of 800 ft. in front of the locomotive, at which distance small newspaper print could be read by the light of the lamp. In passing stations the position of switches could be seen distinctly, and the light was visible for a distance of 2½ miles. The light, it reports, burns very steadily, and was not disturbed by the motion of the engine. It is so arranged that on curves it turns automatically, so as to throw light on the track.

* Difference due to ground movement. Post absolutely true and straight.

† At this point all hair cracks disappear.

Municipal Electricity Showrooms.

E.C.A. President on the Need of a Policy.

In a message to members of the Electrical Contractors' Association of which he is the new President, Mr. R. Robson states: "The municipal showroom is a question which requires considerable attention and study. In several branches co-operative working arrangements have been entered into. But we require a definite policy on this question as well as in trading, and a committee has been formed to gather information and define our policy. But I consider the most important point appertaining to this question is for our members to do their duty and to be first on the scene. To open their own shops and showrooms, and allow no corporation engineer to be in a position to say that his consumers are unable to see, and have demonstrated to them, electrical apparatus unless the corporation itself opens a showroom."

Indenturing Boys.

In regard to the question of indenturing boys, Mr. Robson says the Council has passed a standing order allowing any branch, if it thinks fit, to compel all members of that particular branch to indenture all their boys. It is believed by the Council that if a branch adopts this system it will prevent, to a great extent, work being carried out mainly by boys and thereby relieve undercutting. With regard to undercutting, Mr. Robson is endeavouring to reduce this as far as possible, and adds that he would like to see the financial status raised so that members would get a legitimate profit for their work. It is proposed, later on, to lay before members a system of cost-keeping mainly to show proper allowances for standing charges on various items and how certain items vary as to standing charges to others. The new President also hopes entirely to abolish the system of quoting and charging on the "per point" basis, whichhe describes as a curse to the trade. He looks forward to the time when all architects will send out electrical quantities as they do plumbing quantities.

Engineering and Machinery Exhibition.

Electrical Exhibits to Look For.

The official bulletin issued in connection with the Shipping Engineering and Machinery Exhibition, which opens at Olympia, London, on August 31st, which has been printed in English, French and Spanish, and circulated very largely abroad as well as at home, shows the wide range of interests to be represented. There is a list of some forty institutions, including the Institution of Electrical Engineers and the Cable Makers' Association, which are to pay official visits, and these functions will afford three weeks' exchange of courtesies between British manufacturers and potential customers from overseas.

Among the exhibitors of interest to the electrical industry will be the Anglo-Swedish Electric Welding Co.; Automatic and Electric Furnaces, Ltd.; W. Boby and Son; the British Arc Welding Co.; British Electrical Repairs, Ltd.; British Engine Boiler and Electrical Insurance Co.; British Engineers' Association; Cambridge and Paul Instrument Co.; Chadburns (Ship) Telegraph Co.; Concordia Electric Wire Co.; Edison Accumulators, Ltd., Electrical Apparatus, Ltd.; Electro-Mechanical Brake Co.; Elkay Electrical Manufacturing Co.; Foster Instrument Co.; Lea Recorder Co.; London Electric Firm; London Electric Wire Co. and Smiths; Premier Electric Welding Co.; Quasi-Arc Co.; Radio Communication Co.; Relay Automatic Telephone Co.; Reliance Telephone Co.; Swedish General Electric Ltd.,. Telephone Manufacturing Co.; British Thomson-Houston Co.; C. A. Vandervell and Co.; John Gibbs and Son; Alloy Welding Processes, Ltd.; H. R. Gear Co.; Buckley, Saunders and Co.; Auto-Welding and Engineering Co.; E. W. Farrow and Sons; Ransomes, Sims and Jefferies; the Midland Dynamo Co.; A. C. Alexander and Co.; H. C. Slingsby; Newton Bros. (Derby), Ltd.; Hesco, Ltd.; Laurence Scott and Co.; Sunderland Forge and Engineering Co.; G. D. Peters and Co.; Palnut Co.; J. W. Ray and Co.; F. Smith and Son (London), Ltd.; Werf Gusto Firma A. E. Smulders; W. Hamilton Wilson; Scholey Construction Co.; Joseph Booth and Bros.; Henry Joseph and Co.; Siemens Bros. and Co.; Record Engineering Co.; Sprecher and Schuh Co.; and Crosbie and de Mowbray, Ltd.

Miscellaneous.

According to a recent census, there are 9 577 ELECTRIC SIGNS in New York.

The Nobel Prize winner, Prof. Bohr, is still experimenting with the new element hafnium. The Copenhagen correspondent of "The Times" says it is expected that it will be possible to use hafnium in the manufacture of audion lamps in wireless telegraphy, and a Dutch firm is now investigating the possibilities of its use in this manner.

The CIVIL SERVICE COMMISSIONERS announce that an open competitive examination for not fewer than twelve situations as probationary assistant engineer in the Engineer-in-Chief's Department of the General Post Office will be held in London, commencing on November 6th next. The limits of age are 20 and 25, with certain extensions. Regulations and form of application will be sent in response to requests by letter addressed to the Secretary, Civil Service Commission, Burlington Gardens, London, W.1.

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The Manufacture of Wireless Apparatus.

Impressions of the Works at Ponder's End.

With the object of learning something of what is being done by the EDISON SWAN ELECTRIC CO. in the manufacture of wireless apparatus an ELECTRICIAN representative was recently afforded the opportunity of visiting the company's Ponder's End works, where everything from the glass valve bulbs to the headphones and batteries was seen in actual manufacture. As these works cover an area of approximately 36 acres it is only possible for us to indicate in the briefest manner some of the interesting things seen in a most interesting tour.

Our representative first visited the glass houses where the manufacture of bulbs of all types both for valves and electric lamps was in progress. Here there are five furnaces in operation, and work is, of course, carried out continuously during the 24 hours. The manufacture of glass tubing is a very interesting process, and the skill and accuracy displayed by operatives in this work is remarkable.

The next department inspected was the new valve shop, a spacious building with a floor space of approximately 14 000 sq. ft., specially built to deal with the manufacture of valves of all types. A neat little machine for fixing the grids on to their supports was particularly interesting, as also were the welding machines for fixing plates to their supporting stems. It may not be generally known that there are some sixteen different chemical elements used in the manufacture of a valve and about twenty-three separate operations are involved in the process.

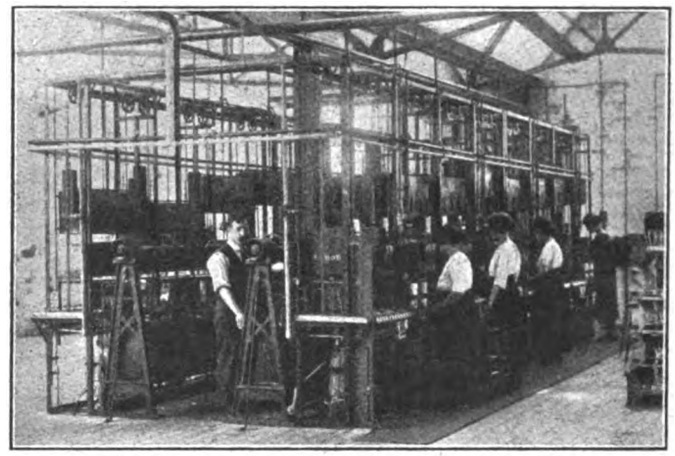

FIG. 1.—THE EXHAUSTING BENCHES.

Besides the well-known "R" and "A.R." types, a valve of considerable interest is the new "A.R.D.E." type "dull emitter," which has given satisfactory results on test and in actual practice. The filament of this valve is said to be considerably stronger than that of an ordinary type valve, and it is claimed to have a longer life in consequence of the low temperature at which it functions (approximately 400 deg. below that of an "A.R." type valve).

The valve test room, a corner of which is seen in Fig. 3, is another spacious department, where every valve is subjected to rigid tests and a certain number from each batch are also tested on actual receiving work. It might be mentioned here that, in addition to the large valve shop and this test room, something like 4 000 sq. ft. of space in another part of the factory is also devoted to valve work.

A view of the exhausting benches in operation is given in Fig. 1.

The engineering side of the works was next visited, the first department seen being the dry-cell shop where high-tension batteries of all types were being manufactured. Passing to the accumulator shop, every process from the casting of the grids, the sawing off, pasteing, forming, to the final assembling was inspected. Fig. 2 shows a part of the accumulator assembly shop.

From the wireless shop, where crystal and valve sets in all stages of manufacture were examined, our representative was conducted through several shops devoted to the production of accessories, and where the manufacture of component parts of all types, such as high and low-frequency transformers, variable condensers, Dewar keys, "headphones," etc., is carried out in its entirety. The telephone headpieces are made throughout in the works, and are very comfortable to wear.

FIG. 2.—PART OF THE ACCUMULATOR ASSEMBLING DEPARTMENT.

FIG. 3.—A CORNER OF THE VALVE TEST ROOM.

Electrical Imports and Exports.

Steady Increase in Volume of Trade.

IMPORTS.—The following are official values of electrical machinery, apparatus and material imported into this country (*a*) during July, 1923, and (*b*) the aggregate figures from January 1st to July 31, with increase or decrease compared with corresponding periods of 1922 :—

Electrical machinery, (*a*) £52 322 (decrease £22 320), (*b*) £605 865 (decrease £130 977); telegraph and telephone cables, submarine, nil, other than submarine, (*a*) £1 902 (decrease £108), (*b*) £55 767 (increase £37 668); telegraph and telephone apparatus, (*a*) £33 875 (decrease £10), (*b*) £307 908 (increase £89 681); other electrical wires and cables, rubber insulated, (*a*) £6 399 (increase £2 176), (*b*) £65 711 (increase £7 504); with other insulations, (*a*) £11 890 (increase, £4 865) (*b*) £70 712 (increase £34 937); carbons, (*a*) £5 746 (increase £2 541), (*b*) £37 213 (increase £15 485); glow lamps, (*a*) £9 807 (decrease, £3 163), (*b*) £103 558 (increase £5 107); arc lamps and electric searchlights, (*a*) £625 (increase £445), (*b*) £2 228 (increase £1 944); parts of arc lamps and searchlights (other than carbons), (*a*) £1 153 (increase £405), (*b*) £9 123 (increase £1 640); batteries, (*a*) £10 121 (increase £6 530), (*b*) £72 666 (increase £34 388); electrical instruments (commercial and scientific), and electricity meters, (*a*) £5 985 (decrease £163), (*b*) £57 576 (increase £18 566); switchboards, (*a*) nil (decrease £280), (*b*) £2 927 (decrease £71); other electrical goods and apparatus, (*a*) £61 564 (increase £25 582), (*b*) £470 361 (increase £182 424). Total of electrical machinery, apparatus and material (other than uninsulated wire), (*a*) £201 479 (increase £16 500), (*b*) £1 860 615 (increase £398 296).

EXPORTS.—The exports of electrical machinery, apparatus and material, produced or manufactured in the United Kingdom, (*a*) during July, 1923, and (*b*) from January 1st to July 31st, with increase or decrease compared with corresponding period of 1922, were as follows :—

Electrical machinery, (*a*) £312 164 (increase £38 523), (*b*) £2 256 646 (decrease £462 910); including railway and tramway motors, (*a*) £30 152 (increase £9 558), (*b*) £177 122 (increase £71 482); other generators and motors, (*a*) £171 614 (increase £35 602), (*b*) £1 177 185 (decrease £258 932); and other electrical machinery, (*a*) £110 398 (decrease £6 637); (*b*) £902 339 (decrease £275 460); telegraph and telephone cables, submarine, (*a*) £38 063 (increase £13 953), (*b*) £316 901 (increase £116 924); other than submarine, (*a*) £53 135 (decrease £8 621), (*b*) £531 875 (increase £192 423); telegraph and telephone apparatus, (*a*) £146 886 (increase £11 613), (*b*) £1 112 058 (decrease £35 925); other electrical wires and cables, rubber insulated, (*a*) £66 856 (increase £2 471), (*b*) £591 195 (increase £232 128); with other insulations, (*a*) £46 670 (decrease £27 533), (*b*) £549 494 (decrease £75 188); carbons, (*a*) £9 253 (increase £5 699), (*b*) £39 190 (increase £12 843); glow lamps, (*a*) £25 211 (increase £5 720), (*b*) £188 330 (decrease £28 657); arc lamps and searchlights, (*a*) £243 (increase £37), (*b*) £5 109 (increase £899); parts of arc lamps and searchlights (other than carbons), (*a*) £972 (increase £488), (*b*) £1 629 (decrease £3 766); batteries, (*a*) £45 319 (increase £1 689), (*b*) £312 616 (increase £31 179); electrical instruments (commercial and scientific) and electricity meters, (*a*) £24 781 (increase £7 656), (*b*) £192 602 (increase £1 286); switchboards, (*a*) £11 054 (increase £5 165), (*b*) £73 065 (decrease £93 092).

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Electricity Supply.

Extensions and Developments.

MARYLEBONE BOROUGH COUNCIL contemplates spending £16 070 on improving the public lighting of the main thoroughfares.

SLEAFORD Urban Council has applied for a loan for the provision and laying of a new set of auxiliary feeders, at an estimated cost of £2 090.

SALFORD Town Council has applied to the Electricity Commissioners for a loan of £76 973 for mains and services, sub-stations, equipment, etc.

WREXHAM Town Council has applied to the Electricity Commissioners for a loan of £900 for the erection and equipment of a sub-station at Acton Park.

The Warwickshire County Council has given conditional consent to the application of the Barford Electric Supply Co. for permission to extend its mains to WELLESBOURNE.

NORMANTON (Yorks) Urban Council has applied for a loan of £6 600 for the erection of a sub-station and the provision of cables, etc. It is proposed to take a bulk supply from the Yorkshire Power Co.

Having failed to agree to proposals made by East Anglian Electricity, Ltd., for increasing the supply of electricity, FELIXSTOWE Urban Council proposes to take over the supply at the end of the present agreement.

HEYWOOD Town Council has approved of a scheme for receiving an alternative bulk supply of electricity from the Bury Corporation, which, it was reported, would enable the Heywood Electricity Committee to dispense with its own generating station at Longfield.

HAZELGROVE and BRAMHALL Urban Council has applied to the Electricity Commissioners for a loan of £40 000 for carrying out an electric lighting scheme under the supervision of the consulting engineer, Mr. T. L. Mellor. Of the total, £32 000 is to be expended forthwith, and £8 000 is to be reserved for mains, etc., when required.

MALVERN Urban Council, which recently applied for a loan of £11 000 for extensions to the electricity works, has been informed by the Commissioners that they will sanction a scheme for taking a supply of electricity in bulk from Worcester for the requirements of Malvern. The Council has authorised the Electricity Committee to take such action as may be necessary to carry out the decision of the Commissioners.

Alterations in Charges, Proposed and Actual.

LYNN Town Council has decided to reduce the charge for lighting by ¼d. per kWh from October 1st next, while a 20 per cent. reduction is being made on power supplies. The charges for heating and cooking will receive further consideration.

SLEAFORD Urban Council has been granted an order fixing the maximum price for electricity at 10d. per kWh, and the following tariff per kWh has been adopted: Power and heating, 5½d.; lighting, etc., at places of worship and cinemas, 8½d.; general lighting, 9d.

The Ministry of Transport has granted an order to the WILMSLOW Electric Light Co. fixing the charge for electricity for the next three years at 10d. per kWh, with minimum payments of 12s. 6d. for each winter quarter, and 8s. 4d. for each summer quarter. The company applied for authority to charge 1s. per kWh.

Tapping New Areas.

LINLITHGOW Town Council is considering a proposal to introduce a system of electric lighting for the town and district.

It is reported that negotiations are proceeding with the Leicestershire and Warwickshire Electric Power Co. for an extension of the supply to BULKINGTON.

HANDFORTH Urban Council has decided to canvass the district with the object of ascertaining whether the demand for electricity is sufficient to warrant the Council undertaking a scheme.

CREDITON Urban Council has received from Mr. Melhuish particulars of an electric lighting scheme, the estimated cost of which is £8 250. Particulars of the scheme are to be placed before the ratepayers before any action is taken.

The National Electrical Construction Co. has informed the BOSTON Corporation that a supply of electricity will be available within a year. The main cables are already ordered, and a site is being secured for a generating station.

LEICESTER City Council is applying to the Commissioners for authority to extend the supply of electricity to Stoughton, Thurnby, Bushby, Scraptoft, Barkby, Barkby Thorpe, Birstall, Syston, Wanlip, Beaumont, Leys, Gilroes, Leicester Frith, Anstey, Anstey Pastures, Glenfield, Glenfield Frith, Braunstone, Braunstone Frith, Kirby Frith, Lubbesthorpe, and Thurmaston.

Inquiries and Orders.

The Minister of Transport proposes to confirm the LLANELLY Electricity (Extension) and the SAFFRON WALDEN Electricity Special Orders. Objections to the Secretary, Ministry of Transport, by August 25th.

WREXHAM Town Council has withdrawn its objection to the order constituting the North Wales and South Cheshire Electricity District and has agreed to take a bulk supply of electricity from the North Wales Power Co.

The Minister of Transport proposes to confirm the HORWICH (Lancs.) and the SHERBORNE (Dorset) ELECTRICITY SPECIAL ORDERS. Any objections must be sent to the Secretary, Ministry of Transport, Whitehall, London, by August 18th.

SANDWICH Town Council has agreed in principle to the application for an order to supply electricity by Sir Charles Bright and Partners providing the undertakers complete their arrangements to get electricity from the power house at Stonar and meet the Corporation's objections to certain clauses of the draft order.

The Electricity Commissioners have refused the application of the HUDDERSFIELD Corporation for special orders authorising the supply of energy to Kirkheaton, Kirkburton, Lepton, Meltham Marsden, and Slaithwaite. They have decided to sanction a similar application by Electrical Distribution of Yorkshire, Ltd., subject to certain modifications.

Miscellaneous Supply Items.

BEXHILL Electricity Committee recommends the abolition, from the end of the current quarter, of the practice of supplying energy to members of the staff of the electricity works at special rates.

According to the Agent-General for ONTARIO the retail cost of electrical energy in Ontario has remained practically stationary during the past few years, and is to-day less than before the war.

The Industrial Court has made an award regarding the wages of men in the SCOTTISH ELECTRICITY SUPPLY SERVICES, which include the municipal departments. The new rates for skilled workers are as follows: A Group, 1s. 4½d. an hour; B Group, 1s. 4d. an hour; and C Group, 1s. 3½d. an hour. Further changes are to be regulated on a cost-of-living basis. The existing schedule of working conditions will apply to the men involved, which will entitle them to an annual holiday of six days with full pay.

Personal Items.

The Maidenhead Town Council has granted honorariums of £25 each to Mr. J. DOWSETT, assistant engineer, and Mr. W. SHERVELL, station superintendent, in recognition of services during the illness of the borough electrical engineer.

Mr. A. V. SIMPSON, electrician, of Burnley, has just qualified for associate membership of the Institute of Radio Engineers. Mr. Simpson is only 22 years of age and has been working for some time on a new system of wireless telephony.

Mr. G. H. CROOK, signal and telegraph maintenance engineer to the Victorian Government Railways, has resigned in order to accept an appointment in the signal and telegraph department of the Great Western Railway, on which system he received his early training.

Mr. R. LEACH has resigned his position as sales engineer for Lancashire and Yorkshire and the adjacent counties with Ferguson, Pailin Ltd., and has taken up an appointment with Johnson and Phillips, Ltd., as chief assistant to the manager of their switchgear department.

COLONEL A. G. STEVENSON, who was officer in charge of electrical machinery at the Aldershot Military Power Station when it was first established, has now returned as chief engineer of the command. CAPTAIN A. J. MAYNE, who has just completed 25 years as chief electrical engineer to the command, has received a presentation and a testimonial from the staff.

Mr. J. H. Crossley, of the Metropolitan-Vickers Electrical Co., has recently returned from the United States, where he has been studying developments in industrial electric heating. Mr. Crossley started on this mission in January last, but after sailing for England in May his ship was wrecked off the coast of Newfoundland, and he only barely escaped with his life and minus his notes and reports. The loss of this material necessitated his return to America.

Although he continues to be the Chairman, Sir JOHN DENISON-PENDER has just laid down the managing-directorship of the Eastern Telegraph Co., which he has held for so many years, and jointly with Admiral Grant since 1918. Sir John's son, Mr. John C. Denison-Pender, succeeds to the post. Sir John succeeded his father in 1893 as managing director of the various companies in the Eastern group, and Mr. J. C. Denison-Pender thus represents the third generation at the head of the organisation.

We are informed that Dr. PERCY LONGMUIR, the director of research to the British Cast-Iron Research Association, has had to resign his post owing to a serious breakdown in health. Dr. Langmuir has now gone away to the East Coast for a rest, but will continue in office until next November. The council is taking steps to appoint at once a successor to Dr. Longmuir so that the research work now being carried out can be continued without a break. Before Dr. Longmuir finally retires he proposes to issue bulletins detailing the research work he has carried out.

Mr. JESSE L. JONES, chemical and experimental engineer of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pennsylvania, left New York by the s.s. "Manchuria" on August 2nd for Hamburg, thence travelling via Berlin and Paris to London. He is expected to arrive in London on or about Friday, August 24th. We understand that Mr. Jones is interested in getting in touch with persons having new technical materials, processes and inventions valuable to the electrical industry. After his stay in London he will proceed for a tour throughout Great Britain with the American Foundrymen's Association Tour, and he will attend the International Foundrymen's Association Convention in Paris, after which he will visit the foundries of France and Belgium.

WILL.—Mr. JOHN CHARLES SMITH, late accountant of the Anglo-American Telegraph Co. (net personalty £5 037) left £5 512.

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Imperial Notes.

AUSTRALIA.

State Hydro-Electric Enterprise in N.S.W.

At the opening of the New South Wales Parliament last week, states Reuter, Sir W. Davidson referred to a number of public works which the Government proposed to undertake in the near future. In this connection the generation of hydro-electric power would receive special attention, and a Bill providing for the constitution of a Commission would be introduced.

N.S.W. Railway Commissioners' Power Scheme.

The construction of the hydro-electric works at Middle River for the N.S.W. Railway Commissioners will be begun during the present year and work will be commenced shortly on the excavations for the dam. The money required for the work is expected to be available this month.

Electricity Projects in N.S.W.

Mr. Franki has been engaged to report to Nowra (N.S.W.) Council on a proposal to establish municipal electricity works.

The Inverell (N.S.W.) Chamber of Commerce is making inquiries as to the probable demands for electricity in the event of hydro-electric works being established at Jackadery on the Upper Clarence, with a transmission line to Glen Innes and Inverell, a distance of about 100 miles. A report on the proposal is being prepared by Armstrong, Whitworth and Co.

CANADA.

An Ontario Power House Contract.

Sir William Arrol and Co. have secured the contract from the Hollinger Consolidated Gold Mines for the construction of a dam and power house on the Abitibi River, Ontario, Canada. This contract, which apparently does not include the electrical machinery or transmission line that will be necessary to complete the scheme, is understood to involve about $1 000 000, or about £200 000. The total cost of the scheme is expected to be over $3 000 000.

An Electrically-Operated Postage Meter.

An electrically-operated postage meter that will seal and stamp an envelope, marking the requisite postage all in one operation, has been approved by the Postmaster-General in Ottawa, and there are indications that the time is not far distant when this device will entirely do away with stamps. Several of the new meters are already in operation in Ottawa and Toronto, and these are said to be of great assistance in the despatch of mails. Each machine is furnished with a permit number, and is under direct control of the department.

INDIA.

New Power Station at Maymio.

A new power station has recently been completed in Maymio, the opening ceremony being performed by the Governor of Burma. In the course of his speech the Governor mentioned that electricity would shortly be available in twenty-nine other towns in the Province.

Indian Railway Electrification Schemes.

Definite progress will soon be made with the electrification of the suburban sections of the G.I.P. Railway, as the Government has now given permission for work to be started on several sections as soon as the electrical equipment for which contracts have already been placed reaches the country. The first section to be electrified is the harbour branch line from Bombay to Kurla and the portion linking the harbour branch with the B.B.C.I. Railway at Mahim. The local passenger line between Victoria Terminus and Thana will also be electrified, and it is understood that this section will eventually be electrified up to Kalyan. It is also intended to electrify the Ghaut sections of the G.I.P. railway.

NEW ZEALAND.

Imports of British Electrical Machinery.

Although the United Kingdom still supplies more electrical machinery to New Zealand than any other country, the latest available statistics show that during the last two years a certain amount of this trade has been diverted to Canada and Australia. In the March quarter of 1923 we supplied electrical goods to the value of £185 304 as compared with £176 942 in the corresponding period of 1922 and £248 542, out of a total of £397 886, of which the United States supplied £105 926, in the same quarter two years ago. In the 1922 period Canada and Australia supplied goods to the value of £4 442 and £2 845 respectively, but these amounts were increased in the current year to £10 515 and £11 846.

SOUTH AFRICA.

Railway Electrification in Natal.

According to "The South African Mining and Engineering Journal," the work of electrifying the Glencoe-Maritzburg section of the main Johannesburg-Durban line is actually now in progress. This section is 180 miles in length, and it carries some of the heaviest traffic of any railway in South Africa. This is the first large railway electrification enterprise of the Union.

Foreign Notes.

EUROPE.

The Genoa Tube Railway.

According to a "Financial Times" correspondent, a concession has been granted to an Italian company, financed by Spanish-French groups, for the construction of a tube railway at Genoa. The works are estimated to ultimately cost 150 000 000 lire, and it is expected they will start early next year.

Versatility of Electrical Energy.

After exhaustive research and experiment the French Government has compiled a list of tasks which can be performed by 1 kWh. This unit, it is stated, will drive a sewing machine for 20 hours; save 1·05 gallons of paraffin; clean 15 steel table knives for a year; clip five horses or 25 sheep; heat water for shaving for one month; light three cigars a day for five years; heat a flatiron for three hours; boil 2·37 gallons of water; fry 15 chops in 15 minutes; heat a curling iron for 20 mornings; incubate 250 eggs; milk 20 cows; separate 350 gallons of milk; churn 440 pounds of butter; and chop half a ton of straw.

French Physics and Wireless Exhibition.

To mark the fiftieth year of its existence the French Physical Society is organising a National Exhibition of Physics and Wireless Telegraphy to be held in Paris at the Grand Palais from November 30th to December 17th next. The exhibition will be divided into nineteen groups and 59 classes, including wireless telegraphy and telephony, telegraphy and telephony, signals of all kinds, the distribution of electricity, domestic applications of electricity, accumulators, electric furnaces, electro-chemistry, cables, electric lighting and heating. Particulars are obtainable from M. R. de Valbreuze, 12, Rue Pellepont, Paris.

The Federation of British Industries announces that a museum of the world's industrial and other products is in process of formation at Armentières for educational and general purposes. Samples should be addressed to M. A. Rannau, directeur de l'Ecole, St. Charles, Rue des Promenades, Armentières, France.

Swedish Telephones and Telegraphs.

The Commercial Secretary at Stockholm states that, according to the annual report just published by the Swedish Telegraph Administration, the telephone apparatus in use throughout Sweden in 1922 numbered approximately 394 500, or about 66 telephone instruments to every 1 000 inhabitants. The number of subscribers increased from 310 705 to 317 455, a result attributed to reduced subscription rates. On December 31st, 1922, there were 4 143 telephone stations in Sweden, and the total length of the State telephone lines was 678 000 kilometres. In 1922 the Telegraph Administration received by way of income about 76 million kronor compared with 89 million kr. in 1921 and 77 million kr. in 1920. The reduction in the receipts is due to the lower subscription rates and other reduced charges. At the end of last year there were 3 475 telegraph stations in Sweden.

The number of wireless telegraph installations on board ship amounted to 264, and the number of wireless telegraph stations leased by the Telegraph Administration totalled 209, the fees from which yielded an income of 750 000 kr. The total number of telegrams dispatched amounted to 17 682 385, or a reduction of about 7·6 per cent. from 1921.

JAPAN.

Proposed Railway Electrification in Formosa.

According to the annual report of the Formosan Government Railway Department the original plan of having a line running completely round the island has been found to be impracticable. An alternative scheme is accordingly under investigation for connecting the east and west coasts of the island by means of an electrified line from the neighbourhood of Suiriko, on the Taiwan Electric Co.'s Nisui-Gaishatei line, near Lake Candidius, across the mountains to Kwarenko or a point further south. A survey of the proposed line has been commenced, and the sum of 50 000 yen has been included in the Budget for this purpose.

Telegraph and Telephone Notes.

The Central Telegraph Office announces that the ANGLO-RUSSIAN CABLE is restored.

THE NEW C.S. "FARADAY," owned by Siemens Brothers and Co., which was fully described in a recent issue of THE ELECTRICIAN, sailed from Woolwich on August 8th on her maiden voyage to lay a cable along the American coast.

The EASTERN TELEGRAPH CO. announces that on September 1st next a system of plain language cable letter telegrams will be introduced, acceptable on any day of the week (except Sunday), with a normal delivery after 48 hours, at one-quarter of the ordinary rate of charge, subject to a minimum charge for 20 words.

A prolific cause of ACCIDENTS IN OVERHEAD LINE WORK is the falling of tools or other small objects that are being raised by means of hand lines. To prevent such accidents, the Philadelphia Electric Co. uses a wooden-bottom canvas bucket for the hoisting of small tools and materials. Experiments are also being conducted with an inverted conical tent around the pole to catch falling articles.

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Electric Traction.

Tramway Extensions and Developments.

The question of widening the bridge over the Monkland Canal on the Cumbernauld Road at Riddrie, for GLASGOW Corporation tramways extensions, was discussed at a meeting of the District Committee of the Lower Ward of Lanarkshire.

A new type of tramcar brake is being tried experimentally on the LEEDS tramways, simultaneously with a similar trial in Birmingham. According to the "Yorkshire Post," the pressure is obtained from cylinders of compressed air, which are brought into operation electrically by the driver, with a switch quite independent of his ordinary driving controls. The brake is the invention of Mr. A. Maley, of West Bromwich, who was formerly an assistant engineer on the Leeds system.

The proposal of the ASHTON-UNDER-LYNE Corporation to run railless trolley-cars between Ashton and Oldham has been favourably considered by the Oldham Corporation Tramways Committee. The proposal has been made owing to the heavy cost that would be involved by the reconstruction of the existing tramways track.

LAMBETH Borough Council has referred back the London County Council's proposed tramway from West Norwood to the Crystal Palace. This proposal was first put forward in 1901 and has been discussed at intervals ever since.

NELSON tramways department is making application to the Ministry of Health for sanction to borrow £50 459 for relaying the light railway track.

The extension of the GLASGOW Corporation tramways from Dumbreck to the new suburb at Mosspark was opened on Sunday. The length of the extension is slightly under 1¼ miles.

The Minister of Transport has sanctioned the borrowing of £17 135 for the purchase of ten new covered top tramcars for LYTHAM ST. ANNES

Rapid progress is being made with the construction of the new tramway through Gosforth Park, NEWCASTLE-ON-TYNE, to link up the line at Wideopen with the main North Road route.

Re-constructed double-decker tramcars are gradually being added to the system served by the GRAVESEND and NORTHFLEET Tramways Co.

Fares, Receipts and Passengers.

GLASGOW Corporation has decided not to re-introduce the halfpenny tramway fare.

BRIGHTON tramways, on August Bank Holiday, carried 108 808 passengers, the day's traffic receipts totalling £801.

BURNLEY Tramways Committee has refused a request by shop assistants for workmen's tickets outside the customary hours.

BLACKPOOL Corporation tramways have created new records for Bank Holiday traffic. There were carried 284 478 passengers, and the receipts were £2 817.

Receipts on LONDON tramways controlled by the "Underground" group totalled £41 860 for the week ended August 4th, a decrease of £4 161 on the corresponding week last year.

Although the extension of the weekly tram ticket system on the BRADFORD tramways to the Duckworth Lane, Allerton, and Thornton routes took place in the holiday period the returns have proved very satisfactory, and bear out the results on the Lidget Green route.

Electric Railway Items.

Traffic receipts on the MERSEY Railway during the week ended August 4th totalled £4 570, bringing the aggregate for the year to date to £140 492.

In view of the great development in the district the METROPOLITAN RAILWAY is providing a new station between Uxbridge and Ickenham, to be known as Hillingdon.

It is expected that the reconstruction of the LONDON Underground Railway's Westminster Station will be completed by the end of September. The station at Piccadilly Circus is to be rebuilt, and will contain no fewer than six escalators and many other time and labour saving devices.

Miscellaneous Traction News.

The failure of a main feeder caused a temporary stoppage of the LIVERPOOL Corporation trams last week.

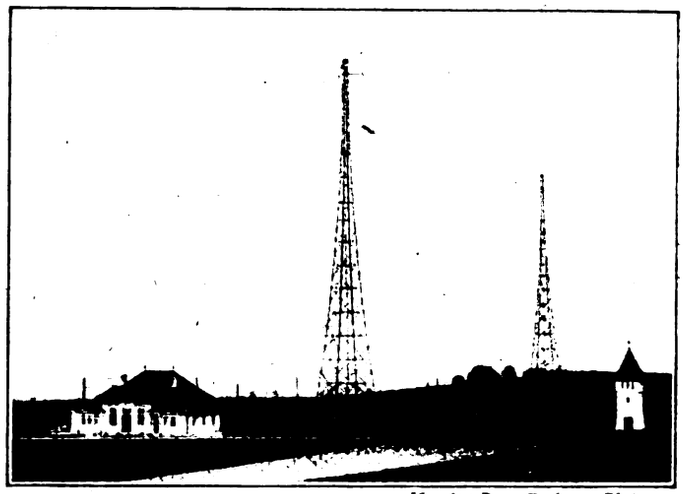
The Bulletin of the Chinese Government Bureau of Economic Information announces that progress is being made in the construction of the electric tramways in PEKING, and that track-laying operations have already commenced.

A memorial to the 58 employees of the PARTICK Tramways Depot who died in the Great War was unveiled last Sunday by Major-General H. L. Reed. A roll of honour has also been prepared of the 310 men of the depot who served during the campaign.

Wireless News.

Wireless Reception in Moving Motor Cars.

Demonstrations of the adaptation of the motor car to the reception of wireless broadcasting were given last week in Windsor Great Park. In one case the occupants of a 30 H.P. Daimler, travelling at normal speed, listened to the London programme with perfect freedom, and in the other the occupants of a small B.S.A. car drew up at the side of the road, cast one end of an aerial over the bough of an oak tree, and sat down to enjoy the programme on a loud-speaker. The experiments are said to have been quite successful and no distortion was apparent in the case of the reception on the running car. In the first attempts to receive broadcasting on running motor-cars the experimenters found reception hopelessly distorted by the sparks from their own magneto and from those of passing cars, but now the Daimler Co., acting in co-operation with the Marconi Co., has successfully "earthed" the magneto sparks and preserved the broadcasting waves unbroken. Furthermore, by the substitution of "lorgnette" head phones, they have settled a considerable difficulty where women's millinery and masculine comfort are concerned. Listeners now raise the lorgnette phones to their ears as they would a telephone receiver.



[London Press Exchange Photo.

THE MARCONI WIRELESS STATION AT BERNE.

Birmingham's New Broadcasting Station.

The aerial at the new Birmingham station of the British Broadcasting Co., which was opened last Saturday, is said to be among the largest in the kingdom. It is 210 ft. in height, and the distance between the insulators, which are fixed on two of the stacks of the Summer Lane Generating Station, is over 100 ft. The aerial which is of the T-cage type, consists of six phosphor bronze wires, each of seven strands of 20 gauge wire. The hoops, which are fixed inside the wires, are 4 ft. in diameter.

Value of Increased Wave Length.

In consequence of complaints that reception in some parts of the country was particularly bad, due, it was assumed, in some measure to the hot weather and long, light days, the British Broadcasting Co. has been experimenting with a wave length of 400 metres instead of the customary 369 metres for broadcasting items from the London station. Although some people declare that audibility has since improved by as much as 100 per cent., the B.B.C. officials are not yet satisfied that the problem of bad reception has yet been solved. It has been suggested that a possible explanation might be that many sets "tune in" better to 400 metres than they do to 369 metres. On Monday night several special items broadcast from London after the ordinary programmes were finished, were broadcast simultaneously from various other stations.

First Wireless Insurance Policy.

The Press Association has received a specimen copy of what is described as the "first wireless policy ever placed on the market." The policy follows the customary lines of insurance, and provides against loss or damage to the apparatus "by fire, lightning, storm, tempest, burglary, housebreaking, and larceny." The circular points out that landlords will usually withdraw any opposition towards the erection of aerials on buildings if the tenant proves that he is insured against damage to such buildings. It is a comprehensive policy, and an annual premium of 7s. 6d. protects against damage to the wireless apparatus, including aerial, and third party damage to the extent of £500, including damage to property belonging to or under the control of the insured person.

The Berne Wireless Station.

By the courtesy of Marconi's Wireless Telegraph Co. we are able to reproduce on this page a photo of the BERNE WIRELESS STATION. The illustration is of particular interest as showing how it is possible to make even a wireless station into an object possessed of some architectural beauty. In this connection the Berne station is in striking contrast to some of the stations erected in this country.

Wireless News in Brief.

Archæologists are protesting against a PROPOSAL TO ESTABLISH A WIRELESS STATION at Avebury.

It is expected that the ABERDEEN BROADCASTING STATION will be ready by the end of the month or the early part of September. The studio will be at the premises of the Aberdeen Electrical Engineering Co.

An experiment was made last week to see whether an elephant would obey the orders of his keeper broadcast from the London broadcasting station through a loud speaker fixed near the animal's cage. The elephant, however, did not respond.

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Tenders Invited.

GREAT BRITAIN.

LINCOLNSHIRE CO-OPERATIVE BACON FACTORY, LTD., CONINGSBY, LINCOLNSHIRE.—Equipment of factory with machinery, electric lighting installation, etc.—Particulars from Mr. B. E. Brighton, at the factory.

H.M. OFFICE OF WORKS, August 21st.—Electric wiring at Somerset House, London. Specification from the Contracts Branch, King Charles Street, London, S.W.1.

H.M. OFFICE OF WORKS, ETC., August 24th.—Heating apparatus for New Science Museum. Specifications from Contracts Branch, King Charles Street, London, S.W.1.

DOVER CORPORATION, August 25th.—About 50 tons of British standard tramway rails. Specification from the Borough Engineer.

LYTHAM ST. ANNE'S CORPORATION, August 25th.—E.H.T. paper insulated, lead covered and steel tape armoured cables. Particulars from the Borough Electrical Engineer, St. Anne's-on-the-Sea.

ENFIELD AND EDMONTON JOINT HOSPITAL BOARD, September 1st.—Two private telephone systems at World's End Hospital, Winchmore Hill, London, N. Specification, etc., from the Board's Architect and Surveyor, Public Offices, Enfield, Middlesex.

HALIFAX CORPORATION TRAMWAYS AND ELECTRICITY COMMITTEE, September 7th. One 10 000 kW turbo alternator, with condenser. Specifications, etc., from Mr. W. M. Rogerson, Borough Electrical Engineer, 29, Northgate, Halifax.

NORWICH CORPORATION, September 11th.—(*a*) Two 5 000 kW three-phase turbo-alternators, with exciters, condensers, auxiliary plant, etc.; (*b*) three 40 000 lb. per hour water tube boilers, with superheaters, mechanical starters, forced draught fans, etc.; (*c*) one motor driven pair of 12 kW boosters; (*d*) one 550 Ah battery; and (*e*) one 50 ton overhead travelling electric crane. Specifications, etc., from Preece, Cardew and Rider, 8, Queen Anne's Gate, Westminster, S.W.1.

NOTTINGHAM CORPORATION, September 14th.—Steam, water and other pipework, valves, tanks, etc., at North Wilford power station (section I). Specifications from Preece, Cardew and Rider, 8, Queen Anne's Gate, Westminster, S.W.1.

MANCHESTER WATERWORKS COMMITTEE, September 15th.—One set of electrically driven high pressure centrifugal pumps, to deliver 1 000 gallons per minute against a pressure of 1 120 lb. per sq. in. Specification from the Secretary, Waterworks Offices, Town Hall, Manchester.

LONDON COUNTY COUNCIL, September 17th.—Supply and maintenance of machine tools at the tramway repair depot, Charlton. Specification from the General Manager, Victoria Embankment, W.C.2.

MERTHYR TYDFIL GUARDIANS, September 18th.—Six months' supply of electrical fittings. Tender forms from the Clerk, High Street, Merthyr Tydfil.

AUSTRALASIA.

COMMONWEALTH OF AUSTRALIA, August 27th.—Testing and telegraph instruments (Q.597). August 30th.—Motor-generator set (N.S.W. 35). September 24th.—Telephone switchboard parts (T.410). October 6th.—Protective apparatus (Q.595). October 10th.—Protective apparatus (S.A.668). Particulars from the Supply Officer, Australia House, Strand, London, W.C.2.

POSTMASTER-GENERAL'S DEPARTMENT, BRISBANE, September 19th.*—Telephone apparatus and parts (Schedule No. 592).

SYDNEY CITY COUNCIL, September 24th.*—Consumers' electricity meters (contract 769).

SYDNEY CITY COUNCIL, September 24th.*—Sub-station apparatus (contract 746); November 19th.—Stepdown transformers (contract 758).

POSTMASTER-GENERAL'S DEPARTMENT, PERTH, October 10th.*—Battery plates, wood separators, etc.

NEW ZEALAND.

PUBLIC WORKS DEPARTMENT, WELLINGTON, October 22nd.*—One 400 kVA three-phase transformer, with oil and accessories, for Waikato power scheme (section 63).

SOUTH AFRICA.

UITENHAGE (CAPE PROVINCE) MUNICIPALITY, September 13th.*—Electrical plant.

JOHANNESBURG MUNICIPAL COUNCIL, September 18th.*—(1) Transformers; (2) 2 000 kW converter panel; (3) pole line, galvanised span wire, etc., for tramways (contract 134); (4) 500 rolled steel tramcar tyres (contract 126).

SOUTH AFRICAN RAILWAY DEPARTMENT, JOHANNESBURG, September 24th.*—Incandescent lamps.

STRAITS SETTLEMENTS.

SINGAPORE MUNICIPAL COMMISSIONERS, September 7th.—(*a*) 5 000 kW turbo-alternators and condensing plants; (*b*) water-tube boilers, draught plants and steel chimneys. Specifications from Preece, Cardew and Rider, 8, Queen Anne's Gate, Westminster, S.W.1.

URUGUAY.

COMISION DEL PALACIO LEGISLATIVO, Montevideo, October 15th.*—286 electroliers and brackets for the new Legislative Palace.

*Particulars from the Department of Overseas Trade.

Tenders Accepted.

DUMFRIES CORPORATION have accepted the tender of the Metropolitan-Vickers Electrical Co. for a rotary converter at £4 658.

HASTINGS CORPORATION have accepted the tender of the Brush Electrical Engineering Co. for plant for the new generating station, at £40 525.

The tender of Munro and Co., for wiring houses included in the Cathcart Road housing scheme, at £582 13s. 9d. has been accepted by the GLASGOW CORPORATION.

HALIFAX CORPORATION are recommended to accept the tender of Tilling-Stevens Motors, Ltd., for a 2 to 2½ ton chassis and two 25 H.P. motors for a trolley omnibus, at £763.

Lowke and Sons have secured the contract for the supply of electrical plant, with battery, and for wiring work at the NORTHAMPTONSHIRE TRAINING SCHOOL, TIFFIELD.

SOUTHEND-ON-SEA TOWN COUNCIL has accepted the tender of the May Construction Co., Ltd., for providing and fixing non-conducting material in the interior of Leigh sub-station at £542.

WESTON-SUPER-MARE URBAN COUNCIL have accepted the tender of Christy Bros. and Co. for electrical plant for Banwell Waterworks, and that of Sulzer Bros. for an additional Diesel engine and pumping plant.

STAFFS, WOLVERHAMPTON AND DUDLEY JOINT TUBERCULOSIS COMMITTEE have accepted the tenders of Ruston and Hornsby for an engine and dynamo, £531, and Smith and Bellhouse for electric light wiring and fitting, at Groundslow sanatorium, £575.

MARYLEBONE (LONDON) ELECTRIC SUPPLY COMMITTEE recommend acceptance of the tender of the Enfield Ediswan Cable Works, for special cables required for the new 12 500 kW turbo alternator, etc., at £1 927 10s. Two other tenders were received, £2 145 14s. 8d., and £2 015 12s.

The Vickers-Spearing Boiler Co. have received official confirmation of the order from the BIRMINGHAM CORPORATION for six water tube boilers with superheaters, economisers, stokers and accessories. The boilers are for a normal evaporation of 35 000 lbs. per hour at 325 lbs. steam pressure.

LIVERPOOL CORPORATION are recommended to accept the tenders of the Western Engineering Co., for wiring 75 houses on Edge Lane Drive and Walton Clubmoor estates at £7 17s. per type A house, and £8 11s. 6d. per type B house, and for rearrangement of electric lighting in the City Hospital East, at £88 17s. 6d.

For the South Eastern and Chatham portion of the SOUTHERN RAILWAY the English Electric Company are to supply 508 traction motors of 300 H.P. each, and the Metropolitan-Vickers Electrical Company 251 motor-driven air compressors, traction control apparatus, and heating and lighting equipment for 490 coaches. The aggregate value of the orders placed with the two companies is about £600 000.

The following tenders are recommended for acceptance by St. PANCRAS (LONDON) BOROUGH COUNCIL: J. G. Statter and Co. (lowest tender) for l.t. switchboard for King's Road power station, £2 578 9s. (22 tenders received, highest £5 080); A. Reyrolle and Co., for e.h.t. switchgear with automatic regulators, for King's Road power station, £19 980 (12 tenders received varying from £15 155 to £40 376).

STEPNEY (LONDON) BOROUGH COUNCIL are recommended to accept the following tenders: W. Lucy and Co. (lowest tender), 50 two-way disconnecting boxes, £60 12s. 6d. (4 tenders received, highest £132); Sutton and Co. (overseal) (lowest complete tender), one year's supply of troughs and covers, £314 6s. (5 tenders received, highest £3,603 13s. 7d.); Brighton Corporation 250 second-hand demand indicators, with broken strips, 10s. each.

SALFORD CORPORATION have accepted the following tenders: Hadfields, Ltd., tramway points, crossings, etc., £708; W. T. Glover and Co., 2 215 yards e.h.t. 3-core paper insulated lead covered cable, £1,341, 975 yards l.t. 4-core ditto, £624, and 5250 yards single core ditto, £1 164 10s.; De Laval Chadburn Co., oil purifier, £260, and 6kVA oil immersed auto-transformer, £27 16s. 8d.; Ferranti, Ltd., pressure testing transformer, £172 7s.; Metropolitan Vickers Electric Co., six 6 000 kVA s.p. transformers, £3 350 each, and one 6 000 kVA spare transformer, £3 285; British Insulated and Helsby Cables, 3 740 yards 3-core 33 000 V cables and auxiliary cables, £24 380 13s. 9d.

British Empire Exhibition.

Electrical Industry Supports E.D.A. Plans.

We understand that the plans of the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION for a combined display at the forthcoming British Empire Exhibition on behalf of the electricity supply industry, are maturing rapidly, and that a large number of undertakings, both municipal and company, have now taken definite steps to support the project. Recent additions to the list of collaborators show how widespread is the interest taken in the scheme, and it is gratifying to note that even among the smallest enterprises there is a commendable desire to be represented and to bear their full share of the expense. As previously announced, the management of the enterprise will be primarily a matter for the supporters, the suppliers of electricity. The example set by those undertakings that have already decided to take part acts as an incentive to others to contribute their part towards the provision of a valuable, business-promoting display.

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Company Meeting.

Benn Brothers, Ltd.

Satisfactory Results from Hard Work.

The twenty-seventh annual general meeting of Benn Brothers, Ltd., was held last Friday, at the offices of the company, Bouverie Street, London. Sir ERNEST J. P. BENN, Bart., C.B.E., presided.

The Chairman said: The report and accounts which are before you follow the example of their many predecessors, and show that your company not only continues to do well, but continues to do better. I feel, as I have always felt, that this business is capable of almost indefinite expansion, and it is very satisfying to me to see my hopes and aspirations justified. There may, perhaps, come a time when there will be a slackening in the pace of our forward march, but you may rest assured that your directors and the admirable staff that is working under them are always on the alert, watching for the first signs of any such novel tendency, and that no effort on their part will be spared to make it as remote as possible.

Strengthening the General Position.

The year 1922–23 was in most departments a little better than its immediate predecessor, but the figures, unless they are carefully examined and thoroughly understood, are likely to make it appear better than it really is. The sale of our book stock to a subsidiary company has given us a book-keeping profit which we cannot expect to repeat in the future. The price at which this stock was transferred is believed by your board to be a proper price in all the circumstances, but even so we have not felt justified in looking upon the sale as an ordinary sale to the book market. For that reason your directors have not allowed this item to influence them in deciding the rate of dividend that they will recommend, but have taken what they believe to be the wiser course of doubling the usual allocation to the reserve account, and have thus strengthened our general position.

Value of Personal Endeavour.

The satisfactory results of the year's trading are due to one cause, and to one cause only—hard work. My fellow-directors and the staff share with me the view that our fortunes are in our own hands, and that outside and political influences have far less power to help or to damage commerce and industry than is generally supposed. We hold the belief that our own personal work is the only thing upon which we can rely, and if trade can't be done in the Ruhr, well, we find it somewhere else. In any case, it is our business to find trade, whatever may be the conditions, and seeing that, as publishers, any trade which we do is only the first step in a much bigger volume of trade done by our customers, we are strengthened in our attitude, and rather proud of the success which accompanies it.

Demand for Technical Information.

The world to-day seems to be a little uncertain as to where it stands, and as to its real needs, but our experience shows that there is no uncertainty as to the need for technical information and industrial and scientific research. Our business is to minister to this need, and the growing circulations of all our trade and technical journals are the proof that we are doing our work satisfactorily.

The two main branches into which our business is divided, now arranged more systematically by the establishment of a subsidiary company, are periodicals and books. The periodicals give the latest news and information, which the trader, manufacturer, or retailer must have as soon as it is available, while in the books is found that complete record of the technology of an industry which is the basis of all efficient and progressive working. In both departments we are experiencing an ever-increasing demand, showing that, not only in this country, but the world over, the trading classes are taking their work more and more seriously, thus developing an ever greater degree of technical and scientific skill.

Publication of Standard Works.

We aim at leading the way in this great world movement, and to some extent we succeed. One could give innumerable illustrations. Automatic telephony is about to be widely introduced. We are the publishers of the standard work on the subject. Art is slowly beginning to be more generally recognised as having some connection with industry, thanks largely to the efforts of the Design and Industries Association, of which my colleague, Mr. H. P. Shapland, is this year chairman. Art is no longer a sort of minor department of the furnishing trade, and there is a widespread recognition that things in general may be beautiful as well as useful. This new idea, for it is a new idea, provides many openings for the publication of art books, and our catalogues show that we have taken full advantage of them.

A World-Wide Business.

Our business is becoming more and more a world-wide business It is perfectly natural and proper that in the collection and publication of technical and scientific and commercial data the whole world should be at our service, and we should serve the whole world. We continue to publish the "European Commercial" from Vienna, and to give the best information which is available week by week of actual conditions on the Continent. I need not remind you that this information has a way of differing, not only in form, but in matter, from much of the political material which is published in the general Press. That, indeed, is its value. It is part of our duty to get at the real facts of the situation in every part of the world, and during the year members of the London staff or special correspondents and agents have visited every country in Europe with the exception of Russia and Portugal. In the autumn of last year Mr. F. E. Hamer, editor of "The Chemical Age," and an ex-president of the National Union of Journalists, made an extensive tour of the Eastern States of America, bringing back to us information of first-class value.

Progress at Home and Abroad.

A great deal of progress is being made both at home and abroad in the art of printing and the processes of reproduction. Since the days when my father, the founder of the business, published in 1880 the first Meisenbach block to appear in a trade paper, Benn Brothers, Ltd., have always led the way in illustrated journalism and artistic reproduction. Our art books have given us opportunities to develop in this connection, and it is literally true to say that during the last year we have ransacked the world's markets for new ideas and new processes.

In this way we are doing our share to set a new standard in publishing, which brings me to the only other detail that I will trouble you with, our "Players' Shakespeare." The celebration of the tercentenary of our national poet appeared to us an event of such importance that in connection with it we attempted the most ambitious publishing project of recent times. The "Players' Shakespeare," a reprint of the first folio, under the general editorship of Mr. Harley Granville Barker, with illustrations by the world's authorities on stage settings, was described by the "Morning Post" as "a credit to human endeavour."

I could give you many illustrations from the past year alone of the opportunities which have presented themselves to us and our endeavour to take advantage of them, but that would not be material proper to a chairman's speech at an annual meeting. My object has been merely to give you a general idea of the aims and aspirations which actuate your directors, and to ask you to approve of the results which they have so far produced.

I beg to move the adoption of the report and accounts and the payment of a balance dividend which, with the two interim payments already made, will make a total, as before, of 17½ per cent., less tax, for the year.

The resolution was seconded by Mr. H. P. SHAPLAND, A.R.I.B.A., and carried unanimously.

The retiring directors were re-elected, and the auditors (Messrs. Cassleton, Elliott and Co.) reappointed.

Companies' Reports, Dividends, etc.

WASTE HEAT AND GAS ELECTRICAL GENERATING STATIONS.—Declaration is made of an interim dividend of 1½ per cent. on the issued share capital, payable, less tax, on August 31st, to shareholders registered on August 18th.

C. A. VANDERVELL AND CO.—The report for the year ended March 31st last states that stocks have been written down to market value at the date of the accounts. The loss for the year amounted to £18 111 (against £205 734 for the preceding year), which is more than accounted for by the loss on the sale of the Brighton factories. The total debit balance to be carried forward is £282 126. During the year £15 000 of the first debentures have been redeemed in accordance with the debenture deed, and in addition £13 600 has been paid in part liquidation of the second debentures.

Traction Company's Results.

TYNESIDE TRAMWAYS AND TRAMROADS CO.—The net profit for the half-year ended June 30th last was £3 127, plus the balance brought forward of £174, making £3 302. Deducting interest on mortgages, loans, etc., £1 914, there remains an available balance of £1 388. The directors propose to pay a dividend on the preference shares at the rate of 5 per cent. per annum (less tax), placing to reserve for renewals, depreciation, and other contingencies, £500, carrying forward £287. The falling off of revenue is attributable to smaller traffic on the company's lines caused by labour troubles and severe depression in trade, which have been prevalent in the district during the period. The annual meeting was held at Newcastle on Tuesday.

Supply and Lighting.

CLYDE VALLEY ELECTRICAL POWER CO.—The directors have declared an interim dividend of 3 per cent. actual on the ordinary shares, compared with 2½ per cent., less tax, for the corresponding period of 1922. The final dividend made 8 per cent. for the year, against 7½ per cent. for each of the two previous years.

New Companies.

E. B. J. GOULD, LTD.—Private. Cap., £2 000 in £1 shares. Electrical engineers, etc. Solicitor: C. D. Capner, 100, Station Road, Ellesmere Port, Ches.

FROGGATT AND PRIOR, LTD.—Private. Cap., £1 000 in £1 shares. Electrical, wireless and general engineers, etc. Reg. office: 211, Broad Street, Birmingham.

MAULE, HUNTER AND CO., LTD. Private. Cap., £20 000 in £1 shares. Electrical, motor and general engineers, etc. Reg. office: 11, Waterloo Place, London, S.W.1.

CROPLEY BROTHERS, LTD.—Private. Cap., £15 000 in £1 shares. Electrical engineers, etc. Solicitors: Hobson and MacMahon, 34, Essex Street, Strand, London, W.C.

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WESSEX ELECTRICAL SUPPLIES, LTD.—Private. Cap., £1 000 in £1 shares. Business indicated by title. Reg. office: St. Benet Chambers, Fenchurch Street, London, E.C.3.

NORTH OF ENGLAND ENGINEERING AND ELECTRICAL CO., LTD.—Private.—Cap., £1 000 in £1 shares. General and electrical engineers, etc. Reg. office: 125, Albert Road, Middlesbrough.

BRUNSWICK ENGINEERING CO., LTD. Private. Cap., £2 000 in 1 900 preference shares of £1, and 2 000 ordinary shares of 1s. Electrical and general engineers and contractors, etc. Solicitors: Fielder, Jones and Harrison, 25, Bloomsbury Square, London, W.C.

ECLAT ELECTRIC MANUFACTURING CO., LTD. Private. Cap., £500 in £1 shares. To acquire the businesses of making and selling electric lamps carried on by E. R. Grote, as "The Spencer Lamp Works" and "Standard Lamp Works." Solicitors: Bruce Millar and Co., 28a, Basinghall Street, London, E.C.2.

HENRY JOSEPH AND CO., LTD. Private. Cap., £4 000 in 3 800 6 per cent. cumulative preference shares of £1 each and 2 000 "A" ordinary and 2 000 "B" ordinary shares of 1s. each. Dealers in electrical appliances and accessories, shippers, forwarding agents, etc. Reg. office: 96, Victoria Street, Westminster, London, S.W.

CITY OF WELLS AND DISTRICT ELECTRICITY SUPPLY CO., LTD.—Cap. £15 000 in £1 shares. To adopt agreements (1) with Sanders Kennedy and Co., Ltd. for the sale and transfer of the benefit of a lighting contract with the Corporation of the City of Wells on payment of £100 expenses; (2) with the said company appointing them engineers; and (3) with A. H. Taylor for the sale and purchase for £300 of a plot of freehold land required for the erection of the company's generating station, and to carry on the business of electricians, engineers, manufacturers and workers of and dealers in electricity, motive power and light, etc. Reg. office: 25, Market Place, Wells, Somerset.

Electrical Workers' Wages.

The National Standardised Agreement.

The National Federated Electrical Association has circulated the following table showing the present scale of wages in accordance with the national standardised wages agreement between the Association and the Electrical Trades Union for a 47-hour week.

GRADE.	TOWNS AND DISTRICTS.	RATE PER HOUR FIRST PAY DAY IN JANUARY, 1923.	RATE PER HOUR FIRST PAY DAY IN OCTOBER, 1922.
		s. d.	s. d.
"A"	London. This rate includes a travelling allowance. No further allowances to be paid except as provided by Rule 9 of the London Rules, dated February, 1920.	1 8½	1 10
"B"	Mersey District, Southport, Manchester, South Wales. Those Towns and Districts which have agreed to follow the Mersey and or Manchester rates. Tyneside, The Hartlepools, Sunderland, Stockton-on-Tees, Middlesbrough, Darlington, West Riding of Yorkshire, Sheffield, Hull. Those Towns in Yorkshire which have agreed to follow the West Yorkshire or Sheffield rates. Bristol, Birmingham, Coventry, Wolverhampton. Those Towns which have agreed to follow the Birmingham rates.	1 6½	1 7½
"C"	The Towns of Southampton, Portsmouth, Plymouth, Devonport, Chatham, Bournemouth, Bath, Luton, Faversham, Sheerness, Gravesend, Crayford, Sittingbourne, Rochester, Dartford, Maidstone, Cambridge, Londonderry, Belfast and Carlisle. Towns and Districts not specified in Grades A or B which are in the Counties of Northumberland, Durham, Yorkshire, Lancashire, Cheshire, Lincolnshire, Norfolk, Suffolk, Essex (outside London area), Hertfordshire (outside London area), Nottinghamshire, Leicestershire, Derbyshire, Nothamptonshire, Staffordshire, Surrey (outside London area), Middlesex (outside London area), Bedfordshire, Oxfordshire, Berkshire, Buckinghamshire.	1 5	1 6½
"D"	The remaining Counties and Towns in England and Wales.	1 3½	1 4½

Provision is made for country allowance at 3s. 6d. per night for the first fortnight and 3s. per night afterwards.

American Dry Cells.

New Government Standard Specification.

The U.S. Bureau of Standards has issued a standard specification, No. 58, for dry cells. The following types of dry cells are affected by the specification:—Telephone or light-service cells; general purpose cells; ignition or heavy-service cells; flash-light cells and batteries; assembled batteries, exclusive of class; desiccated cells and other similar cells to which water must be added; and "B" batteries for radio service. Particulars are given in the specification of standard sizes, the type of carton, zinc can, sealing compound, terminals and cell connections, and voltage to which sellers to Government Departments must conform, and a list of tests is included.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"The Library of Furnishing"; "170 Years of English Decoration"; "Decoration of Furniture: Metal-work."

THE CHEMICAL AGE.—"The Manufacture and Uses of Chloramine T.", by M. Briscoe, B.Sc., A.I.C.; "Chemical Imports and Exports in July."

THE EUROPEAN COMMERCIAL.—"Monthly Review of the Chemical Industry in Europe and America"; "International Chamber of Commerce: Work of the 'Rome Resolution' Committee"; "Mines and Mining in Slovenia."

THE FRUIT GROWER.—"Canada's Orchards: An Englishman's Impressions"; "Market Garden Compensation"; "Digest of Horticultural Research."

GARDENING ILLUSTRATED.—"Tulips and Arabis at Chilverley Hall" (illustrated); "Gardening for the Novice"; "How to Grow Ferns."

THE GAS WORLD.—"Continuous Tar Distillation"; "The Fairweather Calorimeter"; "National Gas Exhibition."

THE HARDWARE TRADE JOURNAL.—"New Hardware Inventions"; "The Trade Barometer: British Hardware Exports"; 'Holiday Hardware Reflections."

Business Items.

MR. JABEZ SMITH, electrical engineer, of 1 and 2, Market Street, Faversham, and 28, High Street, Sittingbourne, has taken into partnership his son, Mr. William Ewart Smith, who has for the last twenty years managed the business at Sittingbourne. The business will be carried on under the style of Jabez Smith and Son.

With reference to a fire last Saturday at their premises in Grape Street, Shaftesbury Avenue, London, W.C.2, the ENTERPRISE MANUFACTURING CO., electrical engineers and manufacturers, announce that no serious damage was done, that all work in hand is being carried out with the utmost speed, and that no delay will occur through the unfortunate accident.

Electric Furnaces for Synthetic Iron.

Carburisation tests to determine the feasibility of making synthetic grey iron in an INDIRECT-ARC ROCKING-TYPE ELECTRIC FURNACE have been made at Detroit, Mich., by engineers of the U.S. Bureau of Mines. The results were very gratifying, an excellent quality of grey cast iron being produced in every test. The carbon content of the metal was under control. With this type of furnace it was found best to mix some grey iron scrap with the steel scrap in order to get the melting started at a lower initial temperature, and thus avoid overheating the roof. Test bars, 1⅛ in. in diameter, were made and broken on 12 in. centres. Deflections as high as 3·65 deg. and breaking strengths of 3 000 lb. were obtained.

Prices of Metals, Chemicals, etc.

TUESDAY, August 14.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£66 15 0	—	£0 15 0
Electro Wirebars	,,	£70 5 0	—	£1 15 0
H.C. Wire, basis	per lb.	10d.	—	1/32d.
Sheet	,,	10½d.	—	¼d.
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2d.	—	1/32d.
Brass 60/40—				
Rod, basis	,,	7½d.	—	—
Sheet, basis	,,	10d.	—	—
Wire, basis	,,	10½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 12 0	—	2s.
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 0 0	—	—
Lead Pig—				
English	,,	£25 10 0	5s.	—
Foreign or Colonial	,,	£24 2 6	2s. 6d.	—
Tin—				
Ingot	,,	£182 10 0	£1 0 0	—
Wire, basis	per lb.	2s. 5½d.	¼d.	—
Aluminium Ingots	per ton	£120 0 0	—	—
Spelter	,,	£31 10 0	5s.	—
Mercury	per bottle	£9 5 0	—	15s.

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2¾d.
,, (Roll-Brimstone)—,, £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. ,, £26 per ton, £7 10s.
Boric Acid (Crystals). ,, £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 3½d.; plantation 1st latex, 1s. 3½d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

COLLINS, W., AND SONS, 12-14, Mill Road, Kingsland Road, N., electrical engineers. £20 5s. 6d. June 18th.

ELECTRICITY HOUSE, LTD., registered office, 35, Queen Street, engineers, Wolverhampton. £17 12s. 10d. June 21st.

MATHEWS, A. W., AND SON, bk. 755, Attercliffe Road, Sheffield, electrical engineers. £11 4s. 4d. June 19th.

PUNTER, Claude M., 109, Ashton Road, Luton, electricians. £13 17s. 8d. July 6th.

WALKER, Samuel, 8, The Laurels, North Ormesby, electrical contractor. £16 17s. June 26th.

WATERLOO ELECTRIC CO., 129, Waterloo Road, S.E. £105 16s. 9d. June 18th.

Receiverships.

BRITISH WIRELESS SUPPLY CO., LTD. L. Nicholas, of 15, Springfield Mount, Leeds, was appointed receiver on July 24th, 1923, under powers contained in debentures dated October 19th, 1922.

MANAOS TRAMWAYS AND LIGHT CO., LTD. C. H. Julius, of 9, Cloak Lane, Cannon Street, E.C., ceased to act as receiver and manager as from August 1st, pursuant to an Order of Court dated July 19th, 1923.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

CALPHOS ELECTRICAL CO., LTD., electric lamp manufacturers, 70, Victoria Street, London. A meeting of creditors was held recently when the liquidator in the voluntary liquidation of the company, Mr. C. T. Payne, corporate accountant, 80, Lancaster Road, West Norwood, S.E., submitted a statement of affairs which showed liabilities £3 549, assets £767, from which had to be deducted £345 for preferential claims, leaving net assets £422, a deficiency of £3 127. A creditor expressed dissatisfaction with the position disclosed and proposed that the company be wound up in compulsory liquidation. An amendment was then proposed that the liquidation should be left in the hands of Mr. Payne and on being put to the vote it was decided that Mr. Payne should remain as liquidator of the company.

ELWELL (C. F.), LTD., radio engineers, Craven House, Kingsway, London, W.C.2. A circular has been issued by the company convening a conference of the creditors for the purpose "of seeing what can best be done in the interests of all concerned." It is stated that trade during the last three months has slumped to such an extent that it has been very difficult to carry on, and it is therefore thought advisable to discuss the matter with the creditors with a view to seeing what is the best course to pursue. The debenture holders are willing to let the company continue its operations, as they believe that the autumn will see a revival in trade, but, of course, they may be forced to act by any hasty action on the part of the creditors.

IRONCLAD SWITCHGEAR CO., LTD., Eccles Mill, Monton Lane, Eccles. This company is in voluntary liquidation, and the statutory meeting of creditors was held on August 10th at the Chartered Accountants Hall, Manchester, when the liquidator, Mr. W. P. Masterton, stated that the liabilities were: Secured creditors, £272; preferential claims, £635; unsecured creditors, £4 139. The Manchester and County Bank, Ltd., were creditors for £7 147, but the liquidator stated that they held security to the extent of £6 000. The assets were as follows:—plant and machinery, £1 245; fixtures and fittings, £300; office furniture, £107; jigs, £1 382; patterns and pattern tools, £1 500; good book debts, £652; doubtful debts, £884; and bad debts, £2 024. It was stated that the stock of the company as at February, 1923, was put down at £10 865. The liquidator added that on the figures submitted there would be a surplus to unsecured creditors of £3 649, but there were further claims to come in which he thought would amount to about £1 000 at least. The books of the company had been kept very badly since February, 1922. In a large number of instances firms were included as debtors to the company whereas he had had reports that their claims had been settled. The stock had been very much overvalued. The liquidator stated that before a proper statement of affairs could be prepared it would be necessary to make a full investigation of the whole of the company's books. The liquidator stated that the company was formed in February, 1919, with a capital of £4 000 divided into 4 000 £1 shares, increased to £12 000 in May, 1920. He added that at the present time 7 300 £1 shares were allotted and paid up. The present directors were E. W. Morgan and S. Whittaker. Mr. B. S. Blackwool resigned in June of last year. For the year to February, 1920, there was a loss made of £1 072. In 1921 there was a profit of £1 902. Year to 1922 a further profit of £456, while for the year to 1923 there was a loss of £970. The sales for the twelve months ended February, 1920, were £1 405; 1921, £12 696; 1922, £9 217; and 1923, £15 318. Dissatisfaction was expressed at the position disclosed, and eventually a resolution was passed in favour of the voluntary liquidation of the company being continued with Mr. Masterton as liquidator. A committee was also appointed. The following are creditors:—Electrical Consulting and Supply Co., £45; Fyfe, Ltd., £63; Morgan, E. W., £109; Whittaker, S., £111; Catchpole and Maurice, £147; Kent, W., £229; Manner Foundry Co., Ltd., £156; Smith, F., and Co., Ltd., £66; Sutcliffe, Hy., £126; Star Foundry Co., Ltd., £155; Wade, G. and Sons, Ltd., £137; Abis and Co. (Birmingham), Ltd., £176.

LOWTH AND SMITH, LTD., electrical engineers, etc., 3, Hanging Ditch, Manchester. A meeting of creditors was held recently at the Building Trades Association Offices, 10, South Parade, St. Mary's Parsonage, Manchester. No statement of affairs was presented but a statement of affairs was read disclosing liabilities £3 599, of which £3 120 was due to unsecured creditors, while the bank were claiming for £479. It was stated that the bank held collateral security. The assets consisted of office furniture valued at £50, deposits £27, motor wagons £20, stock £900 expected to produce £300, and debtors £1 400 expected to produce £600, making total assets £997, from which had to be deducted £35 for preferential claims and £515 for debentures, leaving net assets £447, or a deficiency as regarded the creditors of £3 152. After the matter had been fully discussed it was decided to confirm the voluntary liquidation of the company with Mr. McGregor as liquidator, with a committee of inspection of some of the principal creditors. The following are creditors: Baxendale and Co., Ltd., £48; Birmingham Products, Ltd., £32; Brown, S. C., Ltd., £47; Callender Cable Co., Ltd., £59; Crowther and Osborne, Ltd., £37; Electrical Supplies Co., Ltd., £36; Electrical Co., Ltd., £133; General Electric Co., £130; Hall Bros., £70; Henley Cable and Telegraph Co., £72; Johnson and Phillips, £20; Liverpool Electric Cable Co., £120; Metropolitan Vickers, Ltd., £72; Royal Accumulator Co., £83; Sloan Electrical Co., £86; Telephone Manufacturing Co., Ltd., £100; Telegraph Co., Ltd., £36; Underwood Co., Ltd., £39; Ward and Goldstone, £36; Edison Swan Electrical Co., Ltd., £38.

STOODLEY, Percival Walter, electrical engineer, trading as P. W. STOODLEY AND CO., 65, London Road, Camberley, Surrey. In response to a circular letter issued by Mr. E. T. Close, solicitor, 2, London Road, Camberley, a meeting of creditors was held recently at Camberley. In the circular calling the meeting it was stated that the debtor, finding himself unable to meet his obligations as they became due, had executed a deed of assignment for the benefit of his creditors, under which Mr. E. J. Feilden, of Alpha Chambers, Alexandra Road, Farnborough, was trustee. The statement of affairs presented showed liabilities of £650, while the assets consisted of book debts £72, and stock and furniture £150, making total assets of £222, or a deficiency of £428. The trustee under the deed stated that he did not think the assets would realise much more than £140 at a forced sale, and a resolution was passed confirming the deed already executed.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-Up Voluntarily.

NEWINGTON ELECTRICAL CO., LTD. David Bell, F.S.A.A., of Messrs. David Bell and Co., incorporated accountants, 14, Dale Street, Liverpool, appointed liquidator.

Bankruptcy Proceedings.

SWIFT ELECTRICAL, LTD. The following are scheduled as creditors in the compulsory liquidation of this company:—Best and Lloyd, Ltd., Birmingham, £170; Electric Ordnance and Accessories Co., Ltd., Birmingham, £141; T. Etchells, £35; Hall Bros., Ltd., Old Trafford, £29; H. E. Leigh, £107; London Commercial Electric Stores, £55; A. P. Lundberg and Sons, £30; Magic Appliances, Ltd., £33; New Italian Art Association, £51; Saxonia Electric Wire Co., Greenwich, £119; Siemens Bros. and Co., Ltd., Woolwich, £48; H. Sloog, £339; H. W. Smith and Co., Ltd., Lydbrook, £25; F. Thomas and Co., London, £24; Underwood (Manchester), Ltd., Manchester, £51; Vulcan Electric and Mechanical Co., Ltd., London, £23; P. Waltho and Bros., Wolverhampton, £93; Watshams, London, £114; Welco Patents, Birmingham, £27.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

181 368 F. PELLIN and G. PELLETIER. Resistances. (8/6/21.) (Addition to 165 099.)
199 255 METROPOLITAN-VICKERS ELECTRICAL CO. and A. G. ELLIS. Transformers. (20/6/22.)
199 258 J. H. L. BRIDGE. Inductance coils for use in wireless telegraphy, etc. (22/6/22.)
190 695 F.I.A.T. SOC. ANON. Electric furnaces. (23/12/21.)
199 279 J. ROBINSON. Wireless systems and apparatus. (31/7/22.)
199 283 IGRANIC ELECTRIC CO. (CUTLER-HAMMER MFG. CO.). Electrical capacitance control devices. (3/8/22.)
199 284 J. T. PEDERSEN. Power shut-off mechanism for electric motors. (9/8/22.)
186 314 BRITISH THOMSON-HOUSTON CO. Arc welding apparatus. (23/9/21.)
189 424 SULLIVAN MACHINERY CO. Electric controlling devices. (25/11/21.)
199 308 R. PÖRSCKE and F. FISCHER. Galvanic cells and batteries. (4/10/22.)
199 309 R. PÖRSCKE and F. FISCHER. Galvanic cells and batteries. (4/10/22.)
199 310 ANC. ETAB. BARBIER, BENARD, ET TURENNE, SOC. ANON. Carbon holder for arc lamps having rotary carbons. (23/8/22.)
199 315 A. B. PALES. Electrical interrupters. (13/6/22.)
195 929 AUTOMATIC TELEPHONE MFG. CO. Telephone instruments. (10/4/22.)
199 327 T. LENAGHAN. Automatic telephone systems. (16/1/22.) (Divided Application on 1 360/22.)
191 068 O. KURZ. Apparatus for collecting current from overhead lines. (7/3/21.) (Divided Application on 176 769.)
195 605 C. A. SIMPSON. Prevention of overheating of electric laundry irons, etc. (1/4/22.)
199 337 WESTERN ELECTRIC CO. Telephone systems. (27/2/22.) (Divided Application on 198 413.)
195 981 HART MFG. CO. Electric switches. (24/2/21.). (Divided Application on 175 972.)
173 505 KLEINSCHMIDT ELECTRIC CO. Printing telegraphs. (22/10 20.)
199 412 H. SEPTON-JONES (C. LORENZ AKT.-GES.). Method for multiple high frequency telephone and telegraph wires. (22/12/21.)
199 428 RADIO COMMUNICATION CO. and J. SCOTT-TAGGART. Radio frequency signalling systems. (23/2/22.)
199 434 RADIO COMMUNICATION CO. and N. LEA. Determining direction of electromagnetic or electrostatic fields. (13/3/22.)
199 451 STONE AND CO. and A. H. DARKER. Train-lighting dynamos. (20/3/22.) (Cognate Application, 25458/22.)
199 461 A. REYROLLE AND CO. and H. W. CLOTHIER. Electric switches. (22/3/22.)
199 471 C. S. FRANKLIN, B. J. WITT, G. M. WRIGHT and S. B. SMITH. Wireless telegraph receiving systems. (23/3/22.) (Cognate Application, 1332/23.)
183 801 E. HAEFELY ET CIE AKT.-GES. High-tension transformers. (26/7/21.)
199 480 WESTINGHOUSE BRAKE AND SAXBY SIGNAL CO. (UNION SWITCH AND SIGNAL CO.). Electric signalling system for railways. (25/3/22.)
199 521 N. CLOUGH. Systems of electric traction and suspension of overhead conductors. (5/4/22.)
199 523 F. C. B. CHASE. Insulating device for joints or connections in wires or cables. (6/4/22.)
199 526 CROMPTON AND CO. and W. F. JONES. Automatic circuit breakers. (7/4/22.)
199 535 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Oil-cooled X-ray apparatus. (12/4/22.)
179 157 AUTOMATIC TELEPHONE MFG. CO. Automatic switches of step-by-step type for use in automatic telephone systems. (29/4/21.)
199 546 R. A. DRISCOLL. Electric furnaces. (24/4/22.)
199 548 G. W. WACKER. Electrical alarm switches. (27/4/22.)
199 549 BRITISH INSULATED AND HELSBY CABLES, LTD., and G. H. NISBETT. Apparatus for distributing electric current. (28/4/22.)
199 554 H. KREBS and E. WOLFF. Magneto-electric machines. (1/5/22.)
181 335 FORGES ET ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE JEUMONT. A.C. motor groups. (9/6/21.)
199 560 EVERSHED AND VIGNOLES and J. C. NEEDHAM. Electric order telegraphs. (8/5/22.)
199 564 F. CICOGNA and E. MARIANI. Press-button switches for electrical circuits. (11/5/22.)
180 331 AUTOMATIC TELEPHONE MFG. CO. Automatic switches for telephone systems. (23/5/21.)
180 672 GES. FUR DRAHTLOSE TELEGRAPHIE. Arrangement for multiplying the frequency of an alternating current. (30/5/21.)
199 579 RUDGE-WHITWORTH, LTD., and W. H. WHITMIEL. Controlling magneto-electric machines. (31/5/22.)
199 588 METROPOLITAN-VICKERS ELECTRICAL CO. and E. A. BINNEY. Control of electric motors. (9/6/22.)
181 736 SIEMENS-SCHUCKERTWERKE GES. Electrical metal vapour apparatus. (18/6/21.)
182 486 WESTERN ELECTRIC CO. Switching devices for telephone systems. (2/7/21.)
186 896 WESTERN ELECTRIC CO. Telephone transmitters. (3/10/21.)
199 617 E. WILCOX. Couplers for tumbler switches. (17/7/22.)
185 722 R. C. ARTER. Circuit controllers. (8/9/21.)
199 651 SHIPTON, E. Electromagnetic receivers for telephony, etc. (26/9/22.)
199 655 JOHNSON AND PHILLIPS and W. J. P. ORTON. Outdoor junction boxes for electric circuits. (13/10/22.)
188 646 L. JUBLIN. Circuit breaker. (8/11/21.)
199 673 TYER AND CO. and F. W. LEAKE. Electromagnetic indicating device for railway purposes, etc. (12/12/22.)
199 678 BRITISH THOMSON-HOUSTON CO. and A. P. YOUNG. Telephone receivers and similar devices. (Cognate Applications, 16158/22 and 26980/22. Divided Application on 14300/22). (20/5/22.)
199 680 W. EDWARDS, L. ETHERIDGE and J. A. BAKER. Motor control circuits operated by series parallel controllers of tramway type, etc. (17/2/23.)
195 397 METROPOLITAN-VICKERS ELECTRICAL CO. Automatic electric control systems. (23/3/22.)
175 617 M. H. PETERSEN. Method for effecting an automatic continuous operation of copying telegraphs. (17/2/21.)
200,131 J. B. BOWER. Electrode holders for high-frequency electrical apparatus. (1/3/22.)
200 132 J. BOWER. Electrical interrupters or make-and-break switches with vibratory contacts. (1/3/22.)
200 144 R. B. RANSFORD (W. S. SMITH). Manufacture of electrical conductors. (6/3/22.)
200 149 K. BAUMANN and METROPOLITAN-VICKERS ELECTRICAL CO. Ventilating or cooling electrical machines. (10/3/22.)
178 117 COMPAGNIE FRANCAISE POUR L'EXPLOITATION DES PROCEDES THOMSON-HOUSTON. Safety devices for switch hooks of telephone instruments. (8/4/21.)

APPLICATIONS FOR PATENTS.

July 30th.

19 431 T. JONES. Emergency brake for electric trams, etc.
19 437 A. E. BEALTIE. Protection of telephone instruments against lightning, etc.
19 439 J. F. JOHNSTON. Attachment for wireless receiving installation to reduce interference.
19 445 O. T. BLATKY. A.C. Induction meters.
19 446 G. SANDWELL and R. C. B. STILLMAN. Electric switch.
19 452 F. CREEDY. A.C. commutator machines.
19 455 COVENTRY AUTOMATIC TELEPHONES (ARTER.). Telephone exchange systems
19 480 AUTOMATIC TELEPHONE MFG. CO. Telephone systems. (25/8/22, U.S.)
19 481 AUTOMATIC TELEPHONE MFG. CO. Telephone systems. (16/12/22, U.S.)
19 486 BRITISH ELECTRIC TRANSFORMER CO. and A. C. WHISH. Regulating voltage of a.c. supply systems.
19 488 BASTIAN METER CO. and A. E. SALISBURY. Electric heaters.
14 493 G. M. WRIGHT, T. L. ECKERSLEY and H. J. ROUND. Radio-telegraphy, etc.
19 499 PHILIPS' GLOEILAMPENFABRIEKEN. Glow cathode rectifiers. (31/7/22, Holland.)
19 500 BRITISH THOMSON-HOUSTON CO. Loud-speaking apparatus. (13/9/22, U.S.)
19 505 H. H. BERRY and J. W. REID. Electric fire.
19 521 F. N. CONI. Electric condensers.
19 524 H. A. P. LITTLEDALE. Wireless receiving apparatus.
19 528 J. C. WHITE. Fixing electric cables.

July 31st.

19 536 V. L. and L. L. WILLIAMS. Electric safety lamps.
19 545 G. C. SALSBURY. Ear-piece holder for telephones.
19 549 W. DRAPER and T. FAIRLIE. Electric burglar alarm systems.
19 552 G. SMITH, C. COLLINGWOOD and H. LEE. Device for securing electric lamp bulbs in holders.
19 578 H. COOTH. D.C. motors.
19 583 H. CAEN. Telephone apparatus.
19 586 GENERAL ELECTRIC CO., LTD., and A. C. BARTLETT. Unloaded telephone circuits, etc.
19 587 GENERAL ELECTRIC CO., LTD. Electrodes for tungsten arc lamps.
19 596 W. J. MELLERSH-JACKSON (INTERNATIONAL CALLOPHONE CORPORATION). Telephone systems.
19 606 ELECTROLYTIC ZINC CO. OF AUSTRALIA. Electrolytic recovery of zinc.
19 607 P. W. BAKER. Electric time switch.
19 608 ROSE STREET FOUNDRY AND ENGINEERING CO. and C. A. HADLEY. Electric resistance welding.
19 610 BRITISH THOMSON-HOUSTON CO. and A. P. YOUNG. Ignition magnetos.
19 617 DR. E. F. HUTH GES. Electrodes for thermionic tubes. (9/8/22, Germany.)
19 619 K. W. G. J. STOFFELS. Driving mechanism for electric rail cars. (1/8/22, Holland.)
19 620 W. J. GOODERIDGE. Electric horns.
19 635 J. W. HALL and H. V. MONTAGU-HARRISON. Thermionic valve coupling.
19 636 D. E. BARNETT. Terminals for electric conductors.
19 638 ACIERIES DE GENNEVILLIERS. Tramway crossings. (29/8/22, France.)
19 639 O. E. YEO. Wireless telegraph receiving apparatus.

August 1st.

19 657 R. MCGOWN. Receivers for wireless telegraphy.
19 661 H. C. BEESTON. Glands for cables.
19 674 E. MARTIN. Electric terminals.
19 676 WESTERN ELECTRIC CO. and G. H. NASH. Manufacture of electric cables.
19 685 W. L. HAMILTON. Controlling electric motors for cable haulage, etc.
19 689 M. KOOPMAN. Rheostats, etc.
19 703 L. USSHER. Electric switches.
19 719 C. G. LILLEY. Rejector circuit for wireless telegraph reception, etc.
19 720 C. G. LILLEY. Thermionic valve holder.
19 744 SEAL AND CO. (LONDON), H. D. PATTINSON, I. JASCOURT and J. ROSE. Combined electric lamps and batteries.
19 745 E. E. BATES. Basket coils for wireless telephony, etc.
19 750 W. G. and E. W. SMITH. Electric indicators.

August 2nd.

19 763 D. C. and T. S. ANDERSON. Electric fans.
19 766 L. H. and F. L. BODY. Electro dynamic machines.
19 778 WALSALL HARDWARE MFG. CO. and A. E. MILLARD, A. E. REID. Electric terminal fittings.
19 781 I. CALVETE. Electrical apparatus for generating high frequency currents.
19 784 J. B. A. E. PERANNE. Wireless telegraph apparatus, etc.
19 794 T. H. KOLOMAN. Electric safety fuse.
19 797 WESTERN ELECTRIC CO. Telegraph systems.
19 798 L. USSHER. Electric wiring, etc.
19 803 K. L. PALMER. Automatic wireless call device.
19 809 H. C. H. BRAUN. Burglar alarms, etc.
19 810 ENGLISH ELECTRIC CO. Hydraulic turbines.
19 811 W. CLARK. Loud-speaking telephones.
19 821 STOCKAEL, MARPLES AND CO. and J. J. STOCKALL. Wireless telegraph receivers.
19 836 C. E. PRINCE. Electric call apparatus.
19 842 L. J. STEELE, A. E. MCCARTHY and H. MARTIN. Electric welding.
19 850 T. BROWN and G. ELLISON. Cases for switchgear, etc.
19 861 E. L. MERRETT. Telephone speaking boxes.

August 3rd.

19 878 BRITISH INSULATED AND HELSBY CABLES, J. L. PACKER and C. VERNIER. Electric cables.
19 879 W. M. FRANCE and F. KAY. Arc lamp carbon holders.
19 982 OZON-TECHNIK AKT. GES. Electrically producing ozone. (3/8/22, Germany.)
19 888 R. HOPE and W. G. MORGAN. Telephone receiving apparatus.
19 898 CROMPTON AND CO. and W. F. JONES. Electric central switches.
19 899 CROMPTON AND CO. and W. F. JONES. Automatic drum type controllers.
19 900 CROMPTON AND CO. and W. F. JONES. Battery control apparatus.
19 916 FULLER'S UNITED ELECTRIC WORKS and A. P. WELCH. Telephone receivers.
19 927 H. F. VARLEY. Bunsen burners, etc.
19 931 H. E. LEIGH. Wireless telegraph fittings, etc.
19 933 F. KRUPP AKT. GES. Electromagnetic work fixing devices. (22/8/22, Germany.)
19 935 WESTERN ELECTRIC CO. Submarine telegraph systems.
19 937 WESTERN ELECTRIC CO. Telegraph systems. (3/8/22, U.S.)
19 938 WESTERN ELECTRIC CO. Continuously loaded signalling conductors. (3/8/22, U.S.)
19 939 RADIO-COMMUNICATION CO. and R. E. BESWICK. Electric terminals.
19 950 H. AYLIFFE. Sound amplifying apparatus for telephones, etc.
19 952 D. PEPPER. Batteries. (7/8/22, U.S.)
19 958 METROPOLITAN-VICKERS ELECTRICAL CO. Automatic electric substations.
19 968 ROSE STREET FOUNDRY AND ENGINEERING CO. and C. A. HADLEY. Electric resistance welding.
19 978 WATSON AND SONS (ELECTRO-MEDICAL) and G. PEARCE. Rhythmic interruption of electric currents.

August 4th.

19 998 F. WRIGHT. Audio-frequency transformers.
20 000 C. H. WOODWARD. Wireless telegraph apparatus, etc.
20 004 J. PRICE. Bushes for electric conduits.
20 016 J. F. HALL. Racks for cables, etc.
20 020 R. BOSCH AKT. GES. Dynamo electric machines. (12/8/22, Germany.)
20 024 and 20 025 E. A. GRAHAM. Microphonic transmitters.
20 030 J. C. LEE. Electric cable joint boxes.
20 031 WESTERN ELECTRIC CO. Signalling systems.
20 032 WESTERN ELECTRIC CO. (POLINKOWSKY). Telephone systems.
20 035 C. A. VANDERVELL AND CO. and F. L. HOLLISTER. Permanent magnets.
20 050 E. E. DUTT and S. H. GODFREY. Battery electrolytes.

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THE ELECTRICIAN

VOL. XCI.—No. 2362. FRIDAY, AUGUST 24, 1923. SIXPENCE

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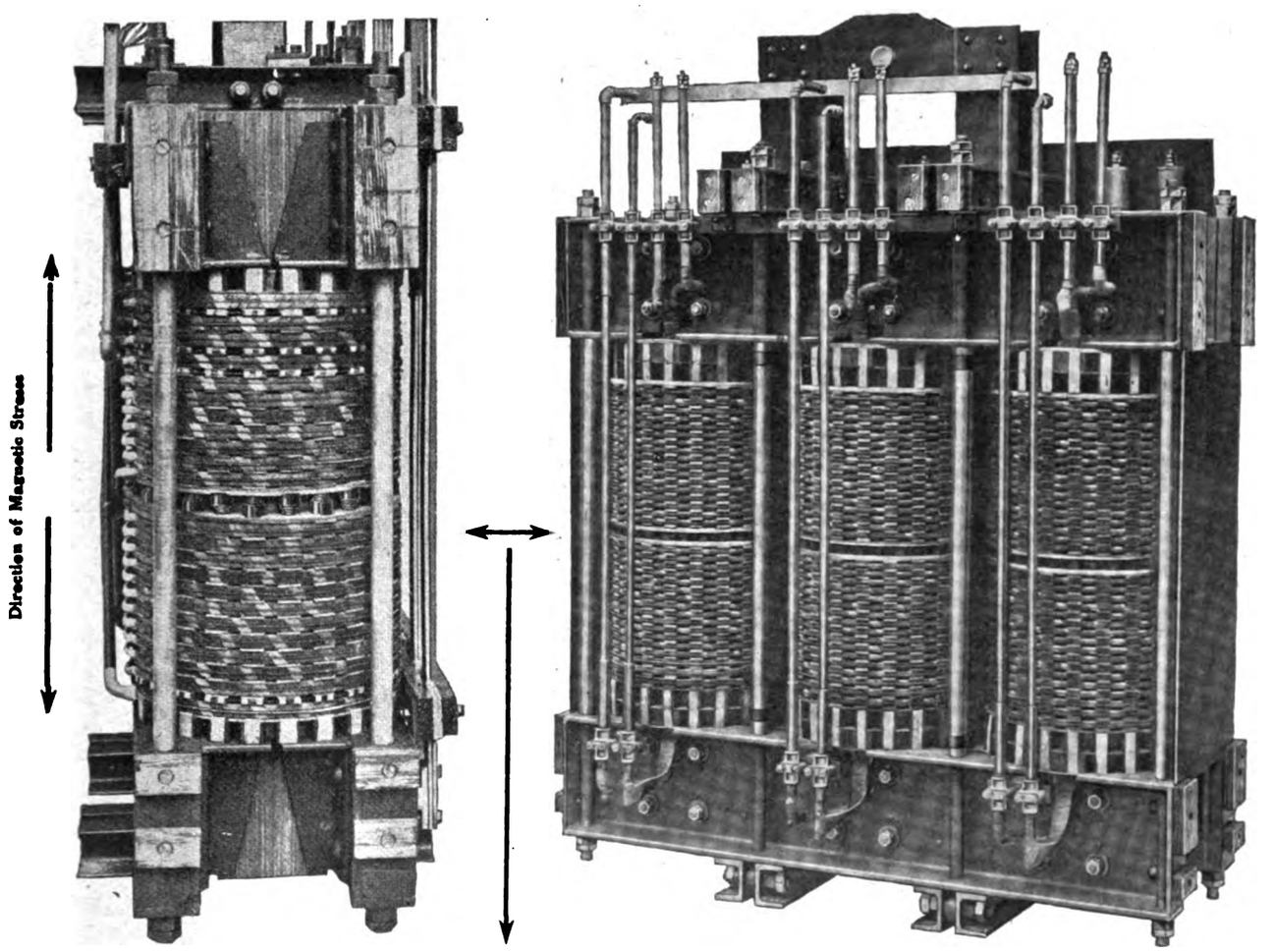

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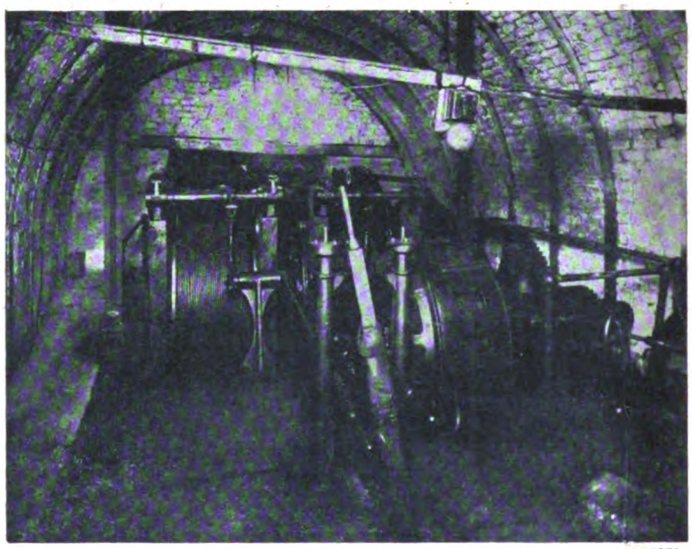

2351

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ESTABLISHED 1861.

THE OLDEST WEEKLY ILLUSTRATED JOURNAL OF

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Notes of the Week.

The Municipal Tramways Conference.

We propose next week to publish a full account of the proceedings at the 22nd annual conference of the Municipal Tramways Association, which opened at Portsmouth on Wednesday and which concludes to-day (Friday) with a steamer cruise round the Isle of Wight. Alderman Sir John Timpson, in his presidential address, recalled that the pioneer Act was passed just 60 years ago, and that only two years afterwards tramways were operated in Portsmouth, which thus formed an appropriate venue for the conference. One point strongly emphasised in the address was that tramway undertakings should be self-supporting and should not be a burden on the rates. There has been a regrettable tendency in this direction since 1913. At the same time wages and other items have not diminished very greatly, and it is evident that until working expenditure is materially reduced no general diminution in fares can be justified. The papers included an interesting account by Mr. Alfred Baker of experiments with trolley omnibuses in Birmingham—in which the author is a firm believer—a discussion of new car equipment by Mr. R. Stuart Pilcher, and a contribution on tramways as a municipal asset by Alderman H. Clark. We note that it is proposed in future to have papers presented before the International Union of Tramways and Light Railways (which has been invited to meet in this country in 1924) published both in English and French, a step that seems likely to be of service to tramway officials in both countries.

Research on Steam Nozzles.

The Second Report of the Steam Nozzles Research Committee, which was recently published by the Institution of Mechanical Engineers, is presented as the first attempt to carry out on a full-size scale a systematic investigation into efficiency of this important equipment. The factors concerned are complex and numerous experimental difficulties arose in the course of the work. The use of the impulse method for obtaining the thrust of the steam at the exit of the nozzle required special care, and superheat on both sides of the nozzle was necessary to ensure absence of moisture. The results are based on Callender's steam tables, which, although regarded as the most accurate and consistent, are not the only ones used; the use of other tables might affect the efficiency curves materially. For the nozzles tested the efficiency of the Parsons nozzle over the working range of modern reaction turbines varies from 98 per cent. at 280 ft. per sec. to 90·2 per cent. at 700 ft. per sec. For the working range of 980 to 1 300 ft. per sec. it is about 89 per cent. In general the angle of efflux of 20 deg. impulse nozzles appears to be the geometrical angle of the nozzle near the face; but there is an inward curvature as the steam gets further away, showing that pressure is not constant across the exit plane. Absence of any obstruction to steam passage is most important, and even the presence of flat surfaces has a marked effect. A complete series of tests was rendered abortive merely because some 2 in. of flat surface was left below the last nozzle in one of the tests.

Retailers and the Wireless Problem.

In view of the fact that the retailer is in close and constant touch with the consumer of wireless goods the recommendations and opinions with reference to wireless licences and "royalties" which have been placed on record by the recently formed Wireless Retailers Association are of more than passing interest. Some of the recommendations are obviously impracticable, but others merit the careful consideration of the Postmaster-General, to whom they have been submitted. We are inclined to agree with the Association that, subject to any special regulations for experimenters which may be deemed necessary in the national interest, there should be only one kind of licence for owners of receiving sets of all types, either home-constructed or not; but if this suggestion were adopted there would have to be some revision of the fee payable unless the Broadcasting Co. is to be deprived of a consider-

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able proportion of its revenue. If, however, a charge satisfactory to all parties could be arrived at the "one-licence" policy would tend to simplify, and incidentally expand, trade in wireless apparatus. As we pointed out in these columns recently, the interlocking of broadcasting and manufacturing is too close, and if the revenue necessary for broadcasting could be obtained from licence fees alone, a separation of these two activities, which would ultimately be to the advantage of all concerned, would then be possible. It is true that Sir WILLIAM NOBLE, in his recent exposition of the Broadcasting Co.'s case in THE ELECTRICIAN, expressed the view that the decision of the Post Office to retain the "royalty" method was a wise one. But, in the opinion of the Retailers' Association the "royalty" policy is prejudicial to the sale of instruments, and they therefore recommend that all direct contributions made by the public for broadcasting service should be paid as a licence fee or other form of separate annual payment

Development of Relay Stations.

WHILE the Association qualifies its demand for a flat rate fee of 10s. by a statement that this figure should be subject to reconsideration in the light of subsequently published figures, it would appear from the context that the retailers expect any revision to be downward, in view of "the probability that by means of relay stations it will be found practicable to broadcast from one centre for the whole country." Here the retailers seem to have gone somewhat astray, as there is no apparent intention on the part of the Broadcasting Co. to utilise the relay stations for sending out one stereotyped programme for the whole country. On the contrary, we understand that the system of local stations giving programmes of local interest will still be maintained, and the relay stations will be able to select their programmes from the items broadcast from the main centres. The relay stations will also bring within measurable distance the time when anyone possessing a simple receiving set in any part of the country will be able to enjoy a wireless concert every night. Developments of this kind cannot be made without the expenditure of considerable amounts of money, and it therefore seems hardly within the realm of practical politics to suggest or anticipate reductions in licensing fees for some time to come. We are in agreement with the suggestion that the proportion of the licence fee retained by the Government is unduly large, and that if levied as an entertainment tax it should be reduced to the same percentage as that charged in respect of other forms of entertainment. The Association takes this point a step further by pointing out that there is no more justification for the direct taxation of listeners-in than in the case of users of gramophone records or music rolls.

Workshop Efficiency.

CONTRIBUTIONS discussing "scientific management" in workshops are frequent nowadays, but are doubtless necessary in order to break down the prejudices which so greatly hamper progress. From this point of view, a paper recently read by Mr G. E. BAILEY before the Manchester Association of Engineers is useful, for it contains a survey of many modern manufacturing problems, amongst which the promotion of prompt and systematic co-operation between designers, drawing office and works staff is highly important. Such matters as planning and production, process and rate fixing, and inspection are also discussed in detail. Systems of inspection, it is pointed out, may prove extremely useful, both in checking mistakes and bad methods and in occasionally leading to valuable discoveries. But the selection of the inspecting staff needs very great care and their duties call for a special degree of tact and judgment. Mr. BAILEY agrees with other recent writers that the system of inspection must not relieve the foreman of ultimate responsibility for good work. Though the duties of the foreman have become modified of late, he still holds a "key" position in the works. Useful data on the handling of material, accounting and shop lay-out and equipment are included in the paper, and a special feature is the analysis of performances of different classes of machines. In conclusion, the writer emphasises the human side of production. His own experience of workers has been favourable, and he believes that employers, as well as Labour, must share the responsibility for the atmosphere of distrust that is so prejudicial to efficient work. Periodical discussions in which managers and workers take part are invaluable. In a nutshell, the secret of success undoubtedly lies in the maintenance of personal touch between employer and worker, the loss of which has been responsible for so much of the industrial trouble of the present day.

Illuminated Street Advertisements.

IN the current issue of the "Manchester Guardian Weekly" the Design and Industries Association, which is working to promote a greater appreciation of design and its application to industry among those who produce and those who buy manufactured things, has a friendly tilt at the design of some of the electric signs which are now so much in evidence not only in London but in many provincial towns. While admitting the usefulness of these signs and anticipating their multiplication to an extent perhaps hitherto undreamt of, the Association, with some justice we think, raises the objection that the method of attaching them to buildings frequently contributes, in no uncertain degree, to the spoliation, from the architectural point of view, of many of our most prominent commericial buildings and thoroughfares, particularly in the daytime when the masses of unsightly framework and other paraphernalia incidental to these signs meet the eye. Attention is drawn to the plight of the tenants whose windows are obscured by signs, which, in many cases, render the use of artificial illumination by day imperative, in addition to obscuring the view and excluding the fresh air; and it is suggested that the difficulty might be overcome if architects would design buildings lighted mainly from the roof, allowing the window space thus saved to be occupied by neat and permanent panels, inside which the sign mechanism could be fitted in such a way as to avoid interference with the lines of the building and protect the apparatus from the elements. There is much to be said for this suggestion, and it is to be hoped that architects and designers of electric signs will combine mutually to solve a problem which, when once it has been arrived at, may help materially to increase the use of this compelling form of advertisement. As Lieut.-Col. E. F. STRANGE said in a recent article on this subject in THE ELECTRICIAN, "the thing cannot be suppressed or 'controlled'—it may be improved."

A Debt Unpaid.

MUCH has been said and many schemes have been put forward of late with a view to finding employment during the coming winter for the appallingly large number of men who are unemployed. But less is heard of another and even more serious problem, that of finding suitable employment for the relatively large number of ex-officers and men of similar standing whose plight is, if anything, worse than that of the men for whom provision is already being made in the shape of work on railway electrification and other extensive development schemes. The fitting in of the 5 941 men who are still—through no fault of their own—on the register of the Appointments Branch of the Ministry of Labour obviously cannot be accomplished in the wholesale manner which is possible in the case of the unskilled classes, and it is difficult, even impossible, for the Appointments Branch to function properly without the active goodwill of the employing classes. That they have this is demonstrated by the fact that 5 523 names have been removed from the register since the beginning of the year; but the goodwill that leaves an even larger number still without work obviously requires brushing up, for only by renewed and concerted effort can these men be given a fair opportunity

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of restarting their civil career. We understand from an official of the Department that there are many men on the register who are qualified to take a variety of positions in the electrical industry, and that by communicating their staff requirements to the Appointments Branch at 3 and 4, Clement's Inn, Strand, London, W.C.2, employers can readily ascertain whether there is a man suited to their needs. The German Reparation problem is to-day exercising the minds of most of us, but we must not forget that we have not yet completed our own reparation to those who do not ask for charity but only for a job of work.

Engineers and Education.

In a recent address on "The College-trained Engineer," Prof. FREDERICK BACON said that he wanted the old hands at the game to tell the young what sort of engineers get fat jobs, and why. He went on to point out what sort of a man the college-trained engineer is and in what his training consists, indicating both directly and by implication that to attain the highest ranks in the profession, whether financially gilded or otherwise, a combination of both theoretical and practical knowledge is necessary. In a foreword to this address, which has now been published in pamphlet form, Sir HENRY FOWLER remarks that he himself went into the shops as an apprentice with two years' college training behind him, and that his education would have been much better if he had had a year in the shops between school and college. Thus we have two experts in two different branches of the profession definitely giving their vote for what has been called the "sandwich" system of education, and arguing not only that both theoretical and practical training are necessary (there used to be differences of opinion about this only a few years ago), but that these two sorts of training should, as far as is physically possible, be injected into the student simultaneously.

The Time Factor Difficulty in Education.

We are not going to quarrel with this decision except to point out that the method of training matters less than the use that is made of it, and that the time that is required for carrying out such a combined system is greater than many a young man can afford, especially as it is inevitably followed by a period of low wages during which education is not only being continued (as it should be throughout the whole of an engineer's life) but a continuous effort has to be made to orient the information acquired in the cloistered atmosphere of the schools to the conditions of everyday life.

Can Some Better Way be Found?

The time and money required (and time and money are the same things for the purposes of this argument) for such a training raises the question whether some better way cannot be found for preparing young men of what may be called the officer's class of the engineering profession? At present their scholastic career consists of a series of abrupt changes. The student attends a public or other school, where he is given a literary education with some scientific tendency. He is then suddenly switched on to a technical course in which he acquires theoretical knowledge with a greater or less degree of success. And, lastly, he is thrown into the world at the age of twenty or so with a market value which for some years is accurately reflected by the low wages which he can obtain. Eventually, of course, most embryo engineers attain positions of responsibility and some rise to eminence, but the start is very slow and the efficiency of the whole process extremely small.

Co-operation Required.

Now, accepting Sir HENRY FOWLER'S and Prof. BACON'S joint dictum that theoretical and practical education should go hand in hand, it may be asked whether this result cannot be obtained in some other way by the co-operation of the professional institutions concerned, the educational authorities and the manufacturers and others connected with the business of industry. Is there any reason, for instance, why the excellent apprentice courses which are to be found, for example, in the Admiralty Dockyards and in the works of the Metropolitan-Vickers Electrical Co. should not become more general? Is there any reason why the young engineer should continue at school until he is eighteen or nineteen? Is there any reason why he should not enter works at fourteen, and begin his specialised theoretical and practical training at that age rather than some years later? That is the course followed by the budding Naval officer, and we have yet to learn that it suffers on the score of inefficiency.

A Sociological Reason.

There is a sociological as well as an educational reason why such an arrangement has much to recommend it. In the technical colleges, with the present syllabuses, young engineers are being trained to be officers. That excellent scheme, which has been jointly prepared by the Board of Education and the Institution of Electrical Engineers, is designed to train men of what may be called the non-commissioned officer class. These are democratic days and engineering is democratic work. Much would be gained by amalgamating these two schemes of education and giving all concerned an equal opportunity to rise or to find their own level. There is yet another reason why such a scheme is worth examination. At this time of year we hear complaints from students who have completed a college course of the difficulties of securing work. We sympathise with them. But the real difficulty is with the employers, who have few suitable positions to offer them. If they obtain work they are for a greater or less period like a fifth wheel of a coach, and, whatever may be the ultimate result, the efficiency of the organisation is not for a time increased by their presence.

Selection at an Early Age Desirable.

On the other hand, if at the age of fourteen or fifteen the boy who can pass a simple entrance examination, and who is physically fit, is admitted to works, there to receive not only practical instruction but a theoretical training directed to the needs of the particular branch of the industry he has selected, he is not only specialising sooner but his employer is discovering his exact value, and the quality of the recruits who are entering the industry is being gradually raised. From a batch of such recruits with different intellectual capacities entering a works it will be possible in a short time to select those who are best fitted to be managers, salesmen, designers, foremen and so on, and to regulate their training accordingly. It may be argued that this will deprive engineers of a University training. But it will not do so. All it will achieve will be that only those who are fitted to derive advantage from such higher education will be allowed to undertake it. It may reduce the number who attend our technical universities, but it will increase the quality of the product.

Connection of Education and After-Life.

This is a matter which we do not expect to see settled without a great deal of controversy, and it will never be settled at all without the co-operation of all concerned. The tendency up to now has been to divorce education in the ordinary sense of the word too much from the conditions of what follows after. It is hard to see how it can be otherwise, unless those whose business is in the industry itself take steps to bring about a change. Manufacturers are beginning to realise that research, which means the examination and arrangement of materials, is worth while, whether it has any direct practical bearing or no. Electrical engineers as a whole must recognise that the examination and treatment of brain-power is equally worth while.

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Eddy Currents in Iron Masses.

By Dr. E. ROSENBERG.

Introduction.

In this article an attempt is made to give an approximate treatment of eddy currents in iron masses, developed from the simplest physical assumptions. Hitherto, investigations into this question have involved the assumption of a particular flux density in the iron which is permissible only for finely divided metal, as can be shown by the analogous case indicated in Fig. 1. A laminated core K, surrounded by a copper tube *Cu*, is embedded in a similarly laminated mass of iron *Fe*. Clearly the core K will not have the same induction density as the mass *Fe*, since the copper tube *Cu* constitutes a short-circuited turn round it. Current will flow in the copper tube in rings under the influence of the induction in K, and, in fact, the ampère-turns (AT) due to the current flow will be approximately equal to the impressed exciting AT which cause the induction in the core. The magnitude of the flux in K is determined from the fact that it must produce the e.m.f. in the copper tube necessary to cause the current to flow against the resistance of the tube. Thus in Fig. 2: *ab* is the exciting AT per cm. length; *bc* is the AT per cm. of the copper tube, and is practically equally and opposite to *ab*, leaving only the small vectorial remainder *ac*. The latter acts in the core to produce the magnetic flux, which will be displaced by nearly 90 deg. in phase against the induction in the rest of the iron mass *Fe*.

Effect of Presence of Iron.

There will be a great difference in effect, according as the core K is buried in a mass of iron, or is not so buried—i.e., forms a part of a magnetic circuit without any other parallel iron paths. In the first case the current in the tube is determined by the value of the impressed AT necessary to drive the flux through the surrounding iron mass. The flux in the core will be small and approximately 90 deg. displaced in phase from the main field. In the second case, however, the magnitude and phase of the flux in the core is naturally determined by the voltage impressed on the exciting winding. The current in the copper tube can attain considerable magnitude, and will cause an equivalent current in the primary or exciting winding, leading the magnetising current by 90 deg.

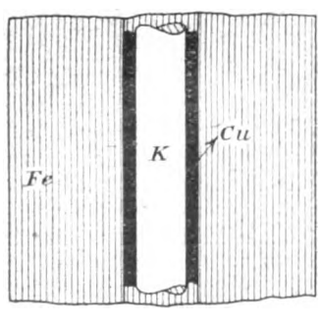
SYMBOLS.—a = depth of penetration, cm.; b = breadth of plate, cm.; B, B_1, B_2 = flux density, lines per cm.^{2}; d = thickness of plate, cm.; e = e.m.f., volts; j = current density at the surface of an iron mass, amps per cm.^{2}; j_1 = current density at the surface of a thin plate, amps per cm.^{2}; P = eddy current loss at the surface of an iron mass, watts per cm.^{3}; P_1 = eddy current loss at the surface of a thin plate, watts per cm.^{3}; P_{cc} = eddy current loss on laminated iron, watts per cm.^{3}; P_{kg} = eddy current loss in laminated iron, watts per kg.; N = ampère-turns per cm. length (r.m.s. value); $\mathfrak{N}$ = ampère-turns per cm. length (max. value); f = frequency, cycles per sec.; ρ = specific resistance, ohms per cm.^{2} cross section and cm. length; Φ = magnetic flux.

Analysis of Circular Core.

A massive circular core can be considered to be composed of a large number of thin concentric tubes (Fig. 3), through which the magnetic flux in an axial direction gives rise to currents in a peripheral direction, as was indicated in the introduction by the analogous case shown in Fig. 1. Each of the thin cylinders has considerable resistance, and the current flowing round a tube is determined by the e.m.f. induced in it, which latter is proportional to the flux pulsating within the tube. The phase of the current in the outer tubes is very much shifted against the magnetising AT. Each successive inside tube becomes magnetised by a somewhat smaller number of phase shifted exciting AT, and the geometric sum of all the tube currents is approximately equal to the exciting AT. On the outside tube the whole magnetising ampère-turns N will act, and thus on the surface of the iron mass a flux density B parallel to the axis is created, as given by the magnetisation curve of the material (Fig. 4) corresponding to the maximum value $\mathfrak{N}$ of the exciting AT. $\mathfrak{N}$ is equal to $\sqrt{2}N$ for sinusoidal variation of the exciting current. With each further inner cylinder account must be taken of the geometric sum of the AT in the outer tube and the impressed exciting AT, which means a decrease in the net exciting AT and a corresponding decrease in the flux density as we proceed inwards: First of all, however, the flux density decreases very slowly from B to B_1, B_2, etc., because of saturation.

The distribution of flux density over the radius of the solid core is given in Fig. 5. The sharp and sudden fall as we proceed inwards is due to the "knee" of the magnetisation curve, Fig. 4. From this point to the centre the density is practically zero, since the sum of the currents in the outer tubes has already become practically equal to the impressed AT. At the same time as the fall in the flux density, a phase shift of the flux takes place, which amounts in all to a quarter-period between the surface and the centre of the core.

Clearly the loss in the inner layers can be neglected in comparison with that in the outer parts, where the flux density is practically equal to the maximum. For simplicity we shall



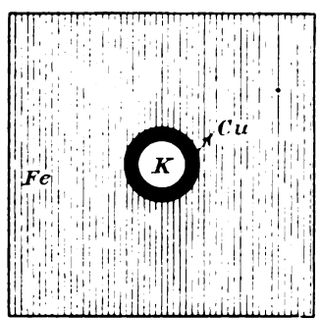


FIG. 1.

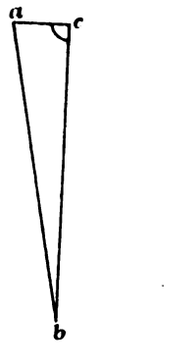


FIG. 2.

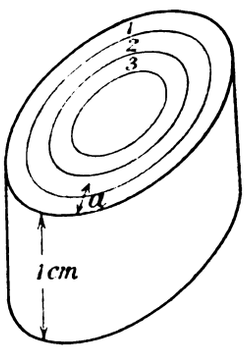


FIG. 3.

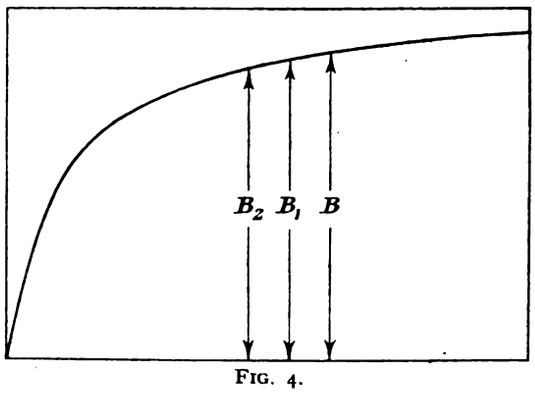


FIG. 4.

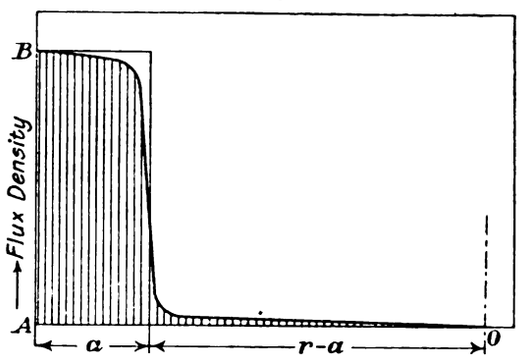


FIG. 5.

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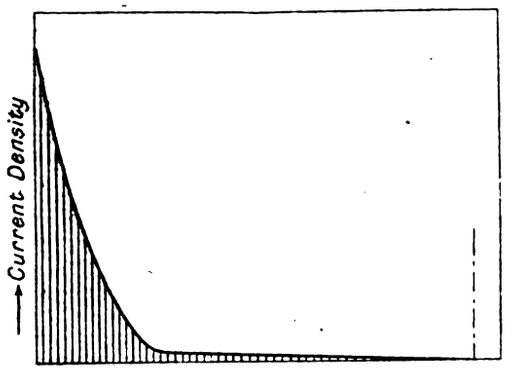

FIG. 6.

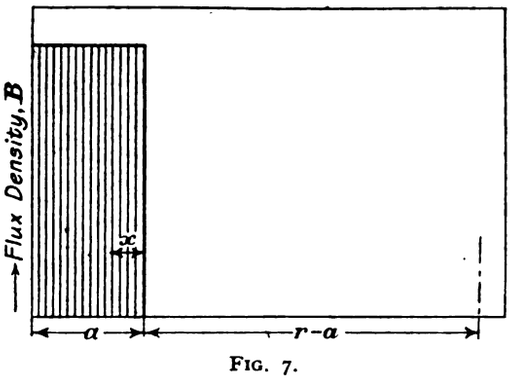

FIG. 7.

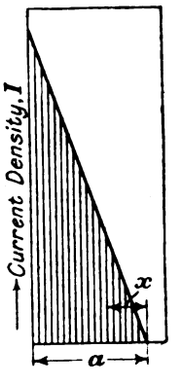

FIG. 8.

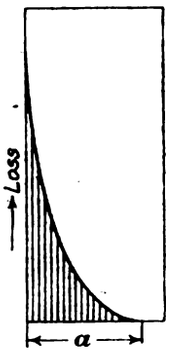

FIG. 9.

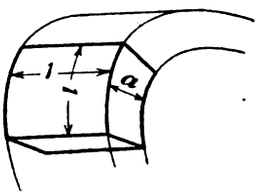

FIG. 10.

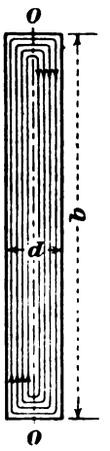

FIG. 11.

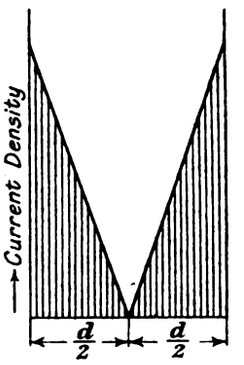

FIG. 12.

make the assumption that the flux density and the currents only penetrate to a certain depth a into the solid iron, and that in this depth the whole density B is active.

The actual current density is indicated in Fig. 6, and the assumed density in Fig. 8. The inner portion of the circular iron mass—i.e., that part of radius $(r-a)$—we shall neglect entirely. Thus in the outer portion, down to a depth a, we assume that there is a uniform flux density B, and a current density uniformly decreasing from j down to zero. Assuming that a is small compared with the radius r, we can neglect the variation of diameter of the elemental cylinders over the depth a, and it is then clear that the flux acting within a tube is proportional to the distance x of the tube from the inner cylinder. The active e.m.f. in any tube is, therefore, proportional to this distance x, the resistance of all the tubes is the same, and the current density is proportional to x. The ohmic (eddy) loss is therefore proportional to x^2 (Fig. 9).

Penetration Depth, Current Density and Loss.

The simple assumptions illustrated in Figs. 7 and 8 enable simple equations to be formulated for the penetration depth a, the current density j at the surface, and the loss. It is no longer necessary to assume a circular mass. The formulæ will hold for any cross section, so long as the penetration depth is small compared with the total iron depth.

If a portion of the surface 1 cm. axial and 1 cm. peripheral length is considered (Fig. 10), the axial depth is a. Behind every 1 cm. of the periphery is an active area a cm.^{2}, and behind every 1 cm.^{2} of surface is an active volume a cm.^{3}. The eddy current density at the surface is j, while within, at a depth a, the current density is zero. The mean is $\frac{j}{2}$, and the cross section through which the whole eddy current flows is a cm.^{2} per cm. axial length of tube, whence

$$\frac{j}{2}a = N, \text{ or } j = \frac{2N}{a} \quad . \quad . \quad . \quad . \quad . \quad (1)$$

The total flux acting on 1 cm. peripheral length is Ba, and all points of the surface are equally active. The e.m.f. excited in a cm. length is therefore also the ohmic drop in the same length. In the peripheral cm. shown in Fig. 10 on the surface, there is generated the e.m.f.

$$e = 4{\cdot}44 f B a \, 10^{-8} \text{ volts} \quad . \quad . \quad . \quad . \quad (2)$$

For a specific resistance ρ (ohms per cm. length and cm.^{2} cross section) the ohmic drop in a cm. of peripheral length will be $j\rho$, or $\frac{2N}{a}\rho$ from equation (1). Equating the latter expression to equation (2), then

$$4{\cdot}44 f B a 10^{-8} = \frac{2N}{a}$$

whence

$$a = \sqrt{\frac{2N\rho\,10^8}{4{\cdot}44 f B}} = 6700\sqrt{\frac{\rho N}{f B}} \quad . \quad . \quad (3)$$

and from equation (1)

$$j = \frac{2N}{a} = \frac{1}{3350}\sqrt{\frac{f N B}{\rho}} \quad . \quad . \quad . \quad . \quad (4)$$

To calculate the loss per cm.^{2} of surface, we must remember that the loss from depth a to the surface increases with the current density in the various elemental tubes according to a parabola (Fig. 9). The hatched area is a measure of the total loss and is equal to one-third of the area of the enclosing rectangle—i.e., one-third of the loss which would occur if the current density j extended over the whole penetration depth. A cm.^{3} of metal with uniform current density j has a loss of $j^2\rho$ watts, thus in our case the loss P watts per cm.^{2} of surface will be

$$P = \frac{1}{3} j^2 a \rho = \frac{1}{3} \frac{4N^2}{a^2} a\rho$$

$$= \frac{4N^2}{3} \cdot \frac{\rho}{6700} \cdot \sqrt{\frac{f B}{\rho N}}$$

whence

$$P = 2 \cdot 10^{-4} \cdot \sqrt{\rho f N^3 B} \quad . \quad . \quad (5)$$

Conclusions from the Formula.

The discussion of the formulæ yields some very important facts. First, with reference to the penetration depth a, let us take an example :—

A mass of wrought iron, with specific resistance $\rho = 0{\cdot}15 \times 10^{-6}$: $f = 50$: exciting AT per cm. $N = 30$: the flux density

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corresponding to $\mathfrak{N} = \sqrt{2} \cdot 30 = 43 \cdot 4$ AT per cm., is $B = 15600$. Then from equation (3) the penetration depth is

$$a = 6700\sqrt{\frac{0{\cdot}15 \cdot 10^{-4} 30}{50\ 15600}} = 0{\cdot}16 \text{ cm.}$$

A penetration depth of 1·6 mm. may well be very small compared with the thickness of a large bolt or plate. When N is increased the penetration depth a will also increase, since B rises but slightly owing to saturation. Quadrupling N will therefore make a nearly double. Further, a varies inversely as the root of the frequency: at 12½ periods it will double that for 50 periods. The penetration depth is also proportional to the root of the specific resistance, which for cast iron is about $0{\cdot}75 \times 10^{-4}$ ohm. The induction density in cast iron is about two-thirds that in wrought iron for the same excitation, so that under similar conditions the loss in cast iron will be nearly three times that in wrought iron.

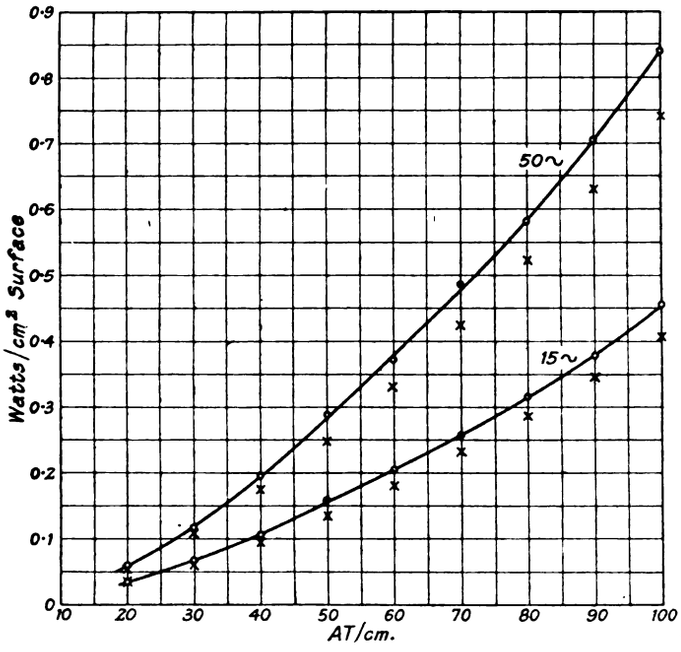

FIG. 13.

Eddy Current Loss Independent of Iron Volume.

We see from equation (5) that the eddy current loss is not dependent upon the total volume of the iron, but on the magnitude of the flux density parallel to the surface of the iron mass, so long as the assumption is justified that a is small compared with the total depth or radius. The loss in a tube of certain thickness can thus be very little less than the loss in a solid bar. Again, the subdivision of large iron masses may often increase the loss, instead of decreasing it, as expected.

The loss P is proportional to $\sqrt{N^3 B}$. In a material with constant permeability the loss will obviously be proportional to N^2. For iron, the induction B at all working densities increases more slowly than N, and at high saturation is practically a constant. We should therefore expect the loss to vary according to a power of N somewhat greater than 1·5.

An interesting point arises in connection with bolts for transformers and the like. Consider the example of an iron length-bolt inside a transformer core. If the excitation is limited to, say, 30 AT per cm., the loss in the bolt will be small—e.g., for $N = 30$, $\mathfrak{N} = 43{\cdot}4$, $B = 15600$, $\rho = 0{\cdot}15 \times 10^{-4}$, $f = 50$.

Then $$P = 2 \cdot 10^{-4}\sqrt{0{\cdot}15\ 10^{-4}\ 50\ 30^3\ 15600}$$
$$= 0{\cdot}112 \text{ W per cm.}^2 \text{ surface.}$$

Cast iron and cast steel endplates in transformers and electrical machines can be similarly treated. Owing to the small penetration depth for normal cases, it is immaterial whether bolts or endplates, etc., be made of steel or brass. Parts formerly made of bronze with a view to safety can be replaced by heavy steel or iron parts without any deleterious effects. Increasing the size of, say, an endplate above a particular value will not make any appreciable difference to the eddy loss in it, but if it is split into two mutually insulated parts, an increase of loss will often follow.

In the development of the formulæ, two assumptions were made. First, it was assumed that the induction density was uniform over the whole penetration depth, making our calculated penetration somewhat less, and the loss somewhat more, than it actually is. On the other hand, we have added the eddy current AT to the exciting AT arithmetically instead of geometrically, neglecting the small differences in phase. This gives a tendency to calculate the loss somewhat less than the actual, so that the two effects will be to some extent neutralised.

Experimental Confirmation of the Formulæ.

Many experiments have been carried out to test the accuracy of the formulæ developed above, and Fig. 13 gives one of the results for a shaft steel specimen 60 mm. diameter, 260 mm. long, with specific resistance $\rho = 0{\cdot}158 \times 10^{-4}$ Ω per cm³. The small circles show measured points, and the crosses calculated points (equation (5)). Tests were performed at 15 and at 50 periods. The proportionality of the loss to approximately the 1·5th power of N is clearly shown. In many other experiments very close agreement was obtained.

The discussion can be extended to thin plates and bars whose thickness is less than double the penetration depth, so that the sum of the eddy currents is considerably less than the exciting AT, and the density B is uniform over the whole cross section. In Fig. 11 the cross section of a plate of breadth b and thickness d is shown. The plate is insulated from neighbouring plates and the flux runs perpendicular to the section. The thickness d is negligible compared to b. The current paths are indicated in Fig. 11: we can say that the lengths of these paths are the same. The current density from the centre-line OO to each outside edge varies uniformly from zero to a maximum (Fig. 12). The e.m.f. generated in the extreme outer rectangular path is

$$e = 4{\cdot}44 \cdot 10^{-8} \cdot fBbd \text{ V.}$$

The length of the path is $2b$ approximately. The density of the eddy currents at the surface of the plate is therefore

$$j_1 = \frac{e}{\rho 2b} = 2{\cdot}22 \cdot 10^{-8} \frac{fBd}{\rho} \quad . \quad . \quad . \quad . \quad (6)$$

For the total loss per cm² surface of the plate we need only calculate that for half the plate thickness, and we shall neglect the surface of the small sides. As before, the loss is one-third of the loss which would occur if j_1 was uniform over the whole cross section:—

$$P_1 = \frac{1}{3} j_1^2 \frac{d}{2} \rho = \frac{d}{6} \cdot \rho \cdot 4{\cdot}93 \times 10^{-16} \cdot \frac{f^2 B^2 d^2}{\rho^2}$$
$$= 0{\cdot}82 \times 10^{-16} \cdot \frac{f^2 B^2 d^2}{\rho} \quad . \quad . \quad . \quad (7)$$

This result is very different from that in equation (5): the loss varies in a completely different way. For a more useful form, we can express equation (7) in terms of the loss per cm³ of laminated iron. P_1 is the loss at a cm² of plate surface, with an active depth of $\frac{d}{2}$ cm, and is thus the loss for $\frac{d}{2}$ cm³. The loss per cm³ is therefore

$$P_{cc} = \frac{P_1}{\frac{d}{2}} = 1{\cdot}64 \times 10^{-16} \cdot \frac{f^2 B^2 d^2}{\rho} \quad . \quad . \quad . \quad (8)$$

and the loss per kg. of laminated iron, assuming a specific weight of 7·7 will be

$$P_{kg} = 2{\cdot}13 \times 10^{-14} \cdot \frac{f^2 B^2 d^2}{\rho} \quad . \quad . \quad . \quad . \quad (9)$$

The value common to both equations (5) and (7) is obtained naturally when d in equation (7) is equal to $2a$, the double penetration depth. For a bolt with circular cross section the common value is given when the radius is $\sqrt{2}a$, the value of a being obtained from equation (3). The "critical radius" is then

$$\rho = 9500\sqrt{\frac{PN}{fB}} \quad . \quad . \quad . \quad . \quad (10)$$

Iron Masses Without Parallel Paths.

When an iron mass forms by itself a part of a magnetic circuit, then the eddy loss is determined by the number of turns and the applied voltage on the exciting winding. In equation (3) for the penetration depth N is unknown, but the total flux is known, and this gives the product Ba. Multiplying both sides of equation (3) by B, then

$$Ba = 6700\sqrt{\frac{\rho}{f}} BN. \quad . \quad . \quad . \quad (11)$$

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The product BN is obtained from the magnetisation curve; hence one can find the flux density and ampère-turns for any product Ba. The practical importance of this is for three-phase induction motors with solid rotors of steel or cast iron. The penetration depth of such a rotor at starting on 50 periods is usually only a small part of the available iron depth, but not so small as one usually assumes. For instance, for a wrought iron armature with a flux density of 6000 (referred to the whole cross section), then the penetration depth is more than one-quarter of the actual radial depth.

Electromagnetic Forces.

A Search for More Rational Fundamentals: A Proposed Revision of the Laws.*

By CARL HERING.

It is pointed out by the author in this Paper that the fundamental laws of electromagnetic forces and motions were formulated some 50 or 100 years ago and that they are now being applied to new and much more severe conditions than were ever thought of by those who framed them. The writer's experience in the application of electromagnetic forces in practice has convinced him that the time has come when these laws should be re-examined and tested, to find whether they can still safely stand the weight of the much greater responsibilities which are now being placed upon them.

Old Arguments Sometimes Mislead.

The purpose of the present paper is to show, by means of experiments and arguments, how certain of the older laws and explanations of electromagnetic forces and motions, as now taught in many text books and colleges, sometimes mislead, or lead away from, rather than toward, the truth; how they sometimes fail to apply, and even indicate results directly contrary to the facts, and how they have practically forbidden us to enter new fields in which progress may, perhaps, be made. Some of the points involved were recommended by Faraday and by Ampere, but they were discouraged by Maxwell.

During the past fifteen years the author has repeatedly called the attention of physicists to the experimental evidence of the present unsatisfactory state of things, and has shown how some of our laws have misled and even deceived the engineer when he tried to apply them. But not only was there no response (with one notable exception), but there was a surprising lack of interest, and even an effort to prevent the publication of the writer's investigations. In one case publication was at first refused on the ground that if the experimental evidence was correct, which was easily demonstrated, it was so serious a matter to change one of the older laws, that it ought to be kept a secret! The invention of a new and special definition of a sliding contact, to make an exception still fit an old law, seemed quite satisfactory to many physicists. Consequently, the author now makes an appeal to engineers.

Fundamental Ideas.

Our unit of current is based on the radial force of a circular circuit. A closed finite line had better be made a special case of an infinite straight line, rather than the reverse. In going from the general to a special case some factors generally drop out and can never reappear in any subsequent deductions. In a complicated system it is important to find the best and most basic fundamentals.

A revision of our former laws is also desirable now that it is known that every electric current is merely a movement of electrons in the conductor. In Fig. 1, if negative electrons pass from one body A to another B, through a conductor C, what we call a current flows through that conductor during that passage, creating simultaneous magnetic effects m, m, around it, each caused by its moving electron e, e, ; after the operation the body A is left charged positively and B negatively. Telegraph messages have seen sent by currents in such a conductor, after an aurora borealis. It is therefore no longer an absolutely necessity to consider every electric circuit as being a "complete circuit"; in many cases it is a great convenience to do so, a short cut, but in some it misleads and involves great difficulties in making it fit the facts; a law to be universal should therefore not be based on the circuit being a complete one. The complete circuit should better be made a special case of a unit length of a straight circuit. Ampere advocated basing the mathematical treatment on elemental parts of circuits, but Maxwell did not approve of this, preferring the easier method or short cut based on the complete circuit, which, however, is a special case and not the most general one.

When two current-carrying conductors are in some parts quite near to each other, as at a, b, Fig. 2, and at other parts far apart, the force between them will reside almost entirely in the near parts a, b; in practise this force would be practically the same, whether the remaining parts of the circuits are a foot or a mile long.

The present tendency is to abandon that useful stepping stone, the ether. It seems better to consider the magnetic field around the current-carrying conductor to be merely an action at a distance, as Faraday proposed, the seat and source of the force being in the material of the conductor and not in the space around it; no assumption of any ether is then necessary. It is therefore the conductor itself, that is, the matter in it, which had better be referred to in these laws and not the more subtle currents, circuits, fields, or ether.

Some Existing Laws.

The elementary law given in every text book, that like currents attract and unlike repel, is wrongly worded; it is not the currents but the conductors on which the currents act. Maxwell recognised and called attention to this important distinction, but many of his followers did not.

Similarly, it is the conductor, that is, the matter and not merely the circuit, which must cut the magnetic flux in order to induce a current; if the circuit alone cuts it, the conductor remaining stationary with respect to the flux, there will not be the slightest induction even though exactly the same linkages of the flux and the circuit have taken place.

The forces in the fields have their seat and origin in the material of the conductor where the electrons are passing through it; which should therefore be their anchorage or abutment. It is difficult to conceive how the abutment of an electromagnetic force could be in the ether. In other words, the flux around the conductor or magnet should be pictured as though it were in some way elastically attached to the material in which its source lies.

One of the most common of the older laws concerning the production of motions by a circuit is to the effect that a circuit will produce such motions as will make it include more flux. It will be shown below that this law, though often true, is not based on the correct fundamental principle. This law has led many to draw wrong conclusions. Moreover, it is the flux energy and not the flux which is concerned when a circuit does work in producing motion; the flux energy may increase or diminish while the flux can remain constant.

Another favourite law is that only such motions will take place as will increase the self inductance. This is a badly defined law as it involves a factor which is entirely foreign to the case, the number of turns in a coil. The self-inductance is a purely geometric quantity and is independent of any current or energy.

Another law is to the effect that anything that increases the stored energy will give rise to a force. There is no such increase in a running motor. Yet another law is that such motions will take place as will increase the permeance. This also fails for motors unless rescued by forced definitions of sliding contacts.

A General Law of Motions.

There is a well-recognised general law in physics applied generally to a system of mechanical forces and energy, to the effect that in any system such motions will tend to take place as will reduce the potential energy of the system; this potential energy is thereby transformed into the kinetic energy of the motion.

The writer suggests the following version for the usual conditions; in an electromagnetic system in which the current is being maintained by a source, any and only such mechanical motions of the conductor will tend to take place as will generate a counter e.m.f. somewhere in the circuit. The actual

* Abstract of a Paper read before the American Institute of Electrical Engineers.

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motions which this tendency will produce will depend of course on the particular freedom of motion which the various parts of the circuit may have. The counter e.m.f. is not necessarily generated in the part that moves, as will be shown below. It is believed that this is a universal law of all such electromagnetic systems, that is, that there are no exceptions.

Certain Unusual Cases.

The reason for introducing the words about the current and the source is to exclude certain very unusual cases, like condenser discharges, and others. Magnetic material, such as iron, in such a system can store and give off some energy and thereby may introduce a correction factor in some cases. The chief reason for proposing this electrical version of the general law is that it is believed to be without exception; and that when any current-carrying system, connected to a source, produces mechanical motions of any kind there is always produced a counter e.m.f., which when multiplied by the current (in phase) is the quantitative equivalent of the mechanical energy produced. It is believed to be true also that when such flux energy actually produces mechanical motion, that is, kinetic energy, it disappears as such, but such disappearance is quite different in kind from that occurring when a current-carrying circuit is broken.

When the potential energy of the flux is transformed into the kinetic energy of mechanical motion, it seems evident that no counter e.m.f. should be produced directly thereby, though there will be when this lost energy is subsequently replaced again by the current. This is shown by the following example: Assume two parallel copper rings at o deg. absolute temperature at which their resistance is zero; let like and equal currents be started in both by drawing a magnet pole through them; the energy of this process will then be stored as magnetic energy and the currents which maintain it would then continue to flow indefinitely. Now let the rings move toward each other by their attraction over a certain distance and then stop, thereby converting part of their potential energy into kinetic energy; there will then be less magnetic energy and therefore less current flowing after the motion has ceased; this cannot be due to a counter e.m.f. as the motion has ceased.

If two unlike poles of two permanent magnets are permitted to move toward each other, an amount of the flux energy must have disappeared exactly equal in amount to the kinetic energy produced by this motion; this is restored again when the two poles are subsequently forced apart.

An Objection to Potential Energy.

There is an objection to the use of the term "potential energy" in this connection because it is not always clearly understood and the disappearance of the potential energy is generally masked by an immediate replacement of this energy by the source. For example, in a motor the ultimate quantity of the flux energy remains constant; in some cases it is even greater after the motion than before. The amount of the flux and of the flux energy by no means necessarily vary in the same ratio; the energy is the product of the flux and the m.m.f. To the writer it seems that the generation of a counter e.m.f. is the best crucial condition in the electrical equivalent of that general physical law, to take the place of the reduction of the potential energy. He has applied the law to every case he can think of, old and new, and it never fails to apply correctly.

One of the deductions from this law is of special interest because it has been most hotly contested. If a current-carrying conductor be lengthened by stretching, or by sliding contacts, new flux will be produced around the added part, and the production of this flux will generate a counter e.m.f. Hence it would follow from this law that the circuit could produce such a lengthening if the necessary freedom of motion exists. In other words, a current tends to stretch or lengthen its conductor. This force has been termed by the writer the "stretch effect," being a complementary phenomenon to the "pinch effect." This longitudinal force does not appear in the usual mathematical treatments of electromagnetic forces; the reason seems to be that such treatments were originally based on a special case in which this longitudinal component consists of two opposite forces which are exactly equal and therefore drop out. The pinch effect and the stretch effect are generally not great enough to crush or stretch conductors, but with liquid or gaseous conductors they may become of vital importance.

Many years ago the writer noticed that in a wide mercury trough which turned a right angled corner there was great agitation of the mercury at that corner when a large current flowed; showing the presence of decided local forces. This the writer called the "corner effect," which he explained was due to the magnetic flux, the density of which must be far greater on the in[illegible] part of the corner.

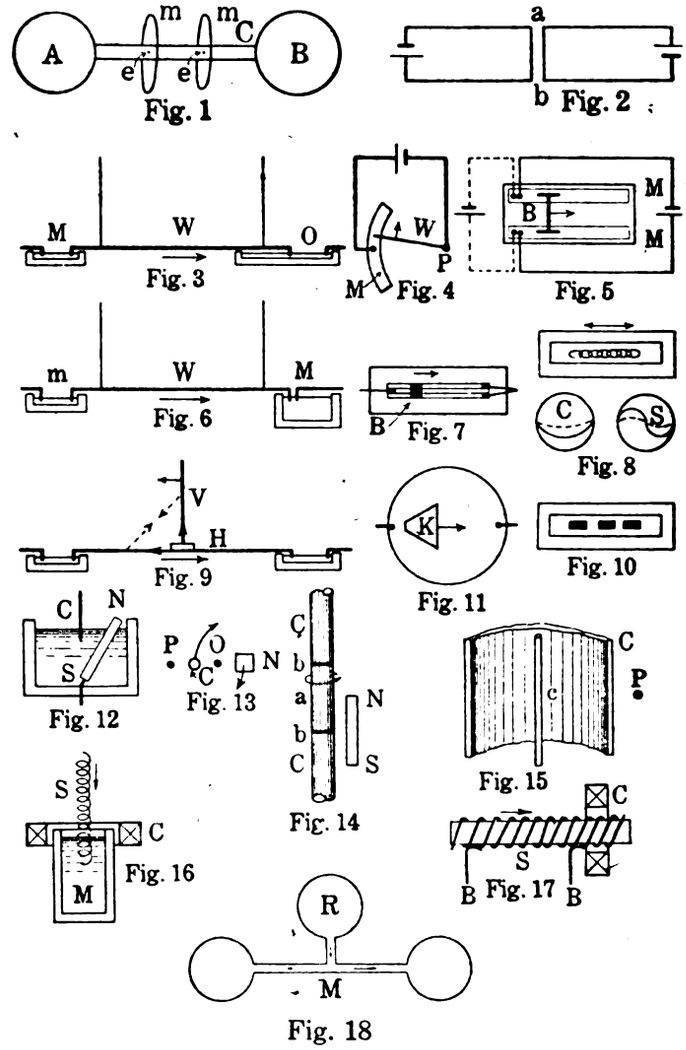
The most unsatisfactory and most confusing element in our present syste[illegible] and the most troublesome and discouraging one to the student, is the inevitable "sliding contact."

Some Experiments.

In the following experiments the currents required are generally rather large and cannot be kept flowing long on account of the heat.

In Fig. 3, *W* is a long horizontal wire suspended so that it can be moved lengthwise. One end dips into the centre of a large dish of mercury *O*, in which, therefore, there was practically no change in the flux when the wire moved slightly. The other end dips into the narrow mercury trough *N*, in which a force to stretch or lengthen that electrically elastic part of the conductor could manifest itself. When current was passed the wire moved decidedly to the right, showing the tendency of the part *M* to stretch. Assuming a constant current, new flux was produced in the part which was added to the mercury trough part of the circuit by this lengthening; and it is in this part that the counter e.m.f. must have been generated.

Fig. 4, described over a decade ago, is of interest because without exception every one of numerous physicists gave the wrong answer as to the direction of motion, showing how badly our older law has misled us. A horizontal wire *W* is pivoted at *P*, the other end being free to move in a curved mercury trough *M*. It was placed in the position as shown before the current was started; with current it moved in the direction shown, which is the contrary one to that called for by the older law that a circuit tends to expand. The enclosure of the



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circuit decreased instead of increasing. The writer's explanation is that the only part of the circuit which has freedom of motion to lengthen itself, namely, the mercury part, did so. When started on the other side of the "dead point," it, of course, moved in the opposite direction, and the same reason.

Modified Form of Ampere's Experiment.

Fig. 5 is a modified form of the classical Ampere trough experiment. *B* is a bridge wire floating on the two mercury troughs *M*, *M*. In the original experiments by Ampere the battery circuit was placed at the left as shown in dotted lines, and the resulting movement of the wire B to the right was attributed to the old law that the circuit tends to enlarge itself; also to the repulsion due to that part of the battery wire which is parallel to the bridge wire. The writer attributes the motion to the tendency of the mercury parts of the circuit to lengthen, owing to the lateral pressures of the discs of flux around them; they are the only parts in which this force is free to act. This was shown to be the correct explanation, and the older explanations were shown to be wrong, by reversing the position of the battery circuit as shown in full lines, as the motion was than in the same direction, as it should be, while according to both the older laws it should have been reversed. The battery wires should not be too near the troughs. An interesting feature about this experiment is that, the counter e.m.f. is evidently generated in the parts around which new flux has been generated.

In Fig. 6 a long horizontal wire *W*, suspended so that it has freedom of motion lengthwise, has one end dipping into a mercury trough *M*, the cross section of which is large, and the other end into one (*m*) in which it is small. For the same current the flux encircling the large cross section in *M* is, of course, less in amount than that around *m*, hence the lateral repulsion of this flux in *m* should be greater than that in *M*; the wire *W* should therefore move to the right, which it does quite decidedly. It was, of course, claimed by the upholders of the old law that this was due to the repulsion of the vertical parts entering the trough, even though they had been made very short. These were therefore placed as shown, close together in *M* and far apart in *m*, yet the movement was still in the same direction though slightly less in intensity; it should have been reversed if caused by those vertical parts.

Fig. 7 shows a better and simpler way of making the same experiment. It consists of three long slender mercury troughs close together with very thin walls. A movable copper bridge *B* floats freely on the mercury connects them. The meniscus of the mercury projected slightly above the troughs so that the bridge piece had practically no vertical component. When current was passed into the middle trough and out of the outer two (or all three) the bridge piece moved very decidedly to the right.

In Fig. 8, a well-amalgamated copper chain was laid in a much longer mercury trough in a contracted position so that it could stretch. When the current was passed it immediately and decidedly stretched to its extreme length. Copper being a far better conductor than mercury, most of the current passed through the copper, which having a far smaller cross section had much more flux around it than there was around the ends of the mercury trough, hence the longitudinal force over-powered that at the ends. When this chain was laid in a contracted form in circular mercury dishes *C* and *S* with its ends secured near the terminals, and in the position shown by dotted lines, it stretched itself into the positions shown in full lines when current was passed, as a compressed helical spring would do. Repeated short applications of the current seemed to act better.

Longitudinal Force.

Fig. 9 is a modified form of an old experiment attributed to Faraday, or perhaps to Ampere. A vertical conductor *V* was mounted so that it could move to the right or left parallel to itself, and it made contact with a horizontal wire *H* which was stationary. When currents were passed in the directions indicated, the movable wire *V* moved to the left. If *V* is fixed and *H* is free to move in the opposite direction, the same force should move *H* in the direction of its length, which it did, thus showing the existence of this strongly denied longitudinal force.

In Fig. 10 three short pieces of well amalgamated copper wire were floated on a mercury trough in a straight line with their ends close together. When alternating current was passed they separated a short distance as shown, but would move no farther even with repeated applications of the current. This seemed to indicate that the denser field around the copper pieces was, as it were, elastically connected to its conductor and that the repulsion of like lines made it extend itself a slight distance beyond the ends.

Fig. 11 shows an interesting difference between a direct and an alternating current. A kite shaped piece of well-amalgamated copper was floated as shown on a circular dish of mercury. With direct current it moved every time the circuit was closed but only for a very short distance and then stopped. An alternating current moved it continuously in the direction of the large end forward.

Fig. 12 represents Faraday's ingenious experiment to show that a single pole *N* of a magnet moves along the circular lines of force around a fixed current-carrying conductor *C*. In the experiment a permanent magnet *N S* was floated in a cup of mercury in a slanting position with one pole tied with a string to the centre of the dish at the bottom. The current entered through the central fixed conductor *C* and left through the centre of the bottom. When current flowed the free pole moved in a circle around the wire *C*. The writer repeated the experiment, and found that apparently the chief force was a couple, as shown in Fig. 13, which represents a top view of the upper part of Fig. 12; the conductor *C* and magnet pole *N* each endeavoured to revolve around the other, as Faraday showed. If linked together and pivoted at *O* they should therefore revolve around *O*; if the link is pivoted at *P* they should revolve less forcibly around *P*, due to the difference between the two torques; these were not tried.

When the conductor is revolvably mounted on its axis it ought to revolve when the magnet is stationary, according to Newton's third law. The revolving force is then tangential, like the pull on a string wound around the wire, and its effect therefore becomes very small when the diameter is small. By making its diameter large relatively to the distance to the magnet, especially when it is made hollow, the writer obtained decided rotation. In Fig. 14, a large fixed conductor *C*, *C*, has a part *a* mounted so that it can revolve on its axis, *b*, *b*, being sliding contacts like a layer of mercury. This part of the conductor rotates with the magnet placed as shown.

Another Deduction.

Another deduction is shown in Fig. 15. We are told that for the same current in the small conductor *c* and in the large hollow one *C* the magnetic effect on a point is the same, being the same as though the current were all concentrated at the axis. Yet, as shown above, if a magnet pole be placed at the point *P*, it will easily rotate *C*, but *c* only with great difficulty. And if the current was concentrated at the axis, it would take an infinite force to revolve its conductor. Hence there is some physical difference between the fields around those two conductors and our older laws leads us away from rather than toward this difference.

In Fig. 16 is a solenoid mounted so that it can move down in a mercury cup *M*. *C* is a stationary coil. When like constant currents were passed through both, *S* moved downwards decidedly. It thereby cuts out some of the ampere-turns, which reduces the flux generated by the solenoid. The reluctance of the combination will also, presumably, be decreased somewhat in a less proportion; and, if so, the total flux of the combination would be less after the motion than before. These results contradict the older laws. In Fig. 17, the conditions are similar, except that the current is now led into the solenoid *S* by a fixed brush *B*. If the lines of force are not considered to be in some way attached to the moving electrons which produced them the troublesome sliding contact must again be called in to give an explanation. In the writer's opinion new flux is generated at the distant end of the solenoid as the current is started in new parts of the conductor, and this is strongly attracted by the coil *C*; the flux at the near end, which is being cut out, exerts little or no attraction on *C*; a part of the flux which was generated by both coils together disappears as such by being converted into the kinetic energy of the motion. The flux therefore seems to move with the coil.

Fig. 18 represents a top view of a mercury trough *M* ending in two large reservoirs of mercury, to which the current connections were also made. When current is passed the mercury in the trough should stretch, thereby moving into the end reservoirs, the flux around it being far denser than around the end reservoirs. It did so, as was shown by a rapid flow of mercury from the middle reservoir *R* through the short connecting channel and into the trough. In this case there was no perpendicular component of the motion, which was not due to the pinch effect, as this would have caused the mercury in the small connecting channel to flow in the opposite direction and there would have been a flow into all these reservoirs.

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The Life of an Alpha Particle.

In his Royal Institution discourse* on "The Life of an Alpha Particle," Sir ERNEST RUTHERFORD gave an account of the latest important development of his researches in a field which he has been studying for over twenty years.

The α particle had long been known, Prof. Rutherford stated, to be the nucleus, carrying two positive charges, of an atom of helium, which was expelled from the nucleus of a radioactive substance in which it was probably an entity before the explosion which caused its expulsion. It was expelled at a velocity of about 20 000 km. per sec. and no doubt gained energy in escaping from the strongly-repelling field of the nucleus. The life periods of the radioactive substances had a very wide range; the same substance always expelled its particles (or rays) at the same speed, but the speeds and consequently the ranges of the rays in air differed with different substances, the range (measured in air at

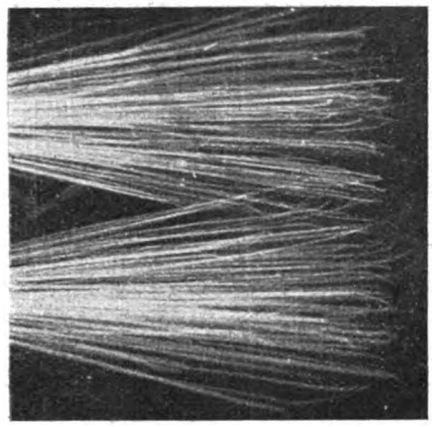

FIG. 1.

ordinary temperature and pressure) being 2·5 cm. for uranium I, 7 cm. for radium C and 8·6 cm. for thorium C_2. Fig. 1, an ionisation photograph of the Wilson-Blackett type, showed that the ranges were approximately constant for all the α rays from the same substance. As the α ray travelled in air saturated with moisture, it collided with a molecule encountered, ionised it and lost energy by the collision. G. H. Henderson's curve, Fig. 2, showed that the ionising power of the α ray increased as its speed decreased to a maximum corresponding to a range of 6 cm., and then seemed to drop

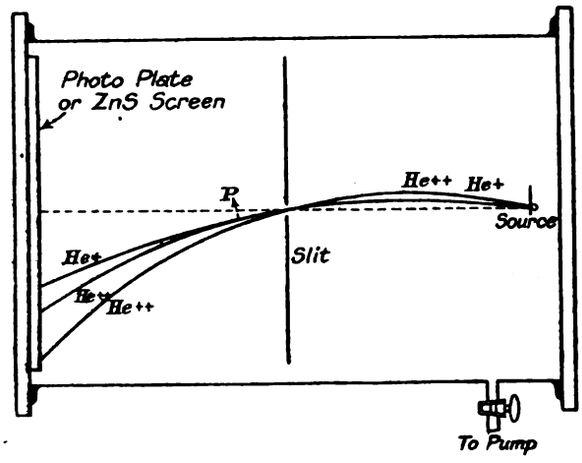

FIG. 3.

off altogether, although the ray would still have about half its original speed, as experiments with absorbing screens of different thicknesses had proved. But the photographic tracks became indistinct at low α speeds, and when Henderson lately resumed these experiments with improved apparatus he obtained evidence indicating that there were α particles apparently not carrying the supposed two charges, but only one charge. Dr. Henderson being unable to continue this research, Sir Ernest took it up himself.

* The delivery of this discourse, as Sir Ernest said, had to be postponed till the end of the season owing to an indisposition of himself and to the grave illness of Sir James Dewar, Superintendent of the Royal Institution, who died on March 27th.

Apparatus Employed.

The apparatus used (Fig. 3) was a small rectangular box standing on its narrow base, containing the radioactive source (a wire, shown in section, coated with RaC, so mounted in a carrier that the particles could only escape through a mica window), a slit and a zinc sulphide screen or photographic plate; a very high vacuum was maintained in the box. The undeflected α rays travelled along the dotted path to the centre of the screen; when the magnetic field was turned on they described curved paths, and the experiments proved distinctly that there were, in addition to the He_{++} particles (carrying two charges) of maximum deflection, also particles of half that deflection which would therefore carry only one

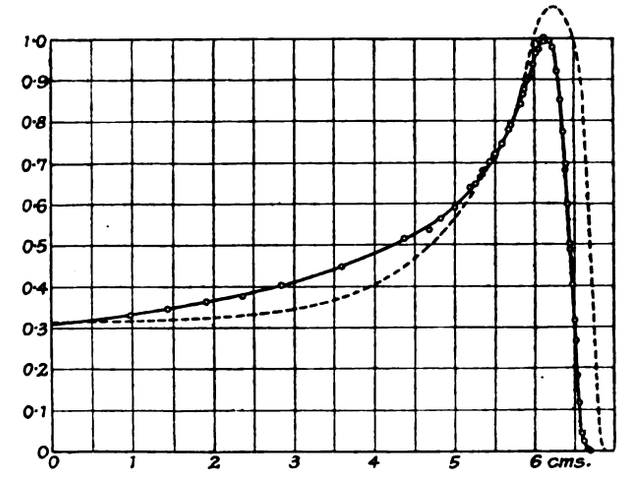

FIG. 2.

charge He_+. There were further some intermediate particles (the curve of which is likewise seen in Fig. 3) and also, even in strong magnetic fields, some particles striking the centre of the screen, apparently due to undeflected neutral particles The relative numbers of the He_{++}, He_+, He_0 particles carrying double charges, single charges or no charge, were found to vary with the experimental conditions, the strength of the magnetic field, the thickness of the mica window in

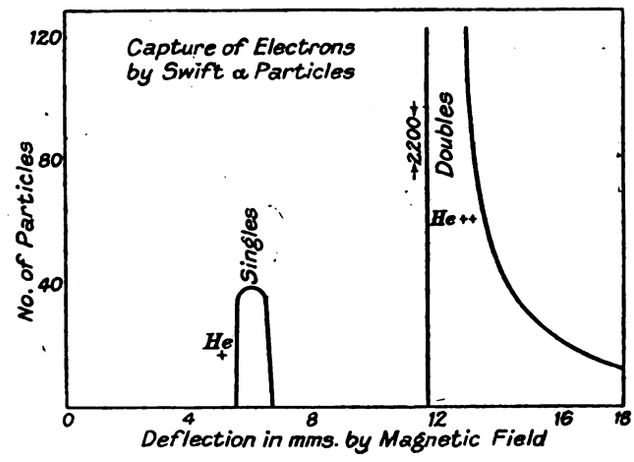

FIG. 4.

front of the source (on which the initial speed V_0 of the α particles would depend) and also with the amount of residual gas left in the box. Different stages of these experiments are represented in Figs. 4 and 5. The ordinates correspond to the numbers of scintillating particles striking the fluorescent screen, counted with the aid of a microscope; the abscissæ are the deflections of the particles by the magnetic field. In Fig. 4 we see no neutral particles, few single-charge particles and a great number of double-charge particles, the numerical ratio of the latter two classes being, in one case, 1 : 55. Later, the areas of the two latter overlap; in Fig. 5 the neutral He_0

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particles, the single-charge He_+ and the double-charges He_{++} occur in quite distinct areas.

Transformation of Alpha Particles.

Now an α particle with the normal double charge might become transformed into an α particle of a single charge by picking up an electron; it might proceed on its path with that additional electron, but it might also lose it again by colliding with other atoms or electrons. There would thus be capture of electrons as well as loss of electrons. In both cases we might assume that the α particle had to travel a certain average distance—a kind of mean free path—before it picked up or lost again an electron; the free paths could be expressed in terms of air at normal temperature and pressure. If λ_1 were the mean free path for capture, λ_2 the mean free path for loss, N_1 the number of particles carrying double charges, and N_2 the number of single-charge particles, there should

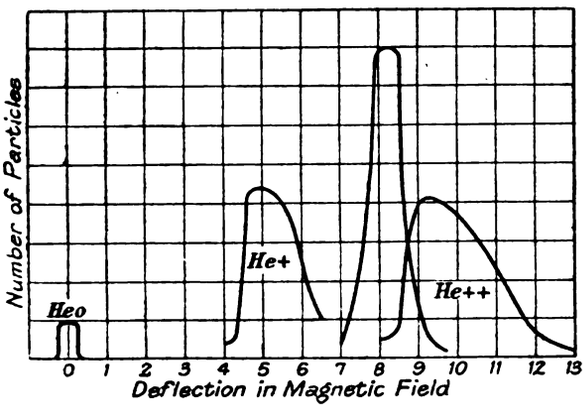

FIG. 5.

be equilibrium between the latter two classes of particles when $N_1/N_2 = \lambda_1/\lambda_2$. The point P in Fig. 3 indicated a point at which a captured electron was lost again by a collision. Similar calculations could be made for the relative numbers of neutral particles. The experimental evidence showed that when the initial velocity V_0 of the α rays ($V_0 = 1{\cdot}922 \times 10^8$ cm. per second) was (by the aid of absorbing screens of mica) reduced to 0·94, 0·76 and 0·47 V_0, the corresponding values of the ratio N_1/N_2 rose, the figures being 1/200, 1/67 and 1/7·5. The initial velocity V_0 being known, the mean free paths would be, for the velocities mentioned, 0·011, 0·0078 and 0·005 mm. for the loss of an electron in air, and 2·2, 0·52 and 0·037 mm. for the capture of an electron. The great diversity in these two mean free paths was apparent from Fig. 6, in which two different scales were employed; the mean free path for loss (represented on a scale of thousandths of a millimetre) increased with the speed itself, the mean free paths for capture (scale $\frac{1}{4}$ mm.) increased at an enormously greater rate with the sixth power of the speed. From these considerations it would follow that the numbers of double-charge and of single-charge should become equal at 0·3 V_0; he had actually observed 0·29 V_0.

A Point of Theoretical Interest.

Another point of theoretical interest had arisen. Sir Ernest removed the mica window, through which all the α particles had so far had to pass, and found to his surprise that single-charge particles still appeared and that an equilibrium relation held. It seemed then that there must already be a rough equilibrium distribution in the particles as they left the radioactive substance. An α ray shot out from RaC would have to pass through a dense distribution of electrons and might take up an electron and lose it again through only passing through its own atom. It was further noteworthy that, when gas was admitted into the box of Fig. 3, the three curves of Fig. 5, marking particles of 0, 1, 2 charges, were replaced by the one high-peaked curve, corresponding to the previous observations of former years. Captures of electrons even took place when the residual gas was hydrogen, not air.

Interpretation of the Phenomena.

How could we interpret the phenomena? Why should a swift α particle capture an electron at all? The chances seemed infinitely remote. The α particle would sweep past the electron with a velocity corresponding to a potential of about 1 000 V; capture might be supposed to take place near the nucleus, but it seemed to occur in the simple hydrogen atom as well as in the heavier oxygen atom which a potential of 20 V would knock to pieces. What became of the enormous energy? We were driven to the conclusion that the energy was dissipated and lost in radiation in a kind of inverted photo-electric effect. In photo-electric phenomena radiation was absorbed and an electron was ejected; here an electron was captured and radiation emitted. If that

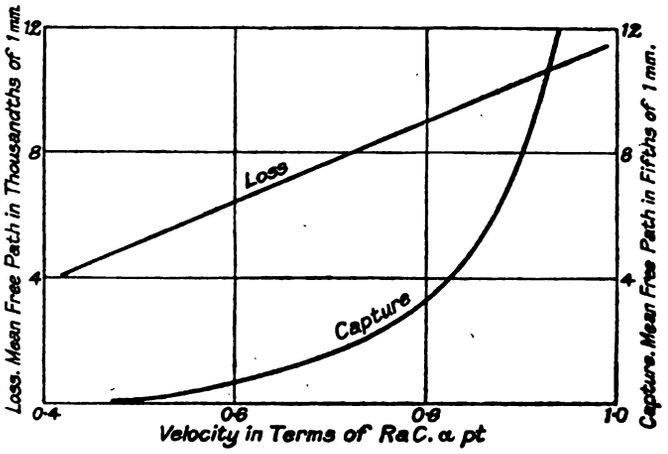

FIG. 6.

were so, some three per cent. of the energy of the α particle should be dissipated in soft radiations or in visible light. We did not know that yet, but he had tried to show what might happen to an α particle; and that it would capture and lose an electron and become neutral.

Supposing, Sir Ernest remarked in his conclusion, the α particle was contained in a mineral like the lump of samarskite lying on the lecture table before him. Some litres of helium, accumulated by the expulsions of α particles from the uranium in that mineral, might be imprisoned in the lump and had been bound there for millions of years. We could easily release that helium. Some of the powdered samarskite was heated in a quartz tube, the gas liberated was cleared of other gases by means of charcoal, and enough helium appeared within a few minutes in a discharge tube to show the characteristic helium colour and spectrum though the room was not darkened. All the helium, manufactured during the war in quantities sufficient to fill balloons, had passed through the same strange history. For millions of years it was at rest as an α particle in the nucleus of a radioactive substance. An explosion within that nucleus released and expelled it, and for a very small fraction of a millionth of a second it became the most destructive projectile known, at once to turn into an atom of an inert gas, which might lie imprisoned in the mineral again for millions of years.

Anglo-Russian Trade.

British Mission Leaves for Moscow.

A number of business men, headed by Mr. F. L. Baldwin, a cousin of the Prime Minister, chairman of Becos Traders, Ltd., left London last week on a mission to Russia, where they hope to be able to conclude definite business with the Soviet. The British Government has assisted the mission in the matter of facilities, and the Russians attach so much importance to the event that, with the assistance of other countries, they have been able to provide for the members a special through coach from the Hook of Holland to Riga and from Riga to Moscow. The visit is the culmination of a long series of negotiations between the Soviet and Becos Traders, Ltd., having in view the re-establishment of trade between this country and Russia.

Books Received.

"Shop Kinks." By Robert Grimshaw. (London: Constable and Co.) Pp. 417. 18s. net.

"Photography as a Scientific Implement." A Collective Work. (London: Blackie and Son.) Pp. 549. 30s. net.

"The Engineers' Pocket Technical Dictionary: French—English." By Mark Lvoff. (London: E. and F. N. Spon.) Pp. 150. 3s. 6d. net.

"Practical Tests for the Electrical Laboratory." By C. H. Johnson and R. P. Earle. (London: Constable and Co.) Pp. 347. 16s. net.

"Practical Control of Electrical Energy." By A. G. Collis. (London: Henry Frowde and Hodder and Stoughton.) Pp. 160. 10s. 6d. net.

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The Ericsson Automatic Telephone System.*

Its Employment in Sweden.

Important developments in connection with the improvement of the Swedish telephone services include the introduction of the automatic system of operation. Primarily, as at present contemplated, the system will be installed in the larger exchanges in Stockholm and Gothenburg; but subsequently, if it proves completely successful, its employment will be more generally extended. As the first step, consideration is being given to the question of deciding what particular system will be used, due regard being had to the technical and economic standpoints. Heavy expenditure must necessarily be incurred in making the various changes involved; but, *per contra*, it is hoped that the substitution of automatic methods will render the Swedish telephone services much more popular.

Effecting the Change-over.

To effect the change-over to automatic operation in the case of a large telephone exchange, provision must be made for a mechanical contact-making apparatus designed to enable any subscriber to connect at will to any other. Some millions of different combinations must be possible through manipulation on subscribers' instruments. It will at once be seen that the contact-making apparatus, while depending upon a series of operations directed by the subscribers, must in no way solely depend upon an arrangement of the digits. Actual contact is provided by a series of selectors, and these must be provided in sufficient number according to the estimated frequency of conversations.

In finally deciding what individual system should be adopted for a particular case there are certain essentials which must be borne in mind—reliability and continuity of service, practical utility, simplicity and ruggedness of construction. Any system which fails to fulfil these essentials must certainly prove troublesome.

There seems, it is considered, every prospect that a satisfactory solution of the various difficulties has been reached in the Ericsson system, which embodies the results of several years' experimentations, and has now reached a high state of development.

Description of the Ericsson System.

In the Ericsson system every subscriber's telephone apparatus is connected to a relay at the exchange; this relay connects the subscriber to the selector for the contact required. The selector, called a register, performs the same functions as the exchange operator's brain. The exchange operator listens to a number, and the brain locates the number required on the switchboard, and then directs the hand to perform the movement required to effect the connection; it finds the number required, and directs the contact-making apparatus to effect contact. Automatic operation would be a straightforward matter if it were only a question of providing for a few subscribers; but in the case of large exchanges with thousands of subscribers it is much more complicated. In these large exchanges there must be a series of contact-makers, each of which will, in turn, contribute to the required combination.

For the present explanation, the case of an exchange with 9 999 subscribers is considered, and it is assumed that these subscribers are distributed over twenty switchboards, each with contacts for 500 circuits. In order to enable one subscriber to be connected to another it must first be possible to find the correct switchboard, and, secondly, to make the required contact.

On the basis of a frequency of conversation of five per cent., twenty-five circuits must be provided from each switchboard to the same number of contact-making apparatus on the central board, which, therefore, must have a total of 500 change-over apparatus. These can be switched on to any of the 500 circuits on the central board, and, in turn, connect to the contact-making apparatus on another series of twenty unit switchboards, each with 500 circuits. There are, therefore, twenty-five contact-making apparatus on each board, having regard to the assumed frequency of conversation, and these are connected in groups to the circuits on the central board. Each incoming subscriber's circuit thus connects to each series of switchboards. The contact-making apparatus on the switchboards are designated circuit selectors, and those on the central board group selectors. It is, of course, not possible to mount 500 contact-making apparatus on one board, and it is usual to distribute this number on ten boards, or a multiple of ten, all provided with similar circuits—an arrangement which naturally does not simplify the working of the change-over equipment. In order to establish contact between the calling number and the number called, three operations are necessary—adjustment of two circuit selectors and one group selector.

Various practical considerations render it undesirable to increase the number of circuits at individual boards, and therefore in very large installations recourse is had to a three-stage change-over equipment, which permits the maximum number of subscribers to be increased twenty-five fold, thus giving a capacity sufficient for the largest exchanges. By introducing a four-stage equipment it would be possible to provide for a maximum of 6 250 000 subscribers.

Function of the Register.

The register has no other function than to direct the three above-mentioned adjustments of the selectors. The contact-making is automatic as soon as the subscriber rings up; and breaking-off is likewise automatic after contact is established, thus leaving the register free for the next subscriber. As this work only requires a few seconds it is only necessary to provide quite a small number of registers for the requirements of an exchange serving 10000 subscribers. Where the frequency of conversation is only 5 per cent., one per cent. only is sufficient—that is to say, one hundred registers for the total number of circuits. It should be noted that the register has nothing to do with the transmission of speech; it only effects the contact making.

The switchboard in the Ericsson automatic telephone system is a tall, narrow framework having vertically stretched circuits arranged in double rows of fan-shaped groups on one quarter of the circumference of the frame. These circuits consist of bright brass wires tightly strung, and are fixed in a large number of horizontal plates of insulating material, each wire being held in its exact position. The contact-making apparatus are mounted on horizontal shelves which, up to the number of fifty, are fixed in grooves one above the other, and can thus be readily withdrawn. The whole of these are thus connected to the same multiple of the system.

Contact Making Apparatus.

The contact-making apparatus consists of a movable washer, crosswise above which is a long lever provided with a short shaft capable of movement radially by means of bevel-wheels attached to the shaft. The points through which contact is made are fixed at the extremity of the lever. The washer is given a rocking movement through double-bevel gearing on a vertical shaft which runs the full length of the frame and is thus capable of actuating any one of the contact-making apparatus. The above-mentioned movements are made possible by means of a ring with wheel segment placed on the circumference of the washer and attached to a horizontal shaft with spur wheels at the ends; one of these gears with the segment, whilst the other is placed half-way between two bevel wheels on the vertical shaft, so that a slight upward movement of the horizontal shaft produces gearing with the wheel above and a slight downward movement with the wheel below. These small movements, due to two magnets, thus produce the rocking movements of the contact-making apparatus in either direction.

On completion of the rocking movement there follows a radial adjustment of the control arm by means of gearing between the spur-wheel on the shaft and an internal segment on the above-mentioned ring. This additional movement is obtained through the same arrangements of wheels, in both directions, as the rocking movement. The change-over from one movement to the other is affected by the ring being either backed with or freed from the washer and occurs automatically through actual regulation of the two movements. The latter as far as motive-power are concerned, are indefinite and cover a whole series of possible positions. The rocking movement has, for instance, twenty-five different positions and the radial movement twenty. Adjustment to a certain position is in either case accomplished by means of a magnet operating a

* Translated from the Swedish by Francis J. Purdie (from an article published in "Industritidningen Norden").

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projection which gears with pawls on the respective instruments. The pawl on the washer is fitted to a segment which occupies a position almost diametrically opposite the wheel segment. The position on the contact arm is on the rear of the wheel shaft. One of the two magnets which raise or lower the horizontal shaft receives current as soon as part of the pawl is raised, when first one and later the other magnet by means of an exchange device becomes actuated in such a manner that the correct change to backward or forward movement takes place.

Adjustment Devices.

The entire adjustment is thus effected by two magnets which by means of reflex movements regulate a further two magnets, responsible for the in-and-out movements of the driving shaft.

The two magnets which affect the in-and-out movements are actuated through contacts in the register apparatus, consisting of a device with a contact arm which moves above a number of contacts, the exterior appearance being similar to that of a box.

The register has several functions to perform. First of all it should be borne in mind that the number of registers is the same as the number of digits in the maximum number of subscribers. If, for instance, there are 9 999 subscribers, then there will be four registers, the contact arms of which can be moved to ten different positions by means of adjustment of the digit plate on the subscribers' instrument. The number required is called in this way. The function of the next six registers is to distribute the number obtained as explained above among the three contact making apparatus which complete the circuit.

Three contact-making apparatus are thus essential and it only remains to impart to each the correct duplex adjustment. The operation is achieved in successive stages by the aid of the last two registers which complete the circuit in the series of registers. The contact arm of one of the registers has twenty five positions and is responsible for the rocking movement of the contact apparatus. The contact arm of the second register has twenty positions and takes care of the radial movement. It will thus be observed that only the last two of the registers are directly connected to the magnets belonging to the contact-making apparatus. Each of the contacts on the boxes actuates a pawl magnet.

Difficulties in Making Change-over.

In conclusion, it should not be overlooked that there are many difficulties in the way of a complete change-over to an entirely automatic system of operation. Questions of first cost and maintenance charges must be carefully considered, and it must be remembered that the public will have to become habituated to the use of the different method. An advantage of automatic operation is its compact construction.

The Ericsson system is designed to work on the normal telephone pressure of 24 V, so that a change-over to automatic operation becomes possible whilst retaining existing circuits and apparatus, leaving only the digit plate or other automatic digit selector to be added later.

Cheap Cable Rates.

Sir C. Bright on a Factor in Empire Development.

Imperial development and British trade are shackled by our cable system, according to Sir CHARLES BRIGHT, who, in an article in the current issue of "Imperial Commerce," reiterates his plea for the introduction of cheaper cable rates for the whole Empire on both Imperial and business grounds.

It should, he thinks, be possible to reduce cable rates very greatly, and suggests an all-round Empire rate of something like a shilling, or less, per word. He says the cable companies have shown splendid enterprise and daring on the technical side, but that they have not perhaps been equally advanced on the commercial side.

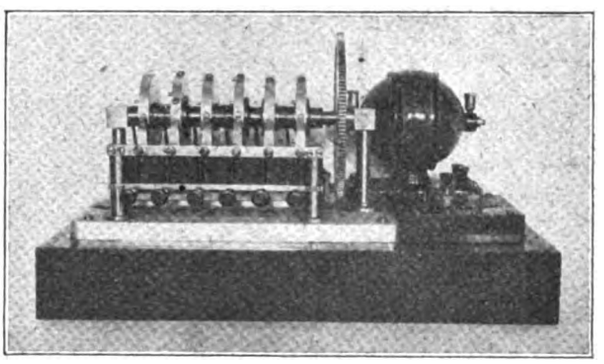
In conclusion Sir Charles suggests that the great commercial and industrial organisations should insist upon the cheapening of the cable service, and that, compared with the vital interests of the Empire, those of the shareholders in the cable companies are of secondary importance. He maintains, further, that the cable system—like "wireless"—should be mainly regarded as a public utility in the interests of the nation and Empire as a whole, and largely for developing inter-Imperial commerce. Pressure brought upon the companies will, he adds, probably convince them that the introduction of an all-round Imperial low rate is possible and that the popularising of "cabling," like the popularising of the post, though momentarily unprofitable, will in the end prove highly advantageous.

An Inventors' Exhibition.

Novel Electrical Devices Shown in London.

A small but interesting exhibition of the members' inventions was held at the offices of the INSTITUTE OF PATENTEES, on Thursday last week.

One of the most attractive novelties shown was an attachment which enables messages typed on a typewriter simultaneously and automatically to be produced in code on a twin machine; it also allows code messages to be transcribed into plain language. The outfit shown at the exhibition is worked pneumatically, but if preferred it can be operated electrically. The motive power is supplied by a pneumatic pump, which maintains a state of vacuum and enables instantaneous response to be obtained in the corresponding typewriter; there is an air cylinder under each key. An essential feature of the invention is the means of connecting up the "plain" letter on one machine with the code letter on the other, and this is done by plugging in the tubes from the respective letters on opposite sides of a circular "board" which stands midway between the two typewriters, and it is obvious that the number of possible combinations is immense.



IMPULSE TYPE WIRELESS TORPEDO CONTROL AND OPERATING RELAY.

An invention which, although not new, was not made public until recently in consequence of its use by the Government during the war, is Prof. A. M. Low's impulse type wireless torpedo control and operating relay illustrated above. This type of control is said to have been one of the first to be used to operate controls successfully and selectively. With the aeroplane about one mile distant on the ground rudder and elevator operated perfectly by wireless. The control was almost entirely free from outside interference, and was the forerunner of many controls now in use. The receiving gear cannot yet be exhibited, as it still remains a secret patent.

Other interesting inventions shown include Beville's self-acting "speaking" sign, in which the hot air from a single electric lamp causes the revolution of a fan, which in turn carries round different coloured glass screens, the effect of this being shown in the lettering or other advertisement; the Clifton electric clock, which switches lights, etc., on and off at predetermined times; a railway carriage safety lock which can only be opened when a push-button is operated; a burglar alarm which is set ringing when the burglar touches a piece of black cotton; electric window and luggage wedges, the removal of which causes a bell to ring; a fuse which gives an alarm when bearings become hot; an electric code switch for starting engines, etc.; a dead end switch for wireless tuning; quick release spring terminals for telephones or wireless head-phones, and an electrically heated trouser press, the necessary current for which is carried to the inner aluminium plates by flexibles attached to a wall plug.

All particulars relating to the Institute will be supplied by the General Secretary, Mr. G. Drury Coleman, 44, Great Russell Street London, W.C.1.

Electricity Supply in Ireland.

Proposed Development of Water-Power Resources.

Dealing with the water-power resources of Ireland and the effect of their development on industry, Dr. J. F. CROWLEY, in the special Irish number of the "Manchester Guardian Commercial," states that electricity supply is in a backward condition in Ireland, and suggests that the attention of statesmen in the new condition of things might well be devoted towards effecting improvements. Referring to the condition of electricity supply in the Greater Dublin area, he points out that no fewer than seven public electricity supply stations supply current to the public, whereas one station only should exist in this area. He estimates the total annual output of these stations at 29 000 000 kWh, and is of the opinion that the whole of this load with ample margin could be supplied from the River Liffey, which flows close by, and at a cost considerably lower than any of the individual stations can generate.

So far, hydro-electric development and the development of electricity supply generally in Ireland has been retarded by the policy of waiting for demand, while, on the other hand, manufacturers have more than once intimated that their development is hampered by the lack of a suitable power supply.

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Merchandise to Sell and Profit By.

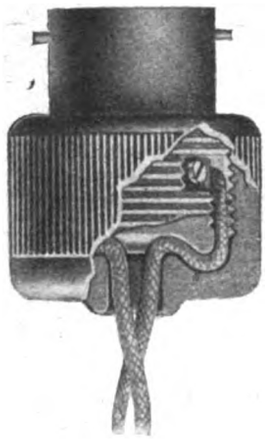
In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

A Lampholder Adaptor that is Different.

One of the most curious facts in the electrical industry is the habit (for such it is), of making certain accessories in hardwood. Such small devices as lampholder adaptors and wall plugs and sockets and many others, are, in the majority of cases, made in hardwood. Such a practice is known to be thoroughly unsound, but still it persists. We hope that the ever growing acceptance of

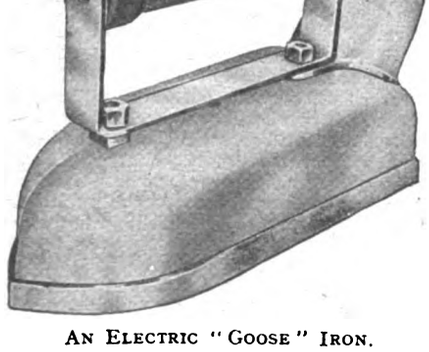


J. C. WHITE PATENT AUTO-GRIP FIREPROOF ADAPTOR.

a higher standard of quality will mean a speedy end to the practice. Referring particularly to the question of adaptors, it is useful to know that "something better" can be bought. The device which we illustrate is White's patent auto-grip adaptor, manufactured by J. C. WHITE, and it represents an earnest attempt to raise the standard of quality and design of these small accessories. The illustration reveals some of the features of the adaptor. It is more satisfactory to ask J. C. White for a sample, with prices.

Business from Tailors.

Certain districts are known for the particular industry which is carried on there, and if the needs of that particular industry are studied closely, contractors can build up a considerable business by catering for its requirements. This reflection is prompted by the fact that the JACKSON ELECTRIC STOVE CO., have recently revised their prices of electric irons, and prominent among their several designs is the familiar tailors' "goose" iron. To the average contractor, however, it is familiar only by the illustration in many manufacturers' catalogues; it is not familiar for the more profitable reason, and that is, selling them. How often do we see an appliance



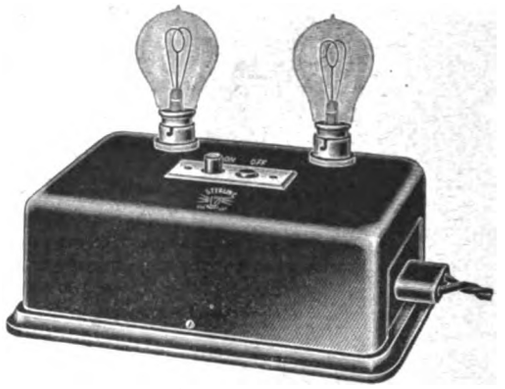
AN ELECTRIC "GOOSE" IRON.

and dream of the market to-morrow; and to-morrow never comes. How typical this is of tailors' "goose" irons! How few realise the market there is for "goose" irons with the numerous tailoring factories in London. We shall be told that a large amount of tailors' pressing is outside homework; we shall be told—many things. The simple fact remains, however, that instead of waiting for tailors to come to us and solicit us to sell irons to them, we must go to tailors and solicit their business by a demonstration with a "goose" iron under actual working conditions.

We illustrate an iron manufactured by The Jackson Electric Stove Co. This range comprises no fewer than nine irons of different weights from 9 to 20 lb.

The "Sterling" High Tension Smoother.

An addition to their already lengthy list of wireless accessories has recently been made by the STERLING TELEPHONE AND ELECTRIC CO. This addition is the "Sterling" high tension smoother which we illustrate, and it will be at once apparent that it will fill a want. This instrument has been designed to enable users of valve instruments requiring a plate voltage of from 100 to 300 V to dispense with the usual high tension dry batteries and to employ instead a direct current supply, where available. The instrument is specially recommended for power amplifiers in conjunction with loud speakers, its use involving freedom from hum or other undesirable noises. The smoother is well insulated, and entirely shock proof, and the containing case is highly finished black stove enamelled drawn steel. It is fitted with three condensers, four choke coils, two lamp sockets, a double pole push button switch, and end panels mounted with the necessary sockets and connecting plugs with flexible wire for input and output. The usual lamps can be employed for the instrument. They are pilot lamps and give a visual signal in the event of a short circuit. The list price is £7 10s.



HIGH TENSION SMOOTHER.

The Market for Portable Handlamps.

Of the many excellent lines of merchandise for the retailer to market, there are few that have such selling possibilities as a good

THE "A.C.M." PORTABLE LAMP.

line of portable handlamps fitted with a dry battery or an accumulator. It is not difficult to realise where the market is; it is among

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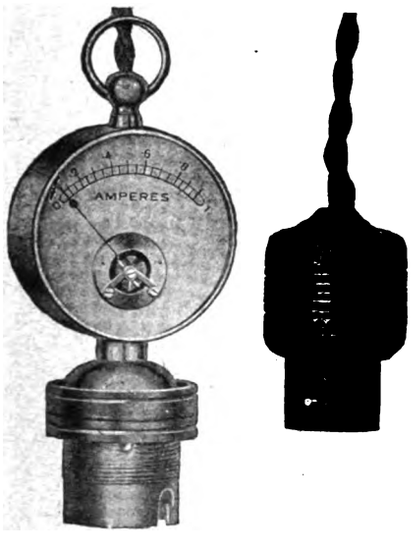
the multitude of domestic buyers. How few of the electrical retailers in this country attempt to sell portable handlamps for home use, and yet with a boost by means of a well-displayed window with pertinent statements pointing out, among other uses, the comfort and usefulness of having a handlamp on a convenient shelf in a dark coal cellar. The majority of coal cellars are "coal holes" and few are fitted with either gas or electricity; but the bad planning of our builders can be turned to profit. The market is not even limited to those who are so fortunate as to live in houses "fitted with electric light." Practically every house is a possible customer, and if portable handlamps are merchandised as "domestic devices" instead of a rare piece of electrical apparatus, then success will come in terms of turnover and profits. There are many portable handlamps with which to run the campaign, some cheap, some medium in price, some high in price, according to size and quality. Among the makers of a really reliable device is the HART ACCUMULATOR Co. We illustrate their type "A.C.M." We shall not elaborate on the details—rather would we occupy space with emphasis on the market there is and to suggest that retailers give close study to the Hart Co.'s list No. 110.

A Familiar Instrument, but British Made.

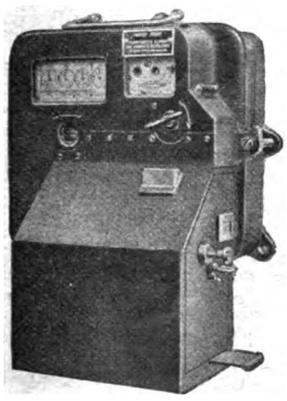
The small lamp testing set which we illustrate is manufactured by the WALSALL ELECTRICAL Co. In appearance it is familiar enough, but it has the advantage of the Continental made instruments, for the simple reason that it is made to the usual "Walsall" standard. We have a particular object in mentioning this instrument in these columns. In pre-war days a considerable business was done in these little sets, but the business to-day is very much smaller. This is due to the fact that it is not widely known that the Walsall Co. manufacture a reliable instrument, and if such an instrument is required (that is to say, a reliable instrument, as distinct from a cheap instrument) then our advice should be followed.



A USEFUL SMALL TESTING SET.

A Device to Use and Profit By.

A clever invention which is now being marketed by the COIN CHANGE Co. will have a marked effect on English home life. For how many worthy aspirants for the Dunmow Flitch have lost their chances owing to a domestic "breeze" caused by not having a "penny for the meter?" But important though this effect of the invention is, we are more concerned with the time and money and also worry that is spared to the supply companies. Briefly described, this device is one which will give the consumer "change for a shilling." The change-giving machine is a small and sturdily built device easily affixed at small expense to any make of meter in place of the existing coin box. It consists of a metal tube holding a maximum of 10s. in coppers, into which pennies can fall in an upright column. An additional slot at the side for the insertions of shillings is placed immediately above a ratchet escapement, through which the shillings must pass before falling into the container. The effect of the release of this ratchet is that a small slide, with a groove to hold pennies, may be pulled out twelve times, each time allowing a penny to be withdrawn. After twelve releases the slide becomes automatically locked again. Economies in collecting, handling, checking and banking can be effected by fitting this attachment to all meters in a territory. A five shilling bag of copper weighs as much as a bag of silver containing £5. This means that for every hundred silver coins, easily handled and banked, the equivalent in value is twelve hundred copper coins. The fact that the meter cannot get choked is of as great importance to the company as to the consumer, for it means that the very considerable expense of special collections is entirely eliminated. From these facts it will be seen that the attachment practically creates a shilling meter at a penny usage. The fact that consumers are never obliged to "do without" light or heat owing to shortage of coppers means in large districts a considerable increase in the total receipts.



METER FITTED WITH "COIN-CHANGE" ATTACHMENT.

The meter shown in our illustration fitted with a "Coin-change" attachment is by Ferranti. The Coin-Change Co. will be pleased to arrange demonstrations to anyone interested.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

The "Autovac" petrol feed system is described in a booklet just issued by the manufacturers—THE AUTOVAC MANUFACTURING Co.

WATSON AND SONS (ELECTRO-MEDICAL), LTD., ask us to inform our readers that they have just issued bulletin 29S describing "Sunic" diathermy apparatus.

"Series Parallel Starting Switches" is the title of a price list, No. 5113, just published by the BRITISH THOMSON-HOUSTON Co.; also a descriptive list, No. 5301a, entitled "D.C. Motor Control Panels."

To seekers of real bargains we tender the advice to study the folder L.282 recently issued by THE BRITISH THOMSON-HOUSTON Co. It is a selection of well-designed semi-indirect fittings at exceptionally low prices, and as the offer closes on August 31st it is necessary to apply at once.

A welcome announcement of reduced prices on outside lanterns is made by the GENERAL ELECTRIC Co. Two of the most popular selling lines, one known as the "Birmingham" and the other as the "Boro," are illustrated and described in a single sheet list just published by the firm.

Buyers and engineers instinctively seek information on the latest Brookhirst development when thinking or talking of switchgear. It is our pleasure to announce the publication of catalogue No. 7 by BROOKHIRST SWITCHGEAR, LTD. The catalogue describes their latest development, viz., oil-immersed a.c. control gear.

The laurel for being the first manufacturer to issue a catalogue of fires for the coming winter season must surely be awarded to the JACKSON ELECTRIC STOVE Co. They have some appealing new designs for the winter trade, and prices of some old favourites which will be carried through in the Jackson range have been reduced.

"Something New in Switchgear" is the title of a folder just issued to the trade by THE MIDLAND ELECTRIC MANUFACTURING Co. The new range of "Memak" quick-make ironclad switches is described and list prices quoted. We hope to make early reference to this new M.E.M. development in our "Merchandise to Sell and Profit by" columns.

"A boiler in stock is worth more than a promise of early delivery." This is the adage with which HERBERT MORRIS, Ltd., head their new list, No. 435z, describing Morris-Cross-tube type vertical boilers. We also have to note the publication of other lists by this firm. List No. 501z is devoted to a description of worm-gear pulley-blocks, and list No. 777x describes the Morris portable cranes.

Engineers and others will be interested in the fact that the ENGLISH ELECTRIC Co. have recently issued a publication, No. 278, which gives a complete list with much interesting detail of "Rotary Convertor Installations" carried out by them. This company has recently developed and has ready for delivery a new range of ironclad switch pillars. These new pillars will be known as classes SXD and SXE, and are described in list No. 2111.

Among the manufacturers who announce new publicity matter is the METROPOLITAN-VICKERS ELECTRICAL Co. The latest publications are (*a*) No. 1297/1 entitled "Type S automatic oil break ironclad switchgear," (*b*) Circular No. 1299/1 containing a description of a 650 V flexible unit type ironclad switch gear; (*c*) Descriptive leaflet No. 17/1 on D.C. dealing with commutating pole motors; (*d*) Descriptive leaflet No. 301/81 giving details of sheet steel cubicle switchboards; and, to complete the list, (*e*) Descriptive leaflet No. 301/71 on panel type switchboards.

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Irish Electricity Supply.

First Annual Conference of the New Association.

The first annual conference of the Electricity Supply Association of Ireland was held last week in the Mansion House, Dublin.

Mr. WILLIAM HEWAT, who presided, said the position of the electricity supply industry in Ireland was very much behind that of other countries, mainly on account of the small extent to which industries had been developed. But that fact made the work of the Association all the more important, inasmuch as it could guide electrical development on the best and most modern lines. A great work lay before the members of the Association. They were in a position to impress their views on the Government, but in order to do that effectively they must inspire confidence by showing that they had undertaken the work in no self-seeking or self-advertising spirit, but for the national good.

In his report the hon. secretary recapitulated the history of the Association since its inception, mentioning that, owing to the change in Government, the business of Governmental control of electricity supply had got into a somewhat chaotic state. The new Government, however, took prompt steps to deal with this question, and the Ministry of Economics took over the powers of the English Electricity Commissioners, and took control of Irish electricity supply. Subsequently, the Ministries were changed, and electricity supply control was handed over to the Minister of Industry and Commerce, who formed a special section to deal with the business.

Control of Non-Statutory Undertakings.

Early in November last, he continued, the Ministry got into touch with the Association on the subject of proposed control of non-statutory electricity undertakings in Ireland. A sub-committee of the Association was formed to deal with the subject. They prepared a report which the Association placed before the Ministry.

Later on the Association was informed by the Ministry that it was proposed to bring in a new Electricity Control Bill, which would not only take the place of the Electricity Supply Act of 1919, which applied to Ireland, but also of the Electricity Act of 1922, which did not apply to Ireland, and further, of all previous legislation on the subject of electricity supply. The Ministry did not find it possible to bring in their proposed Bill before the close of the last Dail, and it was expected that electricity supply control would form the subject of one of the first Bills in the new Dail.

Membership.

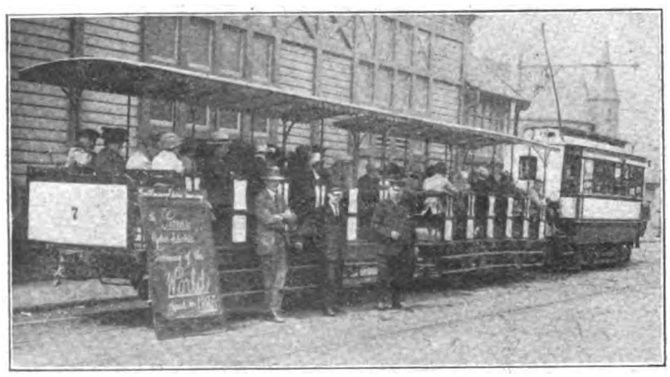
The Association membership at present covered all the larger suppliers or distributors of electricity in Ireland, and also a large number of the smaller undertakings. There were at present in the Free State some twenty statutory authorised electricity suppliers, in addition to the tramway and railway companies.

Mr. G. MARSHALL HARRISS read a short paper on "The future of electricity supply in Ireland and the probable effect thereon of proposed legislation," and the following officers were elected for the coming year:—President, Mr. Hewat; vice-presidents, Mr. Marshall Harriss and Mr. McDowell Grosart; hon. treasurer, Mr. Pilditch; hon. solicitor, Mr. Crosskerry; hon. secretary, Mr. Kettle.

Hydro-Electric Traction.

Ulster's Forty-Year-Old Hydro-Electric Tramway.

The accompanying illustration of cars on the hydro-electric tramway—said to be the first of its kind—at Portrush, Ulster, recalls the interest aroused forty years ago by this development in the utilisation of water-power by means of turbines. The tramway, which connects Portrush with the Giant's Causeway and Bushmills,



THE PIONEER HYDRO-ELECTRIC TRAMWAY.

had on its opening 6½ miles of 3-ft. gauge track and cost £45 000 to construct. Originally the Siemens dynamo supplying the current to the motor on the tram was driven by a steam engine, stationed at Portrush, but as the line runs close to some falls on the River Bush, it was later decided to utilise the water power in place of steam. Two turbines, each capable of yielding 50 H.P. at 225 revs. per min., were therefore erected at the falls to drive the dynamo, the engine and dynamo at Portrush being kept in reserve in case of a breakdown. The work, it is interesting to recall, was carried out under the direction of the late Sir WILLIAM SIEMENS.

A Wireless Firm's Affairs.

Committee of Creditors to Investigate Prospects.

In our commercial columns last week we briefly announced the issue of a circular by C. F. Elwell, Ltd., convening a meeting of the company's creditors. This was held last week at the Institute of Chartered Accountants, Moorgate Place, E.C.

An approximate statement was presented which showed assets of £45 000, made up as follows: Cash at bank £1 800, stock at cost £18 000, machinery £2 000, trade fixtures £1 000, loose tools £1 500, investments £50, book-debts £15 000, and equity in factory £5 000. The amount due on debentures was £13 676, and after allowing for those claims there would be net assets of approximately £31 400 available to meet the preferential creditors and the unsecured creditors of £47 000. There appeared to be a deficiency, so far as the unsecured creditors were concerned, of something like £16 000.

The Wireless Slump.

The chair was occupied by Mr. J. H. Scrutton, one of the directors of the company, who stated that he was prepared to take over the claims of all creditors for £50 and less and pay them in full. Any creditor for slightly more than £50 who cared to assign his debt for £50 was at liberty to do so. He added that the position had been brought about through the slump in trade. The company had been in existence for some years and was originally formed to build high power stations. Broadcasting had also been taken up and a substantial business done. The slump came like a bolt from the blue and people who owed money could not pay at once, while the stock which had been accumulated could not be sold immediately. He suggested that a committee of the principal creditors should be appointed to confer with the debenture holders and the directors with a view to a scheme being brought forward in the interests of all concerned.

Hope of a Reconstruction.

The position was discussed at some length, during which the opinion was expressed that the products of the company were amongst the best on the market, and that the business was well worth continuing. Eventually a resolution was passed appointing a committee of the principal creditors, consisting of the representatives of Fullers United Electric Co., The Western Electric Co., Houghton, Butcher and Co., Engineering Publicity Co., Restall, Brown and Co., S. G. Brown, Ltd., and the Radio Valve Co. It was understood that the debenture holders would not take any action, unless forced to do so by an unsecured creditor, or with the approval of the committee, until those concerned had had an opportunity of considering the best course to pursue in the interests of creditors.

Explosion in a Cable Works.

Report of Board of Trade Inquiry.

The report of a preliminary inquiry, held under the Boiler Explosions Acts, 1882, and 1890, into an explosion from a steam-heated coil in a compound serving pan, at the works of W. T. Glover and Co., Trafford Park, Manchester, last March; as the result of which a machine attendant was injured through hot pitch compound being thrown over his face and hands, states that the pan formed part of a series of serving heads and serving tanks, and was filled with liquid bituminous compound. The electric cable to be coated travels slowly along through the various heads and above the compound serving tanks. Each tank is an open cast-iron vessel about 2 ft. long by 13 inches broad, in which is placed a continuous copper coil in about five turns. The coil is of solid drawn copper $\frac{13}{16}$ in. diameter bore, and $1\frac{1}{16}$ inch outer diameter. Through this steam is passed direct from the works boiler at a pressure of 120 lb. per sq. in., draining to the atmosphere through a steam trap. This maintains the bituminous compound constantly in a liquid condition. A cast-iron wheel on a steel shaft, fitted with a rope pulley is independently driven from a countershaft at the back of the machine. This revolves in the liquid compound at a speed of about 175 revolutions per minute, lifting and spraying it over the cable.

Nature of the Explosion.

The explosion was from the top turn of the copper heating coil within the pan. A split occurred in the pipe about $1\frac{3}{4}$ in. long and $\frac{1}{2}$ in. broad. Through this steam at full boiler pressure flowed, ejecting the bituminous contents from the pan. The cause of the explosion was due to the thinning of the copper heating coil at one end to such an extent that it was unable to withstand the working steam pressure to which it was subjected.

Electrolytic Action Suggested.

To account for the wasting electrolytic action was suggested, and tests were made by Mr. R. E. Pritchard, the works manager, with a very sensitive milli-voltmeter, for a difference of potential between the revolving wheel and the steam coil or other parts of the compound tank, but no difference whatever exists. There seems to be no alternative than to accept the mechanical wastage of the copper coil due to the flow of the liquid compound; and to prevent this in future, a baffle plate has been fitted on one end in front of the coil, to catch the flow of the compound when agitated by the revolving wheel. A guard has also been fitted to protect the face of the attendant in the event of any similar accident. With careful periodical inspection and gauging the outside diameter of the coils for wastage, it is thought that any recurrence of the accident will be avoided.

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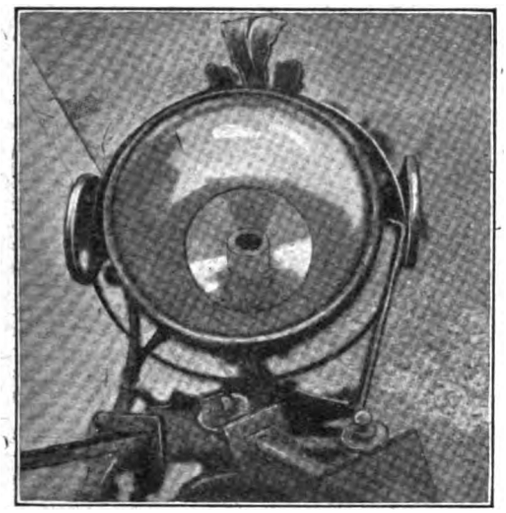
The Lighting of Cinema Theatres.

An Interesting Electrical Installation.

As most of our readers in London are aware, the site of the old Tivoli music hall in the Strand, famous during the war years for the " Beaver Hut " which stood upon it, is now the site of one of the largest picture theatres in London, which will be opened shortly as the Tivoli Palace.

The new Tivoli is practically an " all steel " building, and special arrangements have been made in the steelwork to insert the various



AN EXTERIOR REFLECTOR FITTING.

electric lights and reflectors so that there is no projection of any fitting in the auditorium ; most of the lighting, in fact, is concealed. Both the primary and secondary lighting is electrical, and no other form of illuminant is used, the supply of electricity for lighting and power being divided between the Charing Cross Electricity Supply Co. and the Metropolitan Electricity Supply Co. The lights in the " exit " and other fittings are divided between the above supply companies, so that in the event of one supply failing the other light or lights would still be burning. The remaining lights are arranged so that every room available to the public is supplied from both companies.

Coloured Lighting in the Auditorium.

The auditorium is mainly lit by means of special reflectors supplied by the General Electric Co., concealed in the large centra domes and the four surrounding smaller domes, colour screens being provided whereby three different colours—red, blue and amber—

OUTSIDE LIGHTING AT THE TIVOLI PALACE.

can be utilised. These lights are fed through a bank of dimmers with separate and master control switches whereby any combination of lighting effects can be obtained. Further reflector fittings are also let into the circle and balcony fronts and ceilings arranged in a similar manner, and thus a lighting colour effect comprising any or all of the above-mentioned colours can be obtained.

All the auditorium lighting and dimmers are controlled from the bioscope box, but automatic short circuit switches are connected to the dimmer circuit which can be operated from five different positions in the building to cut out the dimmers in case of emergency. The dimmers were provided by the Igranic Electric Co.

Outside Lighting.

The front of the building is illuminated by means of the special reflector fittings shown in the accompanying illustrations.

There are two " Newton " motor generators of 150 A each on the secondary side. These are arranged to be fed from either supply by means of " throw over " switches, and supply current to the bioscope lamps in the usual manner through resistances giving a dissolving effect on the lamps.

The curtains are electrically operated and the lights round the screen automatically controlled through dimmers so that they are raised or lowered as the curtain opens or closes.

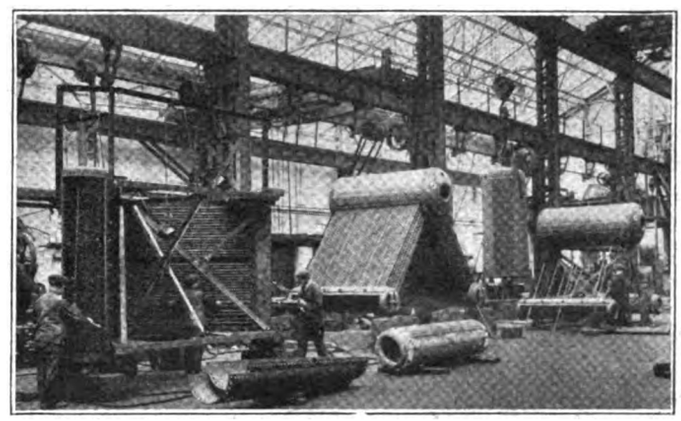
The organ, too, is electrically controlled from the console in the orchestra space. Further energy is provided for the ventilation system, vacuum cleaner system, and artesian well motors by 14 motors of capacities varying from 1 H.P. to 16 H.P. Electric water heaters are provided for the supplementary heating, and the total amount of electrical energy required for lighting and power purposes is 200 kW.

Mr. B. Crewe is the architect, Mr. Humphrey the consulting electrical engineer, and the Berkeley Electrical Engineering Co. the electrical contractors.

Boilers for Power Stations.

Construction of the Yarrow Boiler.

An illustrated booklet issued by YARROW AND CO. describes the salient features of the Yarrow water-tube boiler, which consists of three or more drums of circular section, the lower or water drums being connected to a common steam drum by straight tubes, which form the heating surface. The method of securing straight tubes is an important feature, as this facilitates simple construction with



YARROW BOILERS IN COURSE OF CONSTRUCTION.

the fewest different parts. Access to the drums is simple, a manhole door being removed from each end. The absence of a large number of doors and bolted connections is a manifest advantage.

Capacity for High Overload.

These boilers are designed primarily for steel cases, which are somewhat more expensive initially, but reduce repairs and ensure airtightness ; boilers can, however, be arranged with brick settings if desired. The boiler is considered specially suitable for large outputs and high pressures. Boilers of over 120 000 lb. evaporation capacity at 212 deg. F., and 400 lb. per sq. in., are constructed. Another advantage claimed is the quick response to any sudden increase in load—a point of importance in electricity supply stations.

Internal Cleaning Facilitated.

Another distinctive feature is the straight and nearly vertical tube which is easily cleaned internally and less liable to suffer from deposits. It is stated that a boiler in a modern torpedo boat destroyer will generate sufficient steam for 12 000 H.P., equivalent to a continuous evaporation of 25 lb. per hour from and at 212 deg. F. per sq. ft. of generating heating surface. High rates of evaporation are only possible where circulation is rapid, a condition favoured by the vertical tube system. The upkeep of brickwork is reduced to a minimum, as the arch can be raised, and the brickwork lining does not reach an unduly high temperature. Some of the illustrations show combinations of boilers with economiser, air heater or both. Each arrangement has its merits according to local circumstances. The design of boilers can be adapted easily to the various types of coal, and they are also claimed to be suitable alike for oil, gas or pulverised fuel.

The chief advantages claimed for the boilers may be summarised as follows : (1) The large heating surface exposed to direct radiation from the fire. (2) The big furnace capacity, assuring complete combustion of fuel. (3) All generating tubes are straight. (4) Rapid circulation of water in all tubes. (5) Boilers can be forced to almost any extent without fear of injury. (6) Simplicity of cleaning and inspection.

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British Empire Exhibition.

Exhibitors in the Engineering Section.

Already no fewer than 276 firms, occupying 203 stands, are represented in the Shipbuilding, Marine, Mechanical and General Engineering Section of the BRITISH EMPIRE EXHIBITION. This section, which is being organised by the British Engineers' Association, is said to comprise the largest number of exhibitors from any single industry ever brought together in any one exhibition. The preliminary list of exhibitors includes:—Attwater and Son, insulating material and electrical manufactures; W. S. Barron and Son, electrical engineers; Bolckow, Vaughan and Co., tram rails, etc.; Thomas Broadbent and Sons, electric capstans, etc.; Brown Bayley's Steel Works, steel for railways, tramways, etc.; Davidson and Co., centrifugal high pressure and propeller fans; Davis and Timmins, parts for electrical and scientific instruments, etc.; Etchells, Congdon and Muir, electric lifts; Greenwood and Batley,

PROGRESS IN THE MACHINERY HALL, WEMBLEY.

electric dynamos, accumulators and vehicles, etc.; Gwynnes Engineering Co., centrifugal pumping machinery, etc.; The H.R. Gear Co., reduction, increasing, and multi-speed gears, and gear boxes; Hay, Maryon and Co., hydro-electric installations, etc.; The Heatly-Gresham Engineering Co., electrical generating plants; Petters, Ltd., electrical installations for house or works lighting; Archibald Watson and Co., electrical engineers; and Vickers, Ltd., electrical and general engineers, etc.

The accompanying illustration, taken in the Machinery Hall this week, shows one of a number of sets of metals which will be used to facilitate the movement of heavy machinery into the hall.

The Education of Electrical Foremen.

N.A.S.E. Scholarship Scheme.

As an active translation of its general policy on education the NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS announces a scheme of scholarship exhibitions for its members. In making the announcement the Association points out that the work of the skilled foreman and supervisor gets more and more complicated each day with the advent of new inventions; complete theoretical knowledge is as indispensable as a thorough knowledge of the practical side of the industry, and that it is incumbent on the Association to encourage and assist its members in obtaining such advantages.

Three Scholarships Offered.

With this end in view the board of control has decided to make a start with the following scheme:—Three scholarships are to be offered, one for members under 23 years of age and two for those above that age. The scholarships will be tenable anywhere, subject to the approval of the Association. In the case of those under 23 years of age, the scholarship will be value £6, payable 30s. per annum for three years and 10s. per annum for books. The two scholarships for seniors are valued £7 each, payable £2 per annum for three years and £1 for books.

Scheme becomes Operative this Year.

To enable successful candidates to take advantage of this year's sessions, which commence in September next, the prizes will be awarded by a special selection committee. Applications are to be sent to the General Secretary of the Association, not later than August 30th, giving replies to the following questions:—1. Why I think I should be awarded this scholarship; 2. Present occupation and positions held; 3. Particulars of experience to date; and 4 (to be answered by juniors only) Particulars of general education.

It is hoped that this scheme is only the beginning of something larger, but, as the Association remarks, the project was only mooted in July by the President, Mr. W. E. Highfield, and it is something to have evolved a concrete scheme and to have got it into operation so quickly.

AN ELECTRICALLY-OPERATED MECHANICAL BRICKLAYER is said to be capable of laying 10 000 bricks a day.

Telegraph and Telephone Notes.

It is estimated that there are 1 000 000 automatic telephones in operation throughout the world.

THE CABLE MAKERS' ASSOCIATION announces that the letters C.M.A. have been registered as a trade mark for use by members of the Association.

It is reported that the NEW AUTOMATIC TELEPHONE EXCHANGE which is in course of erection at Bow Street, Sheffield, will not be put into operation before 1926.

For the first time since the installation of the automatic system in 1918, there was a BREAKDOWN IN THE LEEDS TELEPHONE SERVICE on Sunday which completely disorganised the whole of the local system for about two hours.

The employees of BRITISH INSULATED AND HELSBY CABLES, who came out on strike at Prescot on Monday as a protest against the employment of five non-unionist men in the works, returned to work on Tuesday, four of the five men objected to having joined the union.

RADIO TELEPHONIC APPARATUS is to be installed by the Government of Trinidad at the Port of Spain wireless station to link up with stations already established by a British oil company on the Orinoco delta in Venezuela. According to "The Times" the development of a system of radio-telephony throughout the West Indies is in contemplation.

Following upon the decision of the Post Office TO INSTAL AUTOMATIC TELEPHONES IN LONDON, the Post Office has contracted with the Automatic Telephone Manufacturing Co., for the supply of automatic telephone exchange equipment for 50 000 subscribers' lines and a large junction exchange for inter-connecting the automatic and the existing manually operated system.

In order to cope with recent and proposed developments in the telephone service, the Post Office finds it necessary to increase the TELEPHONE TRAFFIC STAFF. The Civil Service Commissioners have arranged to hold another examination, at which the subjects covered will include higher mathematics, electricity, telegraphy, and telephony. The posts offer openings particularly for graduates of technical colleges under the age of 22, with an extension of age for candidates who served with the Forces during the war. Forms of application, to be returned not later than September 6th, can be obtained from the Civil Service Commission.

Business Items.

We are informed that the JAMAICA PUBLIC SERVICE CO., Kingston, Jamaica, B.W.I., has taken over the business of the West India Electric Co.

THE OXFORD ELECTRICAL CO., 2, Ship Street, Oxford, is taking part in the Oxford Shopping Carnival, to be held from September 14th to 22nd.

The IMPERIAL ENGINEERING CO., manufacturers of electric heating appliances, Electric House, Grape Street, Shaftesbury Avenue, London, W.C.2, have appointed Daniel Carmichael and Sons, 125, Howard Street, Glasgow (telephone, Central 5669) as their sole agents for Scotland and the northern counties of England.

The KEIGHLEY GEAR CUTTING CO., of Fleece Mills, Keighley, inform us that they have now moved to more commodious premises. This firm, which purchased the gear cutting business of Mr. Sam Sunderland in October, 1920, has recently completed the erection of an entirely new works, specially equipped for the economic production of accurately cut gearing. The new address is Aireworth Works, Aireworth Road, Keighley, to which all communications should now be addressed.

Institution Notes.

An invitation to participate in the International Foundry Exhibition in Paris between September 2nd and 16th has been received by the INSTITUTE OF BRITISH FOUNDRYMEN.

Sheffield Electricity Committee has decided to supplement its subscription of £100 a year for three years to the BRITISH ELECTRICAL AND ALLIED INDUSTRIES RESEARCH ASSOCIATION by a further sum of £200, making a total of £500, so as to enable the Association to obtain a Government grant of equivalent amount.

Applications are invited for the YARROW SCHOLARSHIPS in connection with the Institution of Civil Engineers. The scholarships vary in value from £50 to £100 per annum, and are open to British subjects who, desiring to become engineers, lack sufficient means to enable them to pursue their practical or scientific training. The regulations concerning the scholarships are obtainable from the Secretary of the Institution of Civil Engineers, Great George Street, Westminster, S.W.1. The latest date for the receipt of applications is September 30th.

A prospectus of the Faculty of Engineering, which is provided and maintained by the Society of Merchant Venturers in the MERCHANT VENTURERS' TECHNICAL COLLEGE, Bristol, has just reached us. Courses of study are available at the College for persons intending to engage in civil, mechanical, electrical, or automobile engineering, and particulars of these courses are given in the prospectus. The ordinances and regulations relating to degrees and diplomas in engineering subjects are included and some particulars of the Bristol sandwich system of training engineers are also given. The prospectus can be obtained from the Registrar of the Merchant Venturers' Technical College, Bristol.

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Electricity Supply.

Extensions and Developments.

The LEICESTERSHIRE and WARWICKSHIRE Electric Power Co. will erect a sub-station at Coalville.

BLACKPOOL Corporation has decided to apply for sanction to borrow £10 000 for cable extensions.

SUNDERLAND Town Council is recommended to carry out extensions to mains at an estimated cost of £662.

Erection of the sub-station at ROYTON is said to be held up temporarily owing to a shortage of bricklayers.

It is proposed to erect a hydro-electric plant to develop water-power from the LITTLE OUSE between Thetford and Two Mile Bottom.

The Yorkshire Electric Power Co is negotiating with the MARSDEN Urban Council for the purchase of a site for the erection of a sub-station.

PORTSMOUTH Town Council is applying to the Electricity Commissioners for sanction to borrow £5 500 in connection with the supply and distribution of electricity on Hayling Island by means of an overhead system.

NEWBURY Board of Guardians has decided to substitute electric lighting for gas in the institution. The cost is estimated to be £370, and it is expected that a saving of something like £60 a year will be effected by the change.

FORMBY Urban District Council has decided to proceed with an electricity scheme for the township, with Mr. James Scott, of Bootle, as engineer. Application is to be made to the Electricity Commissioners for the necessary loans.

PENYBONT U.D.C. has received estimates of the cost of erecting a power station at Kenfig Hill, installing plant and laying distribution cable, etc., in connection with the proposed electricity supply scheme. The outlay is estimated at £28 760.

RHYL Council is applying to the Commissioners for sanction to borrow £7 462 for new plant, high and low tension switchgear, etc., at the power station. A proposal to lay new cable between Sandringham Avenue and the East Parade is to receive further consideration.

Mr. R. W. Harries, electrical engineer, Talog, has prepared plans for the proposed lighting of the ST. CLEARS district by electricity. The plans provide for a generating station at Cleifon Mills, with a turbine of sufficient capacity to supply the whole of the district from the Cleifon waterfall.

The LONDON County Council is contemplating the provision of a new 15 000 kW set at the Greenwich power station. It is intended to dispense with one of the old 5 000 kW sets and to keep the other three 5 000 kW sets entirely as emergency plant. The total cost is estimated at about £77 000.

BLACKPOOL'S Town Clerk has been empowered to proceed with the preparation of an agreement between Blackpool and Lytham St. Annes respecting a bulk supply of electricity to the latter authority. Application is being made for sanction to borrow £10 000, the estimated cost of the cable extensions.

Lots Road Power Station, which supplies the power for the Underground Railways of LONDON, is to be strengthened in view of the Tube extensions now in progress. At present there are two 15 000 kW generating sets in operation, and a third is to be installed. When the third set is completed the station will be generating over 100 000 kW. Lots Road, which supplies 33 sub-stations, is at present one of the largest generating stations under one roof in the world, and, though the additions now being made will provide for the needs of the immediate future, further plant will be required when the new lines recently sanctioned by Parliament are proceeded with.

Alterations in Charges, Proposed and Actual.

STRETFORD Urban Council has reduced the charges for electricity for lighting from 6d. to 5½d. per kWh. For domestic heating and cooking the new rate is 1d. per kWh plus 57½ per cent.

The Ministry of Transport has authorised the ISLE OF WIGHT Electric Light and Power Co. to continue the existing maximum prices for electricity. The company had asked for permission to increase the maximum charges.

Tapping New Areas.

Electric power supplied by Lancashire Power Co. was available in CHORLEY for the first time last week.

REIGATE Town Council is preparing a report on the cost of giving a bulk supply of electricity to Horley and district.

Inquiries and Orders.

WARRINGTON Corporation intends to ask the Commissioners for a Special Order to supply electricity to Orford, Paddington, Padgate and Winwick.

PORTSMOUTH Town Council is applying to the Electricity Commissioners for an Order authorising the supply of electricity in bulk to the Fareham Urban Council.

LANARKSHIRE County Council has consented to the application of the Strathclyde Electricity Supply Co. for a Special Order to supply electricity to certain districts in the county.

TYRONE County Council has decided to oppose the Ulster hydro-electric power scheme on account of the possible flooding of meadowland owing to the proposed raising of the level of Lough Neagh.

The Minister of Transport proposes to confirm the CHADDERTON (LANCS) ELECTRICITY SPECIAL ORDER. Any objections must be sent by August 25th to the Secretary, Ministry of Transport, Whitehall, London.

HUDDERSFIELD Borough Council hopes to persuade the Electricity Commissioners to rescind their decision to sanction an application of Electrical Distribution of Yorkshire, Ltd., for Special Orders authorising the supply of energy to certain districts in the Huddersfield area, the Colne Valley, and the Spen Valley.

Colonel T. C. Ekin, on August 14th, held an inquiry relative to the application of the FRINTON-ON-SEA Electric Lighting and Supply Co. for power to make a permanent charge of 1s. per kWh for electricity for lighting. Objections were lodged by the Urban Council and others, and Mr. A. T. Thomas, for the company, said they would grant a reduction in meter rents provided that the maximum cost of electricity was not lower than 10d. per kWh.

A GLASGOW Corporation sub-committee, in considering recommendations with regard to the projected West of Scotland Electricity Supply District, agreed to request that the members representing the Corporation on the Advisory Board should be increased from three to five. The meeting also decided, in view of the Corporation's proposals to erect a new generating station in the west of the city, that the Electricity Commissioners should be asked to take that fact into consideration when dealing with the constitution of the West of Scotland Electricity Supply District.

Miscellaneous Supply Items.

A demonstration of electrical accessories will be held at the Francis Cafe, Parker Street, Liverpool, from September 3rd to September 22nd.

ABINGDON Town Council is considering the advisibility or otherwise of continuing the present arrangement with the Abingdon Electric Light Co. at the end of the existing agreement.

GLASGOW Corporation Electricity Sub-Committee on Propaganda has reaffirmed its recommendation that the charge for the hire of electric cookers should be lowered to 20s. for the first year and 10s. in succeeding years.

For the purposes of the Electricity (Supply) Acts, the ELECTRICITY COMMISSIONERS approve the construction and pattern of meter numbered 97 291 deposited at the National Physical Laboratory by Measurement, Ltd., for the measurement of electrical energy supplied on the constant pressure two-wire single phase system, and known as the Measurement Type "A" meter, rated size 5 A at 100 V.

The question of the wages paid to the WARRINGTON Electricity Works employees has been engaging the attention of the Warrington Electricity Committee, which has recommended the Wages Sub-Committee to adopt the scale of salaries and conditions of the National Joint Board under protest; and that the Town Clerk be requested to inform the District Joint Board and the National Joint Board that, in the opinion of this committee, the salaries to be paid under the schedule are excessive and that they be requested to reconsider the basis for payment of salaries. The Town Clerk was requested to circularise all municipal authorities with a view to obtaining their support.

Personal Items.

SOUTHPORT Town Council has decided to increase the salary of Mr. E. Moxon, the borough electrical engineer, from £800 to £900 with annual increments of £50 up to £1 000.

Mr. P. CLEGG has been appointed electrical engineer to the Bingley Urban Council in succession to Mr. F. L. PEDLEY. Mr. Clegg will commence his new duties on September 1st.

Mr. A. H. DARKER, chief electrical engineer to J. Stone and Co., Ltd., Cockspur Street, London, S.W.1, who has been making a business tour round the world, has now returned to England.

Mr. W. J. THORROWGOOD, signal and telegraph superintendent of the London and South Western Railway, has been appointed to a similar post, under the chief engineer, on the Southern Railway.

Mr. W. C. L. EGLIN, chief engineer and vice-president of the Philadelphia Electric Co., who is visiting this country, stated the other day that he was much impressed with the state of electrical progress in England.

Mr. H. D. WILKINSON, consulting engineer, 56, Victoria Street, London, S.W.1, has undergone a serious operation and will be laid aside for about three weeks, during which time arrangements have been made to carry on his practice without interruption.

Mr. J. M. CALDER, general manager and engineer to the Reading Corporation Tramways, has been appointed a member of the committee set up by the Tramways and Light Railways Association to consider the question of wireless aerials erected in close proximity to tramway overhead trolley wires.

Out of 110 candidates for the position of electrical engineer, Ilkley Urban Council on Tuesday appointed Mr. E. J. JARVIS, of Waltham Cross, after interviewing five of the applicants. Mr. Jarvis is resident engineer to the North Metropolitan Electric Power Supply Co., and will take up his duties at Ilkley on October 1st.

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Tenders Invited.

GREAT BRITAIN.

MOOR END W.M. CLUB, DEWSBURY MOOR.—Electric light wiring at the Hollins, Dewsbury Moor. Specifications from the Secretary.

RUGELEY URBAN DISTRICT COUNCIL.—Lighting street lamps for eight months. Particulars from the Clerk.

FLEETWOOD URBAN DISTRICT COUNCIL, August 27th.—About 1 050 yards of cable. Specification from W. P. Lilwall, Engineer, Copse Road, Fleetwood.

NEWCASTLE-UNDER-LYME CORPORATION, August 27th.—About 3 000 yards three-core e.h.t. paper, lead-covered steel armoured cable. Specification from the Borough Electrical Engineer.

WEMBLEY URBAN DISTRICT COUNCIL, August 29th.—Percolating filters, screening apparatus, sludge ejectors, pumps, electric motors, etc., for sewage outfall works. Specification can be seen at the office of the Engineer, Council Offices, Wembley.

RAWTENSTALL EDUCATION COMMITTEE, August 31st.—Labour and materials in connection with electric light installation at Cloughfold and Water Council schools. Specifications from the Secretary, Education Offices, Cloughfold, via Manchester.

EDINBURGH CORPORATION, September 3rd.—Extension of five d.c. feeder panels at Leith sub-station. Specification (No. 52) from the Engineer and Manager, Electricity Department, Dewar Place, Edinburgh.

NEWPORT (MON) GUARDIANS, September 4th.—Three or six months' supply of electric light fittings, ironmongery, engineers' stores, etc. Forms of tender from the Clerk, Union Offices, Queen's Hill, Newport, Mon.

BERMONDSEY (LONDON) GUARDIANS, September 6th.—Six months' supply of electric lamps, oils, paints, ironmongery, etc. Forms of tender from the Clerk, 283, Tooley Street, S.E.1.

EDMONTON GUARDIANS, September 10th.—Six months' supply of electric lamps, ironmongery, etc. Forms of tender from the Clerk, 77, Bradport Road, Edmonton, London, N.18.

NORWICH CORPORATION, September 11th.—Supply of the following plant for Thorpe power station : (*a*) Two 5 000 kW three-phase turbo-alternators; with exciters, condensers, etc. ; (*b*) three 40 000 lb. per hour water-tube boilers, with superheaters, mechanical stokers, etc. ; (*c*) one motor driven pair of 12 kW boosters ; (*d*) one 550 Ah battery ; (*e*) one 50-ton overhead travelling electric crane. Specifications from Preece, Cardew and Rider, 8, Queen Anne's Gate, Westminster, S.W.1.

FARNWORTH URBAN DISTRICT COUNCIL, September 17th.—50 kW rotary converter, transformer, switchgear, instruments and cables. Specification from the Engineer, Electricity Works, Farnworth, near Bolton.

PLYMOUTH CORPORATION, September 19th.—(1) 6 000 kW turbo-alternator, condenser, etc. ; (2) 1 000 kW converter. Specification, until September 10th, from the Borough Electrical Engineer, Prince Rock, Plymouth.

GENERAL POST OFFICE, LONDON, September 24th.—Swedish, Norwegian, Finnish or Baltic red fir and home-grown larch or Scots fir telegraph poles, for delivery next summer. Forms of tender from the Controller, Post Office Stores Department, 17–19, Bedford Street, W.C.2.

IRELAND.

RATHMINES AND RATHGAR URBAN DISTRICT COUNCIL, August 29th.—Prepayment meters. Specification, etc., from the Engineer, at the Electricity Works.

BELFAST CORPORATION, September 17th.—Three-phase e.h.t. switchgear for the Harbour power station (specification W.14). Specification from Mr. Johnstone Wright, city electrical engineer and manager, East Bridge Street, Belfast.

AUSTRALASIA.

POSTMASTER-GENERAL'S DEPARTMENT, BRISBANE, October 3rd.* Switchboard apparatus and parts (schedule 594). October 10th.*—Protective apparatus.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS DEPARTMENT, October 24th.*—Rotary converters. October 31st.*—Three steam turbine driven centrifugal boiler feed pumps, and an air washer, and humidifier for White Bay power house.

POSTMASTER-GENERAL'S DEPARTMENT, PERTH, October 31st.*—Telegraph apparatus, telephones, testing instruments, etc.

SYDNEY CITY COUNCIL, December 3rd.*—High tension switchgear and apparatus.

CANADA.

TORONTO MUNICIPALITY, October 9th.*—Alternating current generator.

SOUTH AFRICA.

JOHANNESBURG MUNICIPAL COUNCIL, September 24th.*—Rotary converter.

STRAITS SETTLEMENTS.

SINGAPORE MUNICIPAL COMMISSIONERS, September 7th.—5 000 kW turbo-alternators and condensing plant (section A) ; and water-tube boilers, draught plants and steel chimneys (section B). Specifications from Preece, Cardew and Rider, 8, Queen Anne's Gate, Westminster, S.W.1.

URUGUAY.

STATE ELECTRICITY SUPPLY WORKS, MONTEVIDEO, October 15th.*—Low-tension armoured cable, telephone cable and accessories.

* Particulars from the Department of Overseas Trade.

Tenders Accepted.

STEYNING PARISH COUNCIL have accepted the tender of the Steyning Electric Light Co. for public lighting.

The tender of J. E. Shaw has been accepted for electric light wiring and fitting in the Congregational Mission Church, QUARRY BANK.

EDINBURGH CORPORATION have accepted the tender of the Bristol Wagon and Carriage Works Co. for eight top-covered tramcar bodies, £5 680.

MARGATE EDUCATION COMMITTEE have accepted the tender of the Margate and District Electrical Co. for electric light wiring etc., installation, at the boys' central school at £260.

The tender of C. F. Proctor for wiring the Fenchurch Street depot, £80 10s. 10d., and that of J. Loughlin for wiring the Wincolmlee Cart Works, £77, have been accepted by HULL CORPORATION.

The tender of the Campbell Gas Engine Co. for gas engine and producer and Crompton 100 kW dynamo, £2 830 7s., and switchgear, £200 is recommended for acceptance by DORCHESTER CORPORATION.

ST. PANCRAS (LONDON) BOROUGH COUNCIL are recommended to accept the tender of the Park Royal Engineering Works for four panels for low pressure switchboard at Tavistock Place sub-station.

MARKET DRAYTON URBAN COUNCIL have accepted the tender of the Market Drayton Electric Light and Power Co., for public lighting from September 16th to April 19th, at £3 10s. per lamp for 90 or more lamps.

STAFFORD EDUCATION COMMITTEE have accepted the tender of Smith and Bellhouse for underground main and for wiring at the Staffordshire Farm Institute, £1 828, and that of Tangyes, Ltd., for a 30 B.H.P. crude oil engine belt driven dynamo, £505.

The LONDON, MIDLAND AND SCOTTISH RAILWAY Co. have placed a contract with Belliss and Morcom for a 1 500 kW steam turbo-generator, with surface condensing plant, for the Derby work-shops. The electric generator will be supplied by the Lancashire Dynamo Co.

An order for a twin tandem gas engine (to be worked by blast furnace gas) and a 5 000 kW 6 600 V three-phase alternator has been placed with the Soc. Anon. John Cockerill, of Seraing, Belgium by the STAVELEY COAL AND IRON CO. The alternator is being made by the Ateliers de Constructions Electriques de Charleroi.

The POST OFFICE have placed a contract with the Automatic Telephone Manufacturing Co. for the supply of 50 000 lines of Strowger director automatic telephone equipment, with a large junction exchange for inter-connecting the existing manual and automatic telephone systems during the period of conversion. This is said to be the beginning of the conversion of the entire London telephone system to Strowger automatic operation.

The CAMBRIDGE AND PAUL INSTRUMENT COMPANY have received orders recently for a CO_2 indicating and recording outfit for use on four boilers in the electricity works of Derby Corporation, a similar outfit for four boilers for the Bedford Electricity Department, and an indicating outfit for four boilers in the Cardiff Corporation's works. A repeat order for a CO_2 outfit for the Barton (Manchester) power station has been received through Babcock and Wilcox and a 20-point recording and indicating electrical distance thermometer equipment and a 4-point CO_2 recorder have been ordered by Alfred Hickman and Co. for use with Thompson boilers.

Forty Years Ago.

"The Electrician," August 25th, 1883.

DOMESTIC ELECTRIC LIGHTING.—Messrs. R. E. Crompton and Co. are about to light the house of Mr. W. S. Gilbert, well known as the composer of the music of "Iolanthe," etc., with Swan incandescent lamps. Mr. Gilbert will design his own fittings.

* * *

SERMONS BY TELEPHONE.—Bradford (Yorks) is following the example of Greenock, Edinburgh, and other towns. We hear that the National Telephone Company's exchange in that town is connected with the Chapel Lane Unitarian Chapel, and that many subscribers now listen to the utterances of their pastor through the medium of the telephone. We are afraid that the telephone may fall into some discredit amongst preachers, if congregations elect to be sermonised at home. We believe, however, that the majority of those who use this novel means of being present in spirit, but absent in body, are invalids, and to these the telephone must be an unexpected boon.

* * *

THE BERLIN OPERA HOUSE.—This opera house was recently re-opened after having been somewhat improved as to its internal arrangements. Amongst other things the foyer has been lighted by means of electric lights, the result of which has been considerably to reduce its temperature as compared with that experienced before the introduction of the electric light, and also to make it a comparative icehouse as contrasted with the auditorium of the Opera House. The correspondent of a daily paper, describing the opening night, says :—"I saw not a few ladies hastily wrap themselves up in cloaks, and some incontinently retire from the dangerous though grateful coolness of the foyer." The next best thing for the authorities to do is to light the whole building by the new system.

W. R. Cooke and A. E. Coleman have applied for the RESTORATION OF PATENT No. 1 672/1915, for "Improvements in electrolytic apparatus for the production of liquor for bleaching and other purposes," which expired on February 2nd, 1920, owing to non-payment of renewal fee.

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Electric Traction.

Tramway Extensions and Developments.

Rumours that the LONDON COUNTY COUNCIL intends to seek Parliamentary sanction next session for the laying of a new tramway track between Eltham Road and Sidcup via West Park, are not confirmed officially.

Among the route extensions contemplated by the EDINBURGH Tramways Committee, are the following:—Leith to Portobello; the present Slateford terminus to the village of Slateford; Braids to Lothianburn; and an extension at Willowbrae Road, whence the route will probably be continued to Duddingston and Portobello. The schemes are to be proceeded with as soon as Parliamentary powers have been obtained.

Fares, Receipts and Passengers.

The DUBLIN United Tramways Co. is to re-introduce penny fares for stages of about one mile.

According to the annual report of the ABERDEEN tramway undertaking the number of passengers carried was 41 162 504, an increase of 75 116 on the previous year's figure.

Traffic receipts on the MADRAS electric tramways during the fortnight ended August 15th totalled 53 176 rupees, an increase of 10·1 per cent. on the corresponding period last year.

For the week ending August 11th traffic receipts on LONDON tramways controlled by the "Underground" group totalled £50 201, an increase of £2 939 on the corresponding week last year.

Following the success attending the introduction of weekly tickets on the Bradford tramways, DONCASTER Corporation has decided to experiment in the same direction. The whole area is to be divided into zones, and a weekly ticket on a three-halfpenny stage, or zone, will cost 2s., each stage rising 6d.

In view of the suggestion to scrap the Barrowford section of the NELSON tramways, it is interesting to note that the receipts on the whole system from May 19th to June 30th show a serious decline compared with a year ago—£2 000 against £2 441 in 1922; and passengers 325 140, compared with 385 265 last year.

During the eight weeks that the weekly tram passes have been in operation on the Lidget Green route of the BRADFORD City Tramways, the total takings of £4 450 showed an increase of £400 over the former average takings. The passes will continue to operate until October 31st, but in the meantime it is probable that similar facilities will be extended to the whole of the system.

Electric Railway Items.

Traffic receipts on the MERSEY RAILWAY during the week ended August 11th, totalled £4 453, bringing the total for the year to date to £144 945.

The METROPOLITAN RAILWAY is reported to be contemplating the electrification of the line from Harrow to Rickmansworth, a distance of about 7 miles.

Representations are to be made to the railway companies regarding proposals to electrify GLASGOW suburban services. The electrification of the Subway Railway is to be considered by the Tramways Committee at an early date.

Miscellaneous Traction News.

TORQUAY tramways have contributed 25 guineas to the Torquay Chamber of Commerce for the Combined Advertising Fund for making known the attractions of the borough.

A law suit is pending against the MANCHESTER Corporation, in which the plaintiff is a tramwayman who is claiming half-pay for the time he served in the Army. It is alleged that the Manchester Corporation promised that all employees entering military or naval service should receive at least half-pay. The tramwaymen's union has decided to take action in a test case, as it is alleged that this promise was not kept. Altogether a sum of over £100 000 is said to be involved.

Suburban Railway Electrification.

The London and North Eastern Co.'s Scheme.

The directors of the London and North-Eastern Railway Company, states "Modern Transport," have during the past week definitely decided to embark upon a scheme for the electrification of the London suburban lines of the former Great Northern Railway. Immediately after the formation of the group a committee of the directorate was appointed to investigate the advisability of electrifying the existing railways, and this decision is the first result. The "Daily Telegraph," however, states that no decision has been arrived at, and that although it is anticipated that the decision of the committee will be in favour of electrification, the matter is at present only under discussion. The committee is now engaged in an investigation as to the possibilities of the electrification of the congested suburban lines comprised in the Great Eastern Section, but as this presents a much more difficult problem no decision has yet been reached.

Another important proposal exercising the minds of the directors is the possibility of linking-up, in the vicinity of London, the lines of the former Great Northern and Great Eastern Railways in order to make traffic readily interchangeable between either King's Cross or Liverpool Street st[illegible]ions.

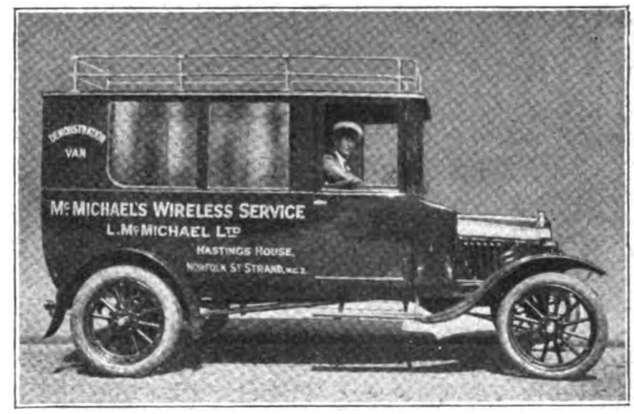
Wireless News.

Wireless Retailers Propose 10s. Licence Fee.

In view of the fact that the Postmaster-General recently agreed to consider representations from the Wireless Retailers' Association on the subject of wireless licences and royalties, the Association has forwarded to him a resolution which, they state, embodies the views of several hundred wireless retailers. The recommendations are:—That, subject to any special regulations for experimenters which may be deemed necessary in the national interest, there should be only one kind of licence for all owners of receiving sets whether home-constructed or not. That the policy of raising revenue for broadcasting by adding a royalty to the purchase price of apparatus, being unfair in its incidence and prejudicial to the sale of instruments, should be discontinued. All direct contribution made by the public for this service should be paid as licence fee or other form of separate annual payment. That the proportion of the licence fee retained by the Government, being equal to 100 per cent. of the sum handed over to the British Broadcasting Co., is unreasonable and harmful to the industry. If levied as an entertainment duty it should be reduced to the same percentage as that charged in respect of other forms of entertainment. The Committee are, however, of opinion that there is no more justification for direct taxation of listeners than of users of gramophone records or music rolls, especially as this is a new industry. And that having regard to the very great increase in the number of licence holders which may be expected as soon as the licence question is settled, and the probability that by means of relay stations it will be found practicable to broadcast from one centre for the whole country, the Committee are of opinion that a 10s. licence fee is adequate to cover the expenses of broadcasting and cost of collection, but submit that the fee should be subject to reconsideration in the light of subsequently published figures.

Wireless Demonstration Vans.

Whether business is good or slack, it is preferable to approach one's customers instead of waiting for them to drift in by themselves. This principle appears to be working successfully in the



A WIRELESS DEMONSTRATION VAN.

wireless trade, judging from the considerable interest shown by the public in the smart-looking wireless demonstration van illustrated above.

British Wireless Inventions.

In reply to a statement that there is no single British patent which is the basis of any of the circuits in English broadcasting transmitters, Captain P. P. ECKERSLEY, engineer-in-chief of the British Broadcasting Co., pointed out to a Press representative on Monday that several wireless devices have been patented by English inventors. The microphone used at the London station was the invention of Mr. Sykes, an Englishman. Another Englishman, Prof. J. H. Fleming, had invented the rectifiers, while the high-frequency circuit relied basically upon English patents. An Englishman had also invented the independent drive, and the grid leak for transmitting valves was a British invention. Basically, he said, the construction of every transmitting valve in a broadcast transmitter as used in London was suggested by an Englishman. In strict justice the patent of the cylindrical anode was a British patent, while Prof. Fleming first suggested tungsten filaments for valves, which were in common use to-day. The only valid foreign patent used appeared to be that of choke control.

Wireless News in Brief.

Estimated to have cost £500 000, the wireless station at PEKING, erected by the Japanese Missui Co., is, states the Central News, completed and in touch with Bordeaux.

As the result of experiments, the BRITISH BROADCASTING Co. is fully satisfied that by a combination of land lines and relay stations, it is quite practicable for a special item at any one station to be radiated at all others.

Further inquiries into certain FINANCIAL QUESTIONS AFFECTING THE BROADCASTING PROBLEM are understood to be delaying the report of the Broadcasting Committee.

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Companies' Reports, Dividends, etc.

LANCASHIRE DYNAMO AND MOTOR CO.—Announcement is made of an interim dividend on the preference shares, but no interim distribution will be made on the ordinary shares.

WALTER SCOTT, LTD.—The directors recommend the payment of a dividend on the 6 per cent. preference shares for the two years ended June 30th last, and a dividend of 2½ per cent. on the ordinary shares for the year ended June 30th.

HADFIELDS, LTD.—Having regard to the general position and the uncertain outlook of the steel trade, the directors have decided not to make an interim distribution on the ordinary shares, but to await the results of the complete year.

WHITEHALL ELECTRIC INVESTMENTS, LTD.—The acquisition is announced of two additional Chilean electrical undertakings by the company. One is the tramways and light and power system of Valparaiso, which has been acquired through the purchase of the share capital of a Chilean company, and the other is the La Florida hydro-electric installation near Santiago, which has been acquired through the purchase of the share and bond capital of another Chilean company.

J. STONE AND CO.—The report for 1922 shows a net profit of £155 875, after providing for depreciation, etc., compared with £176 152 for the previous year. With the addition of £128 755 brought in there is available £284 630, against £228 785. The directors recommend placing £50 000 to reserve, against £25 000 last year, and paying a dividend of 10 per cent. on the ordinary shares, compared with 7½ per cent. for each of the previous two years, leaving to be carried forward £147 590.

C. A. VANDERVELL AND CO.—At the annual meeting last week, Mr. C. A. Vandervell said the position had improved during the year and the loss was smaller than last year. With regard to the present position, the turnover for the quarter ended June was higher by 30 per cent. than last year. This, in spite of keen competition, was, he thought, proof that their lighting and starting equipment still maintained its high standard of excellence. The accumulator section, apart from the motor business, continued to show improvement, and their general business, including orders in hand, was satisfactory.

Consolidated Electrical Winding-up Proposals.

Presiding at the annual meeting last week, Mr. Herbert Allen said that for the past few years they seemed to have drifted from bad to worse, and, owing mainly to the loss of revenue from the company's telephone investments, the disproportion between income and expenditure had become very pronounced. It was a question, therefore, whether the company could still be carried on with advantage to the shareholders. Owing to the collapse of the Portuguese exchange, the Anglo-Portuguese Exchange Co. was unable to pay dividends, and there were no hopes of an immediate recovery in Portuguese currency. The telephone company was not alone in its sufferings, as there was not a single public utility company in Portugal paying its way. As far as he could see, there was little prospect of recovery from the position which now prevailed, whereby the income was mainly swallowed up by expenditure. In regard to their investments, these had suffered since March 31st last in common with other Stock Exchange securities. If it were possible, the directors would do their utmost to bring forward a scheme of reconstruction in the near future, but, as far as he (the chairman) could see, there was no possibility of that. His feeling was that in the autumn there should be a general special meeting at which, unless some better proposal was forthcoming, formal resolutions should be submitted for winding-up and distributing the assets as far as possible in cash. In a discussion which followed, shareholders expressed the view that the company should be wound up.

Stock Exchange Quotations.

The STOCK EXCHANGE COMMITTEE has granted official quotations to 20 000 £1 fully paid 6 per cent. cumulative preference shares of the North Metropolitan Electric Power Supply Co., and £100 000 3½ per cent. B consolidated stock of the Tottenham District Light, Heat and Power Co.

Supply and Lighting.

NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO.—Interim dividends of 3½ per cent. on the seven per cent. preference shares, and 2½ per cent. on the five per cent. preference shares, both less tax, will be paid on September 29th.

SOUTH METROPOLITAN ELECTRIC LIGHT AND POWER CO.—Payable on August 31, the usual interim dividends have been declared on the preference shares. An interim dividend at the rate of 4 per cent. per annum, less tax, is payable on the ordinary shares at the same time.

BROMPTON AND KENSINGTON ELECTRICITY SUPPLY CO.—The directors have declared an interim dividend on the ordinary shares at the rate of 10 per cent. per annum, tax free, compared with an interim distribution last year at the rate of 9 per cent. per annum, less tax, on a much smaller capital.

Cable, Telegraph and Telephone Companies.

WESTERN UNION TELEGRAPH CO.—Figures just to hand for the first six months of this year show an increase in the net income of over $1 000 000. The gross revenue was $56 097 327 which, after payment of $48 141 299, total expenses, leaves the net income of $6 802 603.

Traction Companies' Results.

MANSFIELD AND DISTRICT TRAMWAYS.—On the ordinary shares an interim dividend of 3 per cent. is to be paid, the same as a year ago.

ABERDEEN SUBURBAN TRAMWAYS CO.—The profit for the half-year ended July 31 last was £1 848, making available £5 247. Payment of a dividend at the rate of 7 per cent. for the year and of directors' fees, £100, leaves £2 961 to carry forward. The annual meeting is to be held at Aberdeen on August 30th, at 12.30 p.m.

SINGAPORE ELECTRIC TRAMWAYS, LTD.—A meeting of the debenture holders was held in London recently to consider a resolution approving a scheme entered into by Sir W. Plender, the receiver, with the Shanghai Electric Construction Co. Mr. T. D. Lingard, who presided, said that at the last meeting resolutions had been passed for entering into certain arrangements with the Shanghai Co., but it had since been found impossible to carry out those resolutions. The trustees had then had no alternative but to apply for the appointment of a receiver. Sir W. Plender said the underlying idea of the scheme was co-operation between the two companies; if one benefited so did the other. The Singapore authorities welcomed the advent of the Shanghai Co. The proposed issue of £250 000 debentures should be sufficient to rehabilitate the system and provide working capital. It was proposed to adopt the railless track system. The resolution was carried.

TYNESIDE TRAMWAYS AND TRAMROADS CO.—Speaking at the half-yearly meeting last week, Mr. C. E. Henderson (the chairman) regretted that the results of the half-year had not been such as in the opinion of the directors justified them in paying a dividend on the ordinary shares. The trade of Tyneside had been very depressed during the whole of the half-year, and, in consequence, the traffic receipts showed a decrease of £1 712, as compared with the corresponding half-year in 1922. The expenses had, however, also shown a decrease, amounting to £762, and the gross profit for the half-year was £3 127, a decrease of £1 006 as compared with June, 1922. With the sum carried forward from the previous half-year, they now had £3 302 available for disposal, as against £4 725. The directors proposed that the usual dividend of 5 per cent. be paid on the preference shares, and that £500 be transferred to the reserve account. The balance of £287 would be carried forward to the next half-year. During the half-year the reserve account had been increased by £593, interest on investments, whilst £1 048 had been taken from the account for the renewal of rolling stock. The small piece of single track at the Gosforth Park terminus had recently been doubled in accordance with the terms of the Newcastle Light Railway Order. The report and accounts were adopted.

New Companies.

PERONET, LTD.—Private. Cap., £1 000 in £1 shares. Wireless telegraph, telephone and general engineers, etc. Reg. office: 83, Bloomsbury Square, London, W.C.1.

REVAL CO., LTD.—Private. Cap., £3 500 in £1 shares. Wireless, radio, and electrical engineers, etc. Reg. office: 15, Grape Street, Shaftesbury Avenue, London, W.C.2.

CINEMA APPARATUS CO., LTD.—Private. Cap., £2 000 in £1 shares. Kinematograph, electrical and mechanical engineers, etc. Reg. office: 45, Cannon Street, Manchester.

FRANCIS BAGNALL AND CO., LTD.—Private. Cap., £1 000 in £1 shares. Manufacturers of electric motors, etc. A director: F. E. Bagnall, 18, Mortimer Road, Ealing, London, W.13.

Limited Partnership.

REGENT RADIO CO.—Makers and sellers of radio apparatus, Biscot Road, Luton. Partnership for five years from June 25th, 1923. General partner: J. F. Mongiardino, 38, Conway Road, Luton. Limited partners: P. J. Oliver, Wigmore Hall, near Luton, and A. R. Oliver, New Mill End, near Luton, contributing £200 each in cash.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER. (Special Colonial Issue).—"Furniture for the Colonies"; "The Forthcoming British Empire Exhibition"; "How Retailers Deliver Furniture."

THE CHEMICAL AGE. (Special Chemical Engineering Issue).—Articles by Herbert Blyth, Rex Furness, W. H. Coleman, J. A. Reavell and others. "Safeguarding of Industries Act: Awards on Formaldehyde and Rochelle Salt."

THE EUROPEAN COMMERCIAL.—"Monthly Review of European and American Iron and Steel Industry"; "The Federation of German Industries: An Account of its Organisation and Activities"; "A Conflict in Dutch Banking Circles."

THE FRUIT GROWER.—"'Brown Heart' in Apples" (illustrated); "The Dutch Defence of Potato Importations"; "Ormskirk Potato Trials."

GARDENING ILLUSTRATED.—"Growing for the Home Exhibition": "Potting Early Fruit Trees"; "The Chili Pine."

THE GAS WORLD.—"Low Temperature Carbonisation"; American Rules for Gas Supply"; "The Treatment of Coke."

THE HARDWARE TRADE JOURNAL.—"Prices of Building Materials: Pre-War and Post-War Comparisons"; "Unpacking and Marking-off Goods"; "Difficulties in Hardware Window Dressing."

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

GOLDENBURG, Bernard, 16, John Dalton Street, Manchester, electrical factor. £16 18s. 2d. June 27th.

HOGARTH ENGINEERING CO., 72, Regent Street, W., electrical engineers. £33 12s. 5d. June 25th.

MILLS, Mr. F. O., 27, Martins Lane, E.C., electrical engineer. £18 13s. 3d. June 27th.

MOSELEY ELECTRICAL CO., 8½, Parade, Birmingham, electrical engineers. £20 4s. 7d. July 10th.

TUDOR, Mr. H. Claude, The Electricity House, 35, Queen Street, Wolverhampton, electrician. £10 11s. 5d. June 27th.

WEBER AND LITTLEFORD, Dingle, Colwyn Bay, electrical engineers. £21 14s. July 9th.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

CARTWRIGHT (J. L.) AND CO., Springfield Lane, Strangeways, Manchester, electrical manufacturers and suppliers. Creditors were called together recently when a statement of affairs was submitted which disclosed liabilities of £8 679 (including trade creditors for £8 380) and net assets of £5 090, or a deficiency of £3 589. It was reported that the business was started in September, 1919, at small premises at London Road, Manchester. During 1922 additional works were obtained and the firm commenced the manufacture of wireless components. The firm were inundated with orders which they were unable to cope with owing to lack of accommodation and other premises had to be acquired at Springfield Lane. During the 12 months to November, 1920, the turnover was £1 682 with a net profit of £380. In the following year the turnover fell to £1 500 and there was a profit of £114. During the 11 months to October, 1922, the turnover rose to £2 921, but there was a loss of more than £400. The present deficiency was accounted for by the depreciation written off the assets and the drawings, which had been small. It was pointed out that during the nine months to July 24th last the turnover totalled £17 510 and there was a gross profit made of £2 178, but the trade expenses totalled £3 206. A resolution was passed in favour of a deed of assignment being executed to Mr. A. Hodcroft, accountant, of 7, Brazennose Street, Manchester, together with a committee consisting of the representatives of the Western Electric Co., Ltd., J. Morris and Co., H. Clarke and Co., Ediswan Electric Co., and Varley Magnet Co. The trustee and committee were instructed to carry on the business and the debtors were given time within which to submit an offer.

HALL, W., and CASHNELLA, J. E., electrical engineers, trading as W. HALL AND CO., 71, Beak Street, London, W. A meeting of creditors was held recently at the Chancery Lane Safe Deposit when it was reported that the liabilities totalled £1 257, while the assets amounted to £3 533, or a surplus of £2 276. It was reported that the business was started by the debtor Hall about twenty years ago at Uxbridge and he was able to trade successfully for many years. He carried on business alone until July, 1922, when he was joined in partnership by another man. That partnership was afterwards determined and Hall was then joined by Cashnella, who had previously been in his employ. During the early months of the present year considerable sales were effected, but then the trade slumped off. The drawings had been moderate. It was suggested that the debtors should be allowed to carry on the business and discharge their liabilities in full. Eventually it was decided that the meeting should be adjourned and that a statement of affairs prepared by Mr. C. Latham, accountant and auditor, 15, Eastcheap, E.C. The following are creditors: Burton, E. F., and H., £180; Cort, A., and Co., £40; Castle, T. L., £158; Formo Co., £48; Greenslade and Brown, £21; Oldham and Son, Ltd., £60; Mecanite and Insulators Co., Ltd., £21; Powers Equipment Co., Ltd., £193; Shirley, Owen, £23; Hunt, A. H., Ltd., £103; Pettigrew and Merriman, £94; Crystalite Manufacturing Co., Ltd., £27.

SCOTT (JAMES), LTD., electrical engineers, Knowsley Road, Bootle. The statutory meeting of creditors in this voluntary liquidation was held last week at the Law Association Rooms, Liverpool, when a statement of affairs was presented which showed ranking liabilities of £25 871. It was pointed out that there were 590 trade creditors, whose claims aggregated £15 997, and partly secured creditors for £24 278. The latter held securities valued at £14 402, thus leaving £9 875 to rank as unsecured. There were also fully secured creditors for £600. The assets were estimated to realise £18 680, from which had to be deducted £1 135 for preferential claims, leaving net assets of £17 545, a deficiency as regarded the creditors of £8 326. A resolution was passed confirming the voluntary liquidation of the company with Mr. W. R. Macgregor as liquidator, and it was decided that an application should be made to the Court for the appointment of a committee consisting of Mr. Parkin S. Booth and representatives of Electric Supplies (Liverpool), Ltd., Henleys Telegraph Works, Ediswan Co., Ltd., The General Electric Co., Ltd., and the bank. The principal creditors are: British Insulating and Helsby Cables Co., £115; Boothroyd, H. T., Ltd., £156; Bennis, Edward and Co.,, Ltd., £130; Boulton and Paul, Ltd., £118; Baxendale and Co., Ltd., £126; Concordia Electric Wire Co., £241; Cable Accessories Co., Ltd., £136; Callendars Cable and Construction Co., £123; Clarke, W., and Co. (Manchester), Ltd., £147; Electric Supplies (Liverpool), Ltd., £3 125; Ediswan Co., Ltd., £479; General Electric Co., Ltd., £366; Graham, Alfred, and Co., Ltd., £144; Henleys, W. T., Telegraph Works Co., £521; Hewitt and Kellett, £363; Johnson and Phillips, Ltd., £298; Liverpool Corporation, £377; Leach, S. G., and Co., Ltd., £141; Lancs Dynamo and Motor Co., £376; London Electric Co. and Smiths, Ltd., £114; Lea Recorder, Ltd., £121; Morley, T. B., and Co., Ltd., £196; Metropolitan Vickers Electric Co., Ltd., £437; Manlove, Alliott and Co., Ltd., £299; Parr, Jos., and Co., Ltd., £136; Peach, A. W., and Co., Ltd., £161; Ross and Alexander, £334; Siemens Bros., Ltd., £140; Sawyer, T., and Co., Ltd., £302; Wiltons Engineering Co., Ltd., £111.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Reduction of Capital.

EDISON SWAN ELECTRIC CO., LTD., AND REDUCED. Order of the High Court of Justice registered August 14th, confirming the reduction of the capital of the company from £1 198 307 to £432 565 8s. The reason for the reduction of the capital of the company is that the amount by which the share capital of the company is reduced is unrepresented by available assets.

Company Winding-Up Voluntarily.

NEWINGTON ELECTRICAL CO., LTD. Meeting of creditors at the offices of David Bell and Co., 14, Dale Street, Liverpool, on Friday, August 24th, at 10.30 a.m. David Bell, liquidator.

Bankruptcy Information.

MICHAEL, John, 6, Sneyd Terrace, Silverdale, and 20, George Street, Newcastle-under-Lyme, both in the county of Stafford, electrical engineer. First meeting, August 23rd, 12 noon, Official Receiver's Office, 9, Brook Street, Stoke-upon-Trent. Public examination, August 30th, 11 a.m., Town Hall, Hanley, Stoke-upon-Trent.

TOPLISS, George Reginald, 9, Palatine Chambers, Halifax, in the county of York, electrical engineer. Receiving order, August 11th. Debtor's petition. First meeting, August 24th, 10.15 a.m.; and public examination, October 12th, 10.30 a.m. County Court House, Prescott Street, Halifax.

Edinburgh Gazette.

YOUNG, Frank Broadwood, trading as FRANK BROADWOOD YOUNG AND CO., mechanical and electrical engineers, 45, Queen Street, Edinburgh. Estates sequestrated August 16th. Meeting to elect a Trustee and Commissioners at 3 p.m. on August 27th, Dowell's Rooms, 18, George Street, Edinburgh.

Bankruptcy Proceedings.

ADAMS, Ernest Walter, lately trading as THE WIRELESS ACCESSORIES STORES, 664, Old Kent Road, S.E. The first meeting of creditors under a receiving order made against this debtor on his own petition was held recently at the London Bankruptcy Court. Mr. E. Parke, assistant Official Receiver, presided. The debtor, in a preliminary examination, had stated that in July, 1922, he went into business with his brother and they traded at 664, Old Kent Road, as the Wireless Accessories Stores. Each of them provided £20 capital. The debtor bought wireless outfits and equipment from various wholesalers and trouble had arisen over some equipment which he bought from the North London Wireless Co. The debtor estimated his liabilities at £200 and his assets at £3 6s. He attributed his failure to the purchase of unstamped wireless sets, to the cost of litigation, lack of capital, and to the recent slump in the wireless trade owing to trouble in procuring licences. The case was left in the hands of the Official Receiver for administration in bankruptcy.

WHITEHOUSE, John Henry, 61, Martin Street, Morriston, Swansea, electrical engineer. The statement of affairs shows gross liabilities £2 202, of which £1 914 are expected to rank for dividend, against net assets £142, or a deficiency of £1 772. The debtor attributes his position to unfair competition, slump in prices, depreciation, illness of wife, heavy trade expenses and slackness of trade. At the first meeting of creditors the matter was left with the Official Receiver as trustee.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

200 194 A. M. TAYLOR. Means for and methods of reducing self-induction and eddy-current losses in underground electric cables. (7/4/22.)
200 206 H. S. CONRAD. Telephone systems. (8/4/22.)
200 207 H. S. CONRAD. Apparatus for use in automatic telephone or like systems. (8/4/22.)
200 208 H. S. CONRAD. Switching or like mechanism for use in telephone or like systems. (8/4/22.)
200 209 H. S. CONRAD. Switching mechanism. (8/4/22.)
200 210, 200 211 and 200 212 H. S. CONRAD. Telephone systems. (8/4/22.)
200 217 RELAY AUTOMATIC TELEPHONE CO. and B. B. JOHNSON. Automatic and semi-automatic telephone systems. (10/4/22.)
200 224 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Regulators for electron discharge devices. (11/4/22.)
178 454 DR. A. HELFENSTEIN. Electric furnaces. (12/4/21.)
200 233 N. TOGAMI. Electric distributing systems. (13/4/22.)
200 237 J. A. CRABTREE. Electric fuses. (18/4/22.)
200 250 O. Y. IMRAY (HINELINE ENGINEERING CO.). Electrical stop motions for knitting machines. (24/4/22.)
200 254 WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO., INC.). Means for reducing the distortion in a telephone or like repeating system. (25/4/22.)
200 255 V. PAWELECKI. Electric safety lamps for preventing explosions in the presence of explosive gases. (25/4/22.)
200 268 W. H. ILLINGWORTH. Manufacture of cores for mercurial cut-outs. (29/4/22.) (Cognate Application, 35462/22.)
200 274 R. B. CLAMP. Time-indicating device for use with telephones. (3/5/22.)
180 994 C. A. W. HULTMAN. Setting arrangements for selectors in automatic or semi-automatic telephone systems. (22/5/21.)
200 285 B. A. G. CHURCHER, R. BROOKS and METROPOLITAN-VICKERS ELECTRICAL CO. Controllers for electrical apparatus. (9/5/22.)
179 955 P. ARNOUIL. Convertible and multiple electric junction plugs. (12/5/21.)
200 289 V. E. RICHARDS. Primary cells. (15/5/22.)
200 295 H. FAWCETT and METROPOLITAN-VICKERS ELECTRICAL CO. Operating gear for electrical switches, controllers and other like apparatus. (18/5/22.)
180 339 BENJAMIN ELECTRIC, LTD. Connecting and supporting device for electric fixtures. (20/5/21.)
200 316 A. C. VAN HOOYDONK. Trolley-pole supports for electric traction. (31/5/22.)
200 317 C. TER COCK. Solenoids. (31/5/22.)
183 437 SOC. DES ETABLISSEMENTS GAUMONT. Systems of electro-mechanical control. (22/7/21.)
182 466 T. YAMAMOTO and M. KAWARADA. Electric motors. (4/7/21.) (Addition to 172 603.)
200 347 C. P. WILLIAMS. Electric clock. (29/6/22.)
194 653 WESTINGHOUSE BRAKE AND SAXBY SIGNAL CO. Unidirectional electric current carrying devices. (7/3/22.)
200 362 and 200 363 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Casings for liquid-cooled electrical apparatus, such as transformers. (12/7/22.)
200 373 W. OSBORNE. Junction outlet or like boxes used in electric wiring systems. (15/7/22.)
200 376 L. CASALE. Apparatus for the electrolysis of water. (19/7/22.)
186 037 AUTOMATIC TELEPHONE MANUFACTURING CO. Telephone systems. (10/9/21.)
200 382 M. DOLOUKHANOFF. Automatic regulation of the output of an electric installation. (21/7/22.)
196 561 BRITISH THOMSON-HOUSTON CO. High-frequency signalling systems. (18/4/22.)
183 834 BRITISH THOMSON-HOUSTON CO. Electric arc welding apparatus. (26/7/21.)
200 391 C. MENDLER. Electric couplings. (14/8/22.)
186 318 R. BOSCH AKT.-GES. Electric lighting and starting machines for motor vehicles. (19/9/21.)
200 394 E. C. R. MARKS (E. SALVISBERG FABRI ELEKTRISCHER KOCH UND HEIZAPPARATE "SALVIS"). Combined gas and electric cooking apparatus. (19/8/22.)
200 408 W. MATHESIUS. Electrolytic manufacture of lead alloys. (14/9/22.)
187 949 J. THUM. Apparatus for regulating electric generators running at variable speeds. (22/10/21.)
187 211 AKT.-GES. BROWN, BOVERI ET CIE. High-tension coils composed of round section wire. (11/9/21.)
200 414 BRITISH THOMSON-HOUSTON CO. (INTERNATIONAL GENERAL ELECTRIC CO., INC.). Electric heaters. (25/9/22.)
200 418 J. MUNN. Electric controllers. (5/10/22.)
187 593 F. ALDENDORFF. Multiple armature relay. (19/10/21.)
187 607 A. CREMER. Apparatus for the electrolysis of metals. (18/10/21.)
200 426 W. R. EDWARDS. Non-spillable boxes or containers, such as those used for electric accumulators or the like. (24/10/22.)
200 427 BRITISH THOMSON-HOUSTON CO. and J. SUGDEN. Contact fingers for electric switches. (24/10/22.)
200 428 F. H. ROYCE and ROLLS-ROYCE, LTD. Electrical ignition apparatus for internal-combustion engines. (25/10/22.)
187 903 BRITISH THOMSON-HOUSTON CO. Electric switches. (28/10/21.)
200 431 IGRANIC ELECTRIC CO. (CUTLER-HAMMER MFG. CO.). Electric motor controllers. (30/10/22.)
200 433 S. J. WISE. Electrical driving power applied to clocks. (1/11/22.)
188 668 M. DE CONINCK. Arc welding. (11/11/21.)
192 071 R. BOSCH AKT.-GES. Magneto-electric ignition apparatus. (18/1/22.)
192 072 A. WALDBERG. Electro-deposition of metals. (19/1/22.)
195 354 A. HUGUENIN. Hydro-electric installations. (21/3/22.)
195 369 R. E. POIRIER. Wall plugs or the like. (21/3/22.) (Addition to 181 672.)
174 583 FORGES ET ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE JEUMONT. Alternating current motor groups. (26/1/21.)
199 772 SIR C. A. PARSONS and J. ROSEN. Dynamo electric machines. (3/3/22.) (Cognate Application, 11732/22.)
199 785 A. H. CULLEY and L. MOTT. Method of constructing an electric accumulator. (24/3/22.)
199 787 L. J. HANCOCK and T. R. HANCOCK. Means for preventing oxidation of electrical conductors and the like. (24/3/22.)
199 788 W. H. ECCLES. Electric insulators. (25/3/22.)
199 816 H. KENNEDY AND CO. and P. DAVEY. Electric spark-gap apparatus. (29/3/22.)
199 821 G. W. CLOSE and W. T. PEARSON. Electric water-heaters. (30/3/22.)
199 824 JAMES ANTI-FOULING APPLIANCES, LTD., J. B. WILKIE and H. NEVILLE. Mounting of electrodes or electric discharge points in the hulls of ships and submerged structures. (30/3/22.)
177 799 G. ALFANI and L. MAZZA. Automatic selectors for automatic telephone systems and the like. (1/4/21.)
199 826 G. F. SHOTTER and E. W. HILL. Alternating current electrical instruments. (31/3/22.)
199 830 TILLING-STEVENS MOTORS, LTD. and H. K. WHITEHORN. Electric transmission for vehicles. (31/3/22.)
199 831 A. C. GOOLDEN, V. E. PULLIN and A. G. WARREN. X-ray tubes. (31/3/22.)
177 808 S. STRAUSS and W. BRANDT. Measurement of high electrical resistances or ionization strengths. (3/4/21.)
199 839 WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO., INC.). Telephone exchange systems. (3/4/22.)
178 429 SOC. ANON. POUR L'EXPLOITATION DES PROCEDES M. LEBLANC-VICKERS. High speed dynamo electric machines. (16/4/21.)
199 848 F. E. PERNOT and L. J. RICH. Means for the selective reception of alternating currents. (7/4/22.)
199 879 BRITISH LIGHTING AND IGNITION CO and E. O. TURNER. Induction coils. (26/4/22.)
199 887 IGRANIC ELECTRIC CO. (CUTLER HAMMER MANUFACTURING CO.). Electrical controllers for lighting circuits. (2/5/22.)
199 894 E. Y. ROBINSON. Generation of alternating currents by thermionic devices. (12/5/22.)
199 895 J. DUGDILL. Movable supports for electric light, gas and other purposes. (12/5/22.)
199 898 G. FORNACA. System for regulating the voltage of a dynamo at varying speeds. (15/5/22.)
199 901 H. MACE. Electromagnetic motors. (15/5/22.)
199 964 L. G. PRESTON and N. SHUTTLEWORTH. Method of and means for generating and amplifying electrical oscillations by thermionic tubes. (17/7/22.)
199 967 F. L. NEWHOUSE, C. H. SMITH and ELECTRIC FIRES, LTD. Electric water-heater. (20/7/22.)
199 969 H. L. M. J. BENARD. Regulating devices for high intensity arc lamps having extremely rapid ignition. (26/7/22.)
184 183 SOC. INDUSTRIELLE DES APPAREILS ECONOMIQUES. Shades for incandescent electric lamps. (6/8/21.)
195 925 BALT MANUFACTURING CO. Electric arc gap terminal arrangements or installations. (7/4/22.)
199 989 O. LUCAS and F. HANDLEY. Electric switches. (5/9/22.)
199 999 AUTOMATIC TELEPHONE MANUFACTURING CO, S. R. SMITH and P. N. ROSEBY. Loud-speaking telephones. (29/9/22.)
200 015 H. SAVILLE and C. H. THORNTON. Coil holders for wireless apparatus. (25/10/22.)
190 500 P. A. GOVAERTS and P. M. WENMAEKERS. Process for the deposition of metals by electrolysis. (19/12/21.)
200 537 WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO., INC.) Telephone exchange systems. (7/2/22.)
176 803 GES. FUR DRAHTLOSE TELEGRAPHIE. Antenna systems for wireless signalling. (12/3/21.)
177 160 L. A. CORDENOT. Manufacture of electric insulators or other insulation fittings from ceramic paste. (21/3/21.)
178 438 A. H. MAITRE, and V. H. G. MARTIN. Damping device for switch contacts for electromagnetic vibrating members. (18/4/21.)

APPLICATIONS FOR PATENTS.

August 7th.

20 057 J. SPENCER, LTD., and SIR T. H. SPENCER. Arms and brackets for poles.
20 068 H. CRUSE. Impregnation of fibres by electrolysis.
20 073 ECONOMIC CAR LIGHT, LTD., and W. W. LEWIS. Variable electric condensers.
20 094 H. J. BILLINGSLEY. Electric plug.
20 106 F. L. VAN HOUTE and J. VAN STUYVENBERG. Telephone mouthpieces.
20 107 A. FORD-LLOYD. Inductance coils for wireless telegraphy, etc.
20 112 A. J. BULL. Receiving apparatus for wireless communication.
20 116 W. A. LAMING. Thermionic valves.
20 123 HANDSTOCK, LTD., A. E. MCCARTHY, H. MARTIN and L. W. STEELE. Arc welding.
20 135 SOC. INDUSTRIELLE DES PROCEDES W. A. LOTH. Determining direction of magnetic fields, etc.
20 146 W. E. M. AYRES. Thermionic valves.
20 149 AKT.-GES. BROWN, BOVERI ET CIE. Exciting mercury vapour rectifiers. (7/8/22, Germany.)
20 152 J. S. WITHERS (DAVIS). Apparatus for regulating electric current.
20 155 N. SMITH. Telephones.

August 8th.

20 169 HEENAN AND FROUDE, A. W. ARDERN, G. H. WALKER and G. W. BLACK. Air-cooling systems for electrical machinery.
20 172 FUNKTECHNISCHE GES. Receiving apparatus for wireless telegraphy, etc (28/8/22, Germany.)
20 175 W. H. MURAD. Variable electric condensers, variometers, etc.
20 183 J. GUILFOYLE. Boxes for cables, etc.
20 184 S. R. QUIGLEY. Wireless receiving set.
20 220 L. W. WILD, E. P. BARFIELD and J. P. D. COLEMAN. Electric heating elements.
20 222 AUTOMATIC TELEPHONE MANUFACTURING CO. Circuit arrangements for automatic systems. (22/7/22, U.S.)
20 240 PHILIPS' GLOEILAMPENFABRIEKEN. Discharge tubes. (21/2/23, France.)

August 9th.

20 247 E. H. WRIGHT and F. HODGSON. Means for secret wireless intercommunication.
20 271 E. D. WYNN. Electric reversing switches.
20 290 V. C. WILKINSON. Auxiliary crystal rectifier for wireless telegraph instruments.
20 292 W. H. LE BRETON and R. WOODS. Grid leak for wireless telegraphy, etc.
20 296 GENERAL ELECTRIC CO., LTD. N. R. Campbell. Incandescent vacuum lamps.
20 303 S. CALAMATIANOS. Winding of coils.

August 10th.

20 363 HURTON-WHIFFIN MANUFACTURING CO., R. B. and W. W. WHIFFIN and A. K. COOPER. Coil holders for wireless telegraphy.
20 369 L. UBRIG. Switchboards. (12/9/22, France.)
20 388 ROSE STREET FOUNDRY AND ENGINEERING CO. and C. A. HADLEY. Electric resistance welding.
20 398 C. E. PRINCE. Electric clocks.
20 408 AUTOMATIC TELEPHONE MANUFACTURING CO. and H. H. HARRISON. Multiplex telegraph systems.
20 426 H. KIRSCHFELDT. Wireless transmission and reception of signals.
20 428 W. S. WORTHINGTON. Apparatus for eliminating interference, etc., in wireless telegraphy.
20 430 W. J. ODLUM. Magnetic separators, etc.

August 11th.

20 449 F. DUFFY. Life-guard for tramcars, etc.
20 461 T. H. KINMAN. Wireless systems.
20 469 MARCONI WIRELESS TELEGRAPH CO. Radio receiving systems. (12/8/22, U.S.)
20 471 BRITISH THOMSON-HOUSTON CO. Thermally controlled switches.
20 483 METROPOLITAN-VICKERS ELECTRICAL CO. Power looms.
20 484 METROPOLITAN-VICKERS ELECTRICAL CO. and F. B. HOLT. Magnetic brakes.
20 486 A. H. T. GLENNY. Locking devices for incandescent lamps.
20 497 RADIO COMMUNICATION CO. and R. E. BESWICK. Terminals for attachment of wires.
20 499 S. CALAMATIANOS. Sound reproducing devices. (26/2/23, Belgium.)
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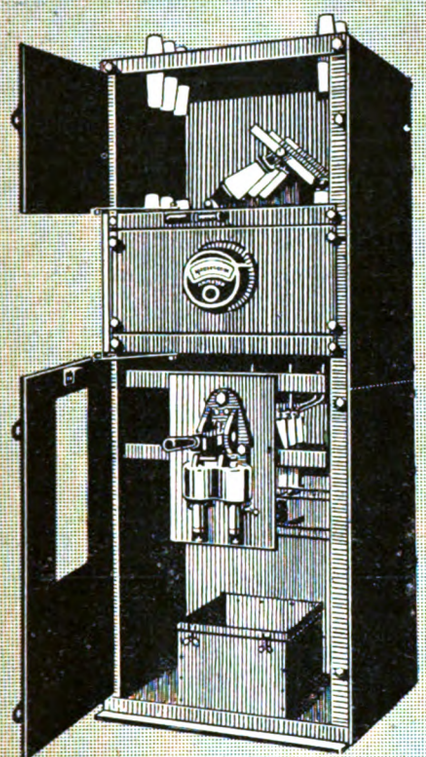

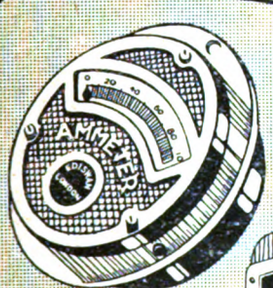

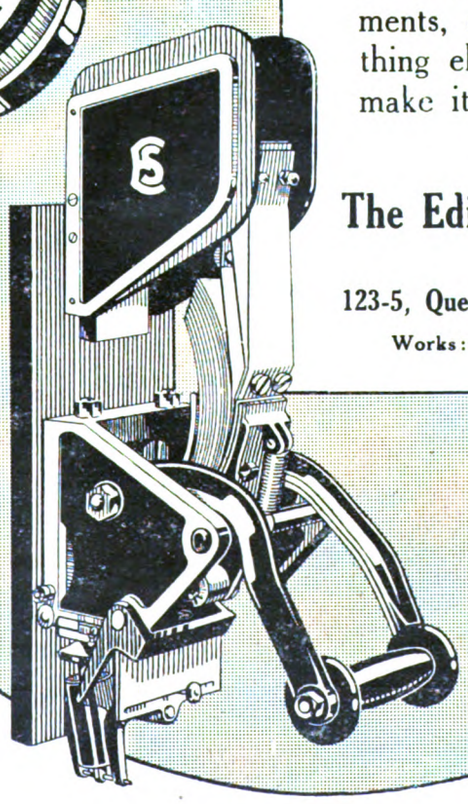

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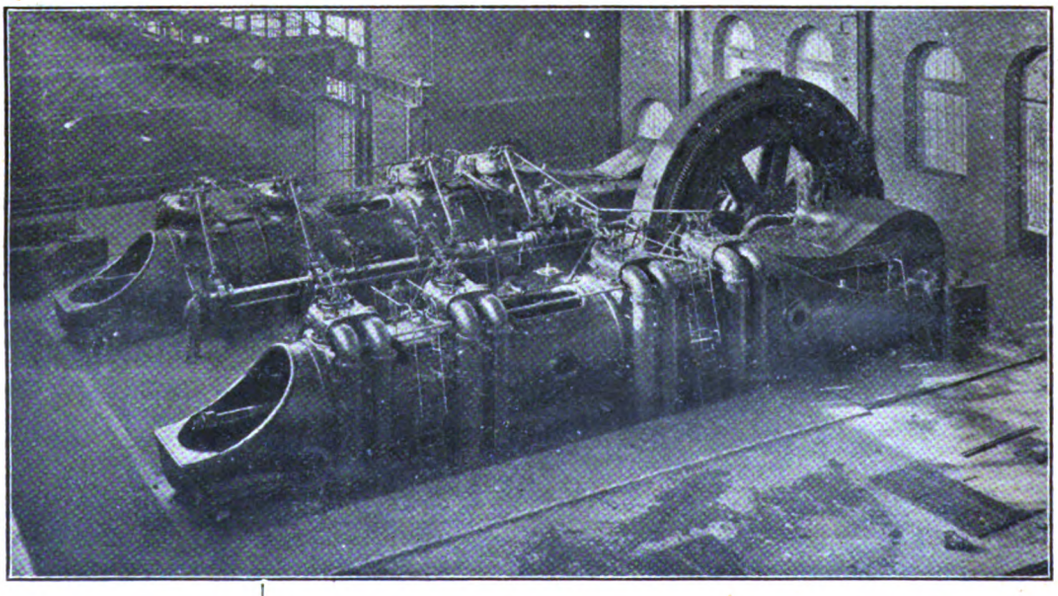

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Notes of the Week.

Tramways—The Psychological Factor.

THE proceedings at the recent conference of the Municipal Tramways Association, of which we give a full account elsewhere in the present issue, did not bring to light anything that was exceptionally new or strange. As we all know, the tramways of this country have passed, and are passing, through a very difficult period. If this is to be changed, as it must be if worse is not to befall, two courses are open: the employment of some new means of transport or the improvement of existing equipment and methods of operation. Both these possibilities were dealt with at the conference, though without any definite solution being arrived at. This is not surprising because it is not realised that the problem that all tramway undertakings have to tackle has its psychological side, and unless this is allowed for nothing much will be done. It is no good, for instance, continually harping on the question of road maintenance as *the* obstacle which prevents any further progress. The right way is to press for the removal of that legislative hindrance, but at the same time to effect such improvements in organisation and equipment that financially it will not matter whether it is removed or not. At present most tramway undertakings are like a man with a grievance, and a man with a grievance is not only inefficient in action, but a nuisance to himself and to everyone else.

Trolley Buses as a Solution.

THE possibility of improving the tramway industry by the use of new methods lends an interest, apart from that intrinsic in the subject itself, to Mr. A. BAKER'S Paper on "Birmingham's Experiment with Trolley Buses." Mr. BAKER claims that by the use of these vehicles he has saved money and turned a non-paying route into a paying one. It must be noted that the claim is particular rather than general, a fact which was more than once forgotten by speakers in the discussion. Nevertheless all tramway managers would do well to consider the possibilities of this system. Improvements which have recently been made in the vehicles themselves place them more on a level with the smaller tram in passenger-carrying capacity, and they have the further advantage that where they are used the tramways department is not charged with road maintenance. The ethics of this relief were questioned by some of the speakers, but it remains a fact of which due advantage might well be taken. The working expenses of the trolley bus, as was pointed out by more than one speaker, should not exceed those of the ordinary tram—a point which makes its use attractive on little developed routes. Its one real rival as an alternative to the tram is the motor bus, which, while possessing many disadvantages, has the two great advantages of low running cost and flexibility. With the bus as with no other form of vehicle is it possible to test the traffic potentialities of a certain route in the only really practical way, i.e., by discovering how many persons will use such vehicles as are available.

Tramway Commissioners.

THE most interesting proposal for improving the present position of tramway undertakings came from Mr. E. S. RAYNER, who suggested the appointment of a central authority on the lines of the Electricity Commissioners, who would deal with the country comprehensively and make the best use of the means of transport now existing. In that way useless and wasteful competition would be avoided and the facilities available would be employed in the most efficient manner. Though we agree with Ald. SMITH that the supply of electricity and the supply of transport are not on all fours, there is a great deal to be said for this proposal. Certain forms of transport are best suited to certain districts, and a central authority could suggest or

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impose the use of that best fitted for a particular place. But the chief use of such a body would be in connection with the traffic congestion, which is now general in all our large towns and in much of the countryside as well. If certain routes were allocated to certain vehicles and more use made of "cross country" streets and roads as feeders to the main arteries, not only would a better service be provided, but a great deal of the present congestion and the cost and the delay which it involves would be avoided. Both these problems in their scope and importance are sufficient indication that the tramway industry is not moribund. There is no reason indeed why it should not have a prosperous future, providing that the technical ingenuity which has been used successfully in other branches of the electrical industry is applied to its improvement, and provided that those concerned with its conduct show a rather greater courage and cheerfulness in tackling the problems which are the lot of everyone.

Manchester Supports the Tram.

As will be seen from the report which we publish elsewhere in this issue, the tramways industry possesses an ardent champion in Mr. H. MATTINSON of Manchester. In Manchester it has been the policy to develop the tramway system to the greatest possible extent and to use the motor bus as a feeder, but not as a substitute for the tram. This policy is said to be vindicated by results, for in average speed, reliability, carrying capacity, avoidance of congestion, and indeed in every respect but mobility the tram has advantages over the motor bus. A little praise, and that but faint, is given to the trolley bus, whose adoption is considered mainly to be dependent on local conditions. On the whole then, while both motor bus and trolley bus have their uses where the traffic is light and infrequent, where the service necessitates six or more cars per hour, the tram is the only possible vehicle to employ. To this the advocates of the motor bus will doubtless reply that the traffic in Central London far exceeds anything of the kind in Manchester, and yet it is successfully dealt with by motor buses. London, however, is a particular case whose traffic has reached such a chaotic condition that something much more drastic than the substitution of motor bus by tramcar or the reverse is required to relieve it. Such drastic methods will eventually be required in other large towns. Until they can be provided the tramways, which have the advantage of being in possession, are the most expedient means of dealing with the transport of passengers within the urban area.

A "Cold Light."

FROM time to time we hear, or read in the lay Press, accounts of the discovery of some gifted young scientist, in the form of a "cold" light—i.e., emitting only luminous rays and no heat—which is to supersede electric lighting. A few months ago a professor in Paris was credited with the discovery that a highly efficient cold light could be produced by the stimulation of fluorescent materials by an electrical discharge through rarefied gases. The latest marvel is Mr. GUIDO BLENSO'S liquid light, which, it is stated, "can be poured into a bulb and used for many years." We await further experience of these new illuminants. While we are cautious in accepting the claims attributed to inventors, there is no doubt that this is a most fascinating field of research which may some day lead to results of great practical importance. A great deal of research has been done on phosphorescent materials during recent years, and our knowledge of luminous bacteria and small marine creatures is extending. Prof. NEWTON HARVEY of Princeton University has done interesting work on the chemistry of these light-giving processes, and it is conceivable that ultimately these materials may be prepared synthetically. The difficulty at present is that the phosphorescence excited by chemical means is too faint and too fugitive to be of much practical value.

Other Possibilities.

ANOTHER line of research is the preparation of substances which respond to stimulation by radioactive material, such as are used for the dials of watches or for gunsights and instruments for night service. The great cost of radium is the chief difficulty, and there is the further drawback that the active material (usually zinc sulphide) is gradually destroyed by bombardment, though the "lasting power" is being steadily improved. If an inexpensive means of continuous stimulation could be discovered the use of these materials would be considerably extended. Substances which continue to glow after exposure to light have long been familiar. In this case it appears that the activity is not appreciably affected by exposure, at least for long periods of time. But unfortunately the intensity of the phosphorescence dies away very rapidly. Nevertheless, there is a possibility, if somewhat remote, that a substance which will glow with sufficient intensity and persistence to be of value for ordinary purposes of illumination may be ultimately produced, and thus realise the dream of a surface which lights up our rooms by night by the aid of energy stored up during the day.

Payment by Results.

THE soundness of the policy of payment by results propounded by Mr. P. J. PYBUS, managing director of the English Electric Co. in "The Times" recently, is clearly proved by a report issued by a joint committee which has been investigating the question of working conditions in the shipbuilding industry. This report cites several illuminating instances of the difference in output by the same workers when paid by the week, and by piecework. On a time basis a squad of riveters fixed 176 rivets in a week; on payment by results the figure rose to 722 rivets per week. Since framing has been done on piece-work, the reports further states, 40 per cent. of time has been saved. On time, 14 weeks were required to do 54 pairs of frames, but when the piece-work system was inaugurated, 80 pairs of frames were completed in 5½ weeks. These and other comparisons show conclusively how a remarkable increase in output can be achieved with advantage to the employer and employee alike. It is, therefore, interesting to note that the Admiralty has addressed a letter to the workers' side of the Shipbuilding Trades Joint Council suggesting that the general adoption of the system of payment by results in the Royal dockyards would be beneficial to all concerned. A ballot of the members of the Amalgamated Engineering Union is to be taken on the question, and if the Admiralty's suggestion is found acceptable it is possible that the system may eventually be adopted in other industries.

Trading Extraordinary.

IF a printed circular issued by the Associated Purchasers, Ltd., is to be believed, a Utopia for that much maltreated person, the retail consumer, is about to be created. Members (and membership is possible by paying a guinea subscription) of this concern will be able to purchase at wholesale prices, on deferred terms and in retail quantities, such articles as electrical plant and installations, furniture, tobacco, groceries, linen and motor cars, and to receive free advice about income tax, insurance, and schools for their children. Such a proposition may be taken in two ways: If seriously, we might point out that our present trading system, with its divisions of wholesaler and retailer, is the result of centuries of experience, and that on the whole it works very well. We might point out that everyone has at some time or another a desire for some small article which can be purchased from the shop round the corner. How can that desire be met if there is no shop round the corner? For that is what this scheme amounts to, or if it does not, then any reduction in price of the kind advertised is impossible. As the concern is not the manufacturer of any of the articles it proposes to

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sell it is a little difficult to see how it can purchase and dispose of goods at wholesale rates and yet make a profit, unless this comes out of the guinea subscription. But if we did not treat the idea seriously, we should say the whole thing was bunkum, and we should advise our readers to keep their guineas in their pockets.

Mrs. Ayrton.

THE death of Mrs. AYRTON removes yet another name from the short list of living pioneers who did so much during the eighties and nineties to bring the use of electricity to its present stage of development. Both by circumstance and by inclination her contribution to electrical progress was theoretical rather than practical, but it was none the less useful on that account, and her researches on the electric arc, the results of which appeared in THE ELECTRICIAN in 1895 and 1896 and were afterwards published in book form, are a valuable contribution to science. In essence they represent a sound foundation for work in a most important branch of electrical science, and subsequent investigations have not impaired their accuracy. Their value was fittingly recognised by the award of the Hughes medal in 1906. In recent years Mrs. AYRTON had forsaken electrical work for other fields of research—notably, on sand ripples and air currents—the latter resulting in the invention of a fan which was largely used during the war to minimise the effects of gas attacks. We shall, however, always look upon her as an electrician, and there will be some difficulty in filling her place in the ranks.

The Ethics of Super-Power.

Once upon a time, some orator or industrious literary gentleman invented the term super-power. At the same time, or a little before, another orator or literary gentleman invented the term reconstruction. It was at a time when the world was becoming weary of destruction, and both the terms and the ideas embodied in these two terms not unnaturally seized the general fancy. It is hardly necessary to add that both reconstruction and super-power in the senses in which they were first used have passed away. Attempts to produce a new earth (not to mention a new heaven) on magic lines with the aid of super-men, super-women, super-railways, super-ships, and super-stations has been given up (for one thing it was soon found they would mean a super-income tax), and we have settled down, some of us reluctantly and some of us unconsciously, to reconstruct a new world by much slow hard work, in the same way as a snail climbs a wall with considerable difficulty, with many divagations and with occasional recessions. As far as electricity supply is concerned things will be the same in the end. But though the end will not be yet the work expended to achieve it will be better done and its results will be more permanent.

The Idea Still Persists in America.

Having discarded a foolish dream which had, perhaps, the not inconsiderable advantage of getting the machine of production started again after a stoppage of some years, it is interesting to find that in the United States they are still talking super-power not less wildly, though with, perhaps, rather more excuse, than we did ourselves. The cynical will find some joy in the fact that this subject was discussed after a banquet at a recent convention of the American Institute of Electrical Engineers. In the course of the speeches Mr. PAUL BRADY said they must give everyone in the United States and Canada an abundant supply of electricity. This must be done by putting water power to work and pouring all this energy into a single great internal network. The area of the United States is 3 026 789 square miles and of Canada 3 729 665 square miles, as against 121 090 square miles of the United Kingdom, so the conception does not lack the grandiose. Moreover, according to Mr. BRADY, it represents the consensus of opinion of all competent engineers, a statement which we beg leave to doubt.

Water Power and Coal Fields.

But in order that it may be a real super-power scheme not only must the water power be placed in fee but the coal fields also. Huge steam plants erected near rivers must be used to supplement the water power, and all must co-operate, so that all may have not only electricity but cheap electricity. If isolated plants become part of a unified system, they will obtain the widest possible market for their excess power and their surplus coal. In Canada there are 18 000 000 H.P. of water power. Further south there are billions of tons of coal. They must be used together for the advantage of the greatest number of people, and it is only by this co-ordination that a general power system covering a wide area can be found. Anyone who thinks differently is "selfish, short-sighted, un-American."

The Engineering of Super-Power.

After this outburst Mr. R. F. SCHUCHARDT's address on "The Engineering of Super-power" fortunately increased the reactance of the circuit and cut down possible surges. He stressed the advantages of cheap power and of interconnection, but he did not talk about networks covering continents; instead he spoke of coal and dollars. He made the further important point that interconnection, of which he was a whole-hearted advocate, should be determined by economic and not by political or geographical reasons. He finally mentioned the importance of standardised frequencies and voltages.

Super-Power as a National Policy.

Mr. M. H. AYLESWORTH, who spoke on "Super-power as a National Policy," complained that super-power development was hindered not by engineering difficulties but by finance, law, economics, politics and policy. We know a great deal about the effect of all these in this country. And Mr. AYLESWORTH gave a sketch of some of the obstacles which exist in the United States which must have convinced his hearers that there is much to be done before the end they are working for is achieved. Nevertheless, he said, in America the electric day had come; electricity was demanded in ever-increasing quantities. It was realised that it was wasteful to build small stations when large stations erected near the mines or on water-power sites would be more economical. Interconnection was an essential feature, as had already been proved, in rate reduction and more reliable service.

Development from Without or from Within?

These contributions are interesting in that they all contain the same idea, that electrical development is best encouraged from without (as it may be termed). If various sites are scheduled for large power stations and various water powers are earmarked for the same purpose, then a super-power system worthy of a civilised country has been started and pæans of praise and self-congratulation may be legitimately set up. But this idea is a fallacy, a fallacy that is best answered by the report of a body of engineers representing various organisations in the States of Washington, Oregon, and Idaho, who were appointed to survey electrical development in those States, with a reference to the desirability of establishing a super-power system in the Pacific North-West. They report that the vast and already interconnected systems of the district will be sufficient through natural expansion to provide for electrical development for many years to come without the need of developing a super-power system for which they would all alike derive energy.

That, we think, is the best general answer to all the grandiose schemes. The only technical policy which is worth anything is one which provides for some standardisation of voltage and frequency and some control of personal idiosyncrasies in technical matters. The rest, as Mr. AYLESWORTH said, is a matter of finance, law, economics and policy, and, might we add, of selling. For without a well thought out commercial policy and low prices, super-stations will not only be inadvisable, but will not be required.

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A Method of Starting Two-Phase Motors.

By NORMAN B. HILL, Wh. Sch., D.I.C.

When starting a squirrel cage motor it is rarely permissible to switch the full voltage directly on to the stator, partly on account of the excessive current which would be drawn from the mains, and partly because it is advisable to retain some control over the torque developed by the motor during the starting period. In general, therefore, a stator starter becomes necessary, and this may either be of the resistance or auto-transformer type. In the former type a resistance, connected between the motor terminals and the mains, is gradually cut out of circuit as the motor starts, while in the latter type an auto-transformer provided with the necessary tappings enables the voltage applied to the motor terminals during starting to be varied in any predetermined manner.

Starting Curves of Squirrel Cage Motors.

Fig. 1 shows the difference between the characteristics of the two methods of starting, and it will be seen that with an auto-transformer starter the relation between the starting current drawn from the mains and the starting torque developed by the motor follows a straight line law, while the resistance starter gives a square law relationship. The curves intersect at the point where full voltage is switched on to the stator, and under these conditions, it is assumed that the motor would develop a starting torque equal to 125 per cent. full load torque while drawing five times full load current from the mains.

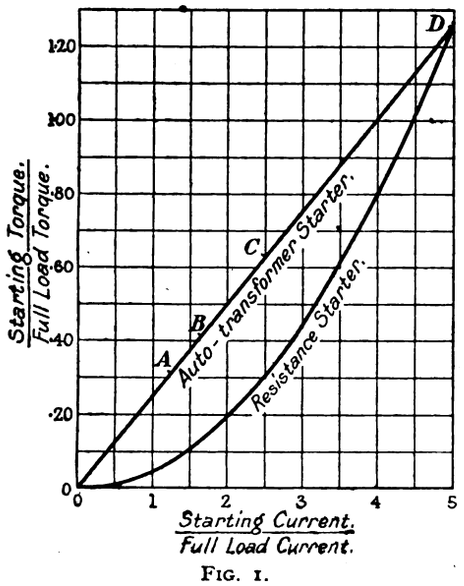

FIG. 1.

A = Series Parallel Starting.
B = Star Delta Starting.
C = Starting by method now being described.
D = Switching full voltage on to stator.

The popularity of the auto-transformer starter will be understood if the curves are examined, as it always leads to a reduction in starting current for any particular torque necessary to start the motor. For example, if the motor has to start against 25 per cent. full load torque, the use of a resistance starter would mean that the current drawn from the mains would be $2\frac{1}{4}$ times as great as when using an auto-transformer, while there is still an increase of about 12 per cent., even if the motor has to start against full load torque (a rather unlikely requirement for a squirrel cage motor).

In addition to the above methods of starting, there are two well-known methods which involve the reconnecting of the stator windings. In the star-delta starting of three-phase motors, the stator is designed to run normally with its phases connected in delta; at starting the phases are connected in star and full-line voltage is applied to the machine. In the series-parallel starting of two-phase machines the stator is designed with two similar circuits per phase, and these are connected in parallel for normal running; at starting they are connected in series and full line voltage is applied to the machine.

These methods may be regarded as special cases of auto-transformer starting (the stator windings themselves acting as a transformer) since the star-delta method gives one-third the starting torque and takes one-third of the starting current from the line that would be taken when switching the machine directly on to the mains, and the series-parallel method gives one-fourth the starting torque, and takes one-fourth the starting current when the sections of the winding are connected in series instead of in parallel.

The points corresponding to these methods of starting are indicated in Fig. 1, and it will be noted that the star-delta method is not suitable in cases where the motor has to start against more than about 40 per cent. full load torque, while the series-parallel method cannot be used in cases where more than about 30 per cent. full load torque is required at starting. Star-delta starting finds a fairly wide application with motors up to about 25 H.P. (and there is apparently no reason why its use should not be extended to include much larger machines where the starting conditions are suitable), but the application of series-parallel starting is somewhat limited by the low-starting torque that is developed. For example, if a two-phase motor is required to start against 25 per cent. full-load torque, it is hardly likely that series-parallel starting would be adopted, as the margin for emergencies would be very low, but on the other hand, there would be no hesitation in adopting star-delta starting for a three-phase machine for the same starting conditions.

Two-phase Motors.

In view of this limitation of series-parallel starting, it may be of interest to examine a further method (which has not previously been described as far as the writer is aware), of reconnecting the stator windings of a two-phase machine, whereby on applying full-line voltage to the reconnected machine at standstill, one-half the normal starting torque is developed while drawing one-half the normal starting current from the line. The point corresponding to this reconnection is also indicated in Fig. 1, and it will be noted that when using this arrangement, a two-phase motor will start against about 60 per cent. of full-load torque while taking about 2·5 times full-load current from the line. In common with the series-parallel method, this type of starting requires the stator to be designed for normal operation with two parallel circuits per phase, and eight leads to be brought out from the machine. In view of this, the method may be used in place of, or in conjunction with, the series-parallel method where the starting conditions demand it, and in the latter case this would be equivalent to using an auto-transformer with 50 per cent. and 70 per cent. voltage taps giving about 30 per cent. and 60 per cent. full-load torque, while taking about 1·25 times and 2·5 times full-load current respectively from the line, provided, of course, that the motor does not start on the series-parallel connection. When used in place of series-parallel starting the starting switch is not complicated in any way, while a drum-type switch would allow the arrangement to be used in conjunction with series-parallel starting. This would probably enable an auto-transformer to be dispensed with in the majority of cases.

Reconnection Arrangements.

The manner of carrying out the reconnections will be obvious from a study of Figs. 2, 3 and 4, which have been drawn to represent the case of a two-pole full-pitch two-layer winding divided into four groups of two coils per group. For normal operation (Fig. 2), groups A_0 and A_1 are connected in parallel and form phase I, while groups B_0 and B_1 in parallel form phase II. The ampere-wire an

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m.m.f. distribution diagrams are drawn out for the instant when the current in phase I is a maximum and the current in phase II is zero, and also for the instant when the current in each of the phases is 70 per cent. of its maximum. These are of the well-known form associated with a full-pitch two-phase winding, the m.m.f. pulsating from a trapezium to a triangle as it revolves.

Fig. 3 shows the reconnection which is applicable only to a four-wire two-phase supply. The four sections of the winding are formed into a closed circuit, and the supply is put across the diagonals of the square. Phase I is connected across C and D; phase II across E and F. The total instantaneous current in any conductor is now made up of two parts—that due to phase I and that due to phase II. By taking this into account, the ampere-wire and m.m.f. distribution curves of the winding can again be drawn, and these are found to be of the same form as with the normal connections. The scale of the diagrams is based on the assumption that the current per phase with the starting connections, is half the current per phase with the normal connections. On this basis, the m.m.f. of the winding when reconnected is $\frac{1}{\sqrt{2}}$ of its normal value, and this lines up with the flux in the machine since the number of turns in series per phase is now $\sqrt{2}$ times the normal.

Fig. 4 shows the reconnection which is applicable either to a three-wire or a four-wire supply. Phase I now consists of groups A_0 and B_0 in series, while phase II consists of groups B_1 and A_1 in series, but with one of them reversed. In the diagram J or K may be connected to either G or H to form the common point of a three-wire supply.

The ampere-wire and m.m.f. distribution diagrams of the winding are again drawn out on the assumption that the current per phase is half that obtained with the normal connections. These are found to be of the same form as those in Figs. 2 and 3, and of the same magnitude as those in Fig. 3—i.e., $\frac{1}{\sqrt{2}}$ of the normal value. As in the case of Fig. 3, the number of turns in series per phase is now $\sqrt{2}$ times the normal, and if we regard both these arrangements from this point of view, we see that the conditions are the same as if we had connected the original winding to a supply at $\frac{1}{\sqrt{2}}$ of the normal voltage—i.e., a 70 per cent. tapping. For series-parallel starting the sections A_0 and A_1 forming phase I would be connected in series when starting, and in parallel for normal running. Similarly with sections B_0 and B_1, forming phase II.

Types of Windings.

If we have to arrange a two pole machine either for series parallel starting or for starting by the above method, it will be seen that we must use a winding that can be divided into four similar groups. When we come to multi-polar machines, however, a difference appears between the series-parallel arrangement and the reconnections now being described. In the former case since the sections similar to A_0 and A_1 always form part of the same phase (and therefore carry currents in phase with one another), it is only necessary to arrange for an even number of coils per phase in the machine (divided into two similar circuits) in order to ensure the production of the correct m.m.f. wave both at starting and when running. In the latter case, however, the production of the m.m.f. wave of each pole pair at starting depends, in Fig. 4, on the sections A_0 and A_1; B_0 and B_1, being in different phases; and, in Fig. 3, on the four sections being arranged in the manner indicated. This means that we are limited to those types of windings which can be divided into four similar groups per pole pair, and only identical groups may be connected permanently in series.

The connections described in Fig. 3 may be arranged for in the case of either a two-layer winding (full pitch or chorded), a mesh winding with an even number of slots per pole per phase, or a concentric winding with an even number of slots per pole per phase (except that with one bar per slot, and leads at each end, an odd number of slots per pole per phase is permissible). The arrangement described in Fig. 4 is applicable to a two-layer winding (full pitch or chorded), and possibly to a mesh winding with an even number of slots per pole per phase.

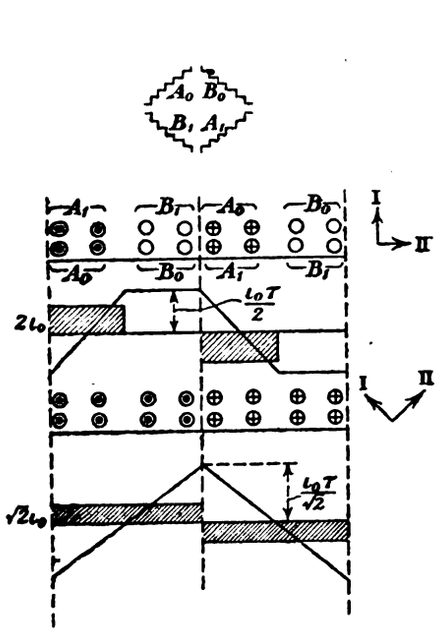

FIG. 2.

Normal Connections.
Phase I.—A_0A_1 in Parallel.
Phase II.—B_0B_1 in Parallel.
Max. Current per phase = $2i$.

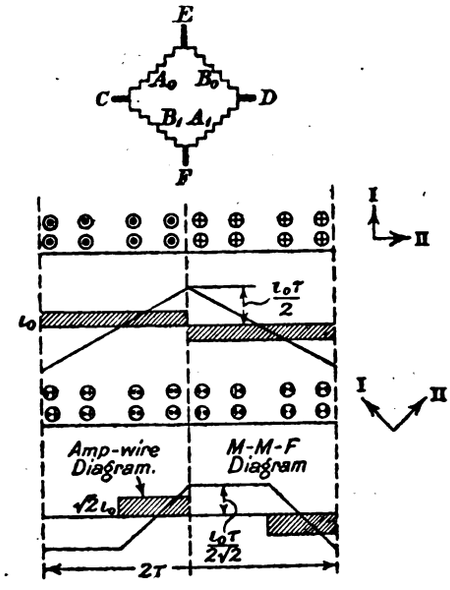

FIG. 3.

Starting Connections.—4-wire Supply.
Phase I across CD.
Phase II across EF.
Max. Current per phase = i.

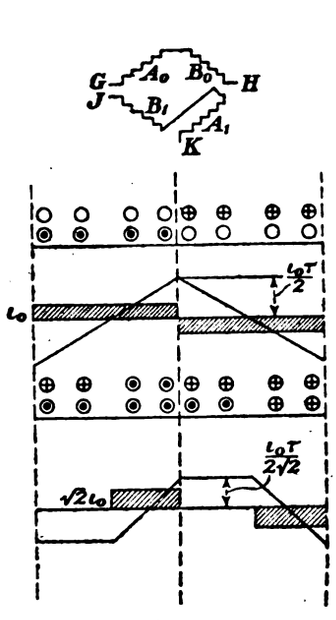

FIG. 4.

Starting Connections.—3-wire or 4-wire Supply
Phase I across GH.
Phase II across JK.
Max. Current per phase = i.

In each diagram I amps per conductor corresponds to i_0 amp-wires per unit length.

Electrically Equipped Mine for Wembley.

To give some idea of the problems with which the coal mining industry has to deal, and of the enormous progress that has been made in recent years, the Mining Association of Great Britain is arranging to sink a shaft at Wembley to illustrate the working of a colliery. The electrical equipment of the mine will include an electric winding engine, which will be able to lower 2 000 people an hour into the workings. Adjacent to the winding engine house will be the electrically driven air compressors, and an electric fan will be seen in operation, ventilating the underground tunnels. The methods of getting coal manually and by electrical cutters will also be demonstrated.

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Note on the Calibration of a Heterodyne Wavemeter.

By E. MALLETT, H. ANDREWES and E. T. A. RAPSON.

The heterodyne wavemeter, whose accurate calibration was desired, was one in which the necessary local oscillations were generated by a valve with an oscillatory circuit with variable condenser in the anode circuit, the inductance coil of which was coupled with a coil connected in the grid circuit. The " picking-up " coil was a few turns connected in series with the main anode inductance. Various ranges were obtained by varying the inductances. The same condenser was in use in all the ranges, but in the highest another (fixed) condenser was added.

A tuning fork was electrically maintained in continuous vibration by means of a valve described by Eccles. The frequency of this was accurately adjusted by means of beats to a standard fork whose frequency was 439. The fine adjustment of the frequency of the maintained fork is conveniently done by adjustment of the distance of the electromagnet in the plate circuit from the fork; the initial adjustment was effected by filing the fork.

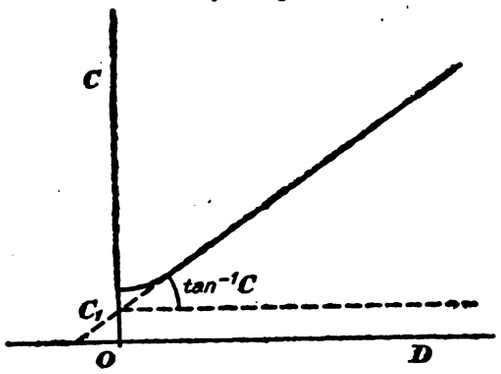

FIG. 1.

Multivibrator Circuit.

A circuit known as the multivibrator and due to Abraham was set up and tuned to the fork by the insertion of a telephone and obtaining beats with the fork. By coupling the multivibrator, so called because of its richness in harmonics, to the wavemeter, set to one of the higher ranges (large wavelength), a number of points could be obtained corresponding to successive harmonics of the multivibrator and hence to nf $(n+1)f$, $(n+2)f$ . . . etc., where f is the fork frequency and n is an unknown integer. There were two disadvantages in this arrangement. First, the points thus obtained were inconveniently close on the wavemeter scale owing to the low frequency of the fork and, second, it required continuous adjustment to keep the fundamental of the multivibrator in tune with the fork.

The first disadvantage was overcome by tuning the multivibrator to the second octave of the fork (i.e., $4f$). In order to do this accurately a loud speaker was inserted in the plate circuit of the maintained fork, when there was sufficient fourth harmonic in the sound produced to enable the beats with the fundamental from another loud speaker in the multivibrator circuit to be heard. So the latter was accurately adjusted with its fundamental $4f=1\,756$. The second difficulty was overcome by abandoning the multivibrator circuit and using an ordinary valve oscillator circuit with a far greater mutual inductance between the anode and grid coils than was necessary to maintain oscillations.

In order to hear the heterodyne notes comfortably a single-stage low-frequency amplifier was inserted between the heterodyne wavemeter and the telephone.

Determination of Harmonics.

In this way, a number of consecutive harmonics were obtained on the highest ranges. These are shown for one range in Table I., col. 1, and a curve was drawn corresponding to these figures (Curve 1, Fig 3). The frequency interval between these points is 1 756. The problem is to find exactly which harmonics they are—i.e., to find n.

In a valve maintained oscillator as in a heterodyne wavemeter the frequency of the oscillation is given very nearly by

$$f=\frac{1}{2\pi\sqrt{(C_0+C)\,L}}$$

where C_0 is the steady fixed capacity from all causes, C is the capacity of the variable condenser, and L is the effective inductance of the anode coil. Over a very large part of the range of a moving vane condenser the capacity C is given by C_1+cD, where c is the capacity per deg., D is the setting of the condenser in degs. and C_1 takes account of the fact that the calibration curve does not as a rule pass through the origin (Fig. 1).

So we may write the effective capacity

$$C_0+C=C_0+C_1+cD=C\left(\frac{C_0+C_1}{c}+D\right)$$
$$=c\,(D_0+D)$$

and our frequency $f=\dfrac{A}{\sqrt{D_0+D}}$

where $A=\dfrac{1}{2\pi\sqrt{cL}}$ and is a constant for any particular range.

Differentiating with respect to D we have

$$\frac{df}{dD}=-\tfrac{1}{2}A\,\frac{1}{(D_0+D)^{\frac{3}{2}}}$$

or taking the numerical value of $\left(\dfrac{df}{dD}\right)$

$$\frac{df}{dD}(D_0+D)^{\frac{3}{2}}=\frac{A}{2}$$

raising each side to the power $\frac{2}{3}$

$$D_0+D=\frac{\left(\frac{A}{2}\right)^{\frac{2}{3}}}{\left(\frac{df}{dD}\right)^{\frac{2}{3}}}=\left(\frac{A}{2}\right)^{\frac{2}{3}}\times\left(\frac{dD}{df}\right)^{\frac{2}{3}}$$

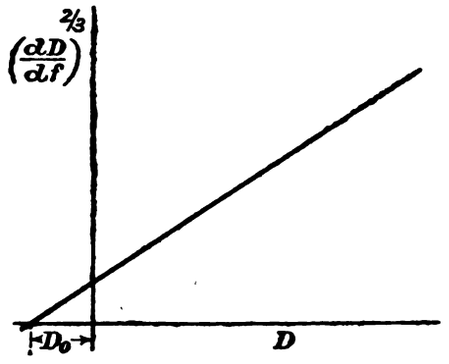

FIG. 2.

We know $\left(\dfrac{df}{dD}\right)$ for different values of D, and so our readings will enable us to find D_0 and A, and hence f.

For if we plot $\dfrac{1}{\left(\frac{df}{dD}\right)^{\frac{2}{3}}}$ against D, we should obtain a straight line whose intercept on the axis of x is D_0, and whose slope is

$$\frac{1}{A^{\frac{2}{3}}}\qquad\text{(Fig. 2.)}$$

Then, knowing f we have only to divide by the fundamental of the oscillator to find the number of the harmonic. The number found will probably not be an exact integer, but the nearest exact integer can be used to find the true frequency at this setting of the wavemeter.

This method worked out well. In col. 2 is entered the mean value of D, D; in col. 3 the difference of the D values

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δD; in col. 4 $\frac{\delta D}{\delta f}$ (δf=1 756); and in col. 5 $\left(\frac{\delta D}{\delta f}\right)^{\frac{2}{3}}$

The curve between D_m and $\left(\frac{\delta D}{\delta f}\right)^{\frac{2}{3}}$ is plotted as II in the figure, and from this curve, D_0=40

$$\text{Slope}=\left(\frac{2}{A}\right)^{\frac{2}{3}}=0{\cdot}000352$$

whence A=303 000

So that $$f=\frac{303\,000}{\sqrt{40+D}}$$

From this formula the values of f corresponding to the

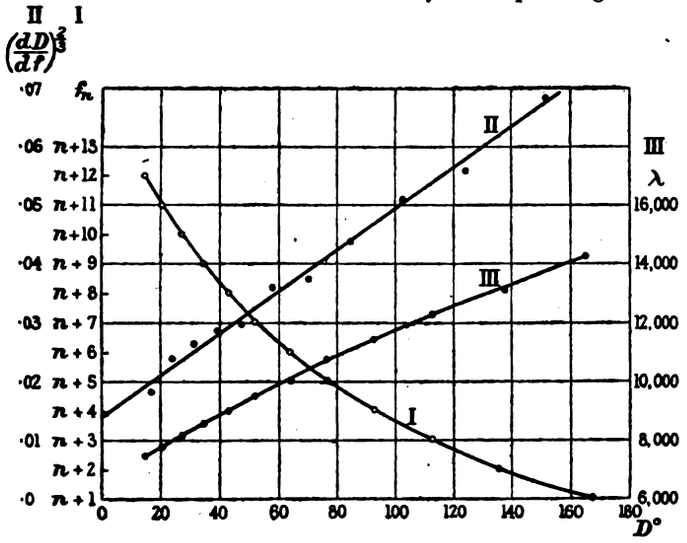

FIG. 3.

observed points are entered in col. 7 and in col. 8 are entered the values of $\frac{f}{1\,756}$.

It is seen that on the whole these come very close to successive integers, and these are indicated in col. 9. Finally, in col. 10 is given the actual wave-length corresponding to the condenser reading D and calculated from

$$\lambda=\frac{3\times10^8}{1\,756\times m}$$

where m is the integer in col. 9.

This is plotted in Fig. 3 as III.

The calibration can be extended in this way throughout the other ranges. All that it is necessary to do is to set the oscillator so that three or four points are obtained on the scale just calibrated. From these points the new fundamental is found, and the same procedure as before can be followed on a lower scale.

Actually, of course, the whole $\left(\frac{dD}{df}\right)^{\frac{2}{3}}$—D curve need not be drawn; only just sufficient of it to determine to which harmonic the wavemeter is tuned.

TABLE I.

1	2	3	4	5	6	7	8	9	10
D	D_m	δD	$\frac{\delta D}{\delta f}$	$\left(\frac{\delta D}{\delta f}\right)^{\frac{2}{3}}$	$D_0+D=D+40$	$=\frac{f}{\frac{303000}{\sqrt{D+40}}}$	$\frac{f}{1756}$	n	λ
167					207	21100	12·01	12	14200
	151	31·5	0·01795	0·0685					
135·5					175·5	22900	13·04	13	13100
	124	23·0	0·01310	0·0557					
112·5					152·5	24600	14·00	14	12200
	102·5	20·0	0·01140	0·0508					
92·5					132·5	26400	15·02	15	11400
	84·5	16·0	0·00912	0·0457					
76·5					116·5	28100	16·00	16	10700
	70	12·5	0·00712	0·0371					
64·0					104·0	29700	16·92	17	10000
	58	12·0	0·00684	0·0360					
52·0					92·0	31600	18·00	18	9500
	47·5	9·0	0·00513	0·0298					
43·0					83·0	33300	18·98	19	9000
	39	8·5	0·00484	0·0286					
34·5					74·5	35100	20·00	20	8550
	31	7·5	0·00427	0·0264					
27·0					67·0	37000	21·08	21	8140
	24	6·5	0·00370	0·0239					
20·5					60·5	38900	22·20	22	7750
	17	4·25	0·00242	0·0181					
14·75					54·75	41000	23·35	23	7430

Where great accuracy is not required, a second method may be adopted, which is simpler practically and does not involve the determination of the fundamental frequency of the oscillator. An electrically maintained tuning fork is again used as the frequency standard, and the heterodyne note heard in the telephone receiver of the wavemeter is tuned accurately by means of beats to this frequency or an octave, on either side of the null points of a series of harmonics given by the subsidiary oscillator. In this way a series of pairs of condenser readings is obtained, each pair corresponding to a particular harmonic of the oscillator, and the frequency difference of the readings of each pair being 2f. From these dD/df is obtained, and the straight line connecting $(dD/df)^{\frac{2}{3}}$ and D drawn. From this line the values of the constants D and A are obtained as before, and the calibration of the wavemeter, at any rate for the extreme ends of the condenser scale, is known.

It is, of course, necessary to use very loose coupling between the oscillator and the wavemeter, as otherwise the beat note would not be given by the differences of the frequencies of the oscillator and wavemeter, but would have some lower value (*vide* Appleton, Camb. Phil. Soc., January, 1923.)

Another scale of the heterodyne wavemeter was calibrated by this means, and the results compared very well

TABLE II.

D	δD	$\frac{\delta D}{\delta f}$	$\left(\frac{\delta D}{\delta f}\right)^{\frac{2}{3}}$	D_m	$D+D_0$	$\sqrt{D+D_0}$	f	λ metres
166·2					193·2	13·90	38440	7800
	8·3	0·009725	0·0456	162·05				
157·9					184·9	13·60	39290	7635
82·0					109·0	10·44	51180	5862
	3·6	0·00422	0·0261	80·2				
78·4					105·4	10·27	52020	5767
42·1					69·1	8·313	64270	4670
	1·7	0·001993	0·01584	41·25				
40·4					67·4	8·21	65090	4608
20·0					47·0	6·856	77930	3850
	1·0	0·001172	0·01111	19·5				
19·0					46·0	6·782	78790	3804

with those previously obtained by the first method. The results are tabulated in Table II, and the resulting curves are given in Fig. 4.

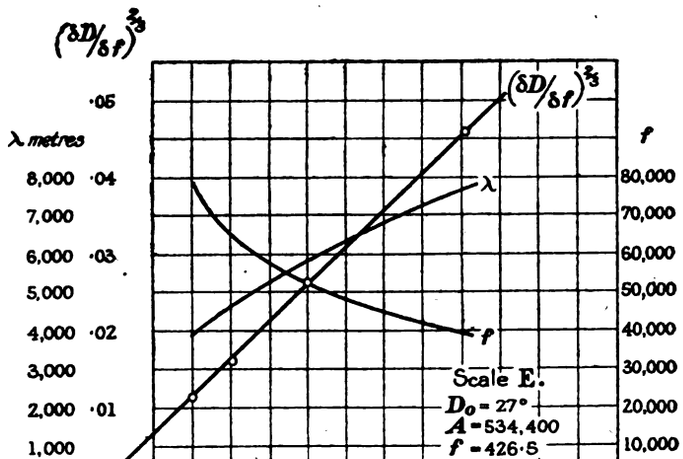

FIG. 4.

The work was carried out in the Electrical Engineering Department of the City and Guilds (Engineering) College at South Kensington.

Hints for Inventors.

Need of Improved Method of Power Transmission.

Further additions to the list of suggestions presented to the Institute of Patentees by Sir William Bull, a director of Siemens Bros. and Co., have now been made by Prof. A. M. Low, whose list of "wants" includes an improved method of storing and transmitting electrical energy, a selective method of radio communication with really sharp tuning, an efficient method of varying radio oscillation frequencies over an almost unlimited range, and a loud speaker that is controllable without distortion.

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The Municipal Tramways Association.

The annual conference of the MUNICIPAL TRAMWAYS ASSOCIATION was held at Portsmouth from August 22nd to 24th, under the presidency of Sir John Timpson, K.B.E.

On the opening day the Association was given a civic welcome in the Municipal School by the Mayor, Ald. F. G. Foster, after which the Presidental Address was delivered.

Presidential Address.

Portsmouth, said the President, in his opening remarks, was the first Corporation in this country to obtain Parliamentary powers to construct, but not to work, tramways. It was just 60 years since that pioneer Act was passed, and 58 years since tramways were operated in Portsmouth. It was, therefore, appropriate that Portsmouth should be the meeting place of the Association this year.

The International Union of Tramways and Light Railways was impressed by the desirability of making the expérience on the Continent more accessible to British Tramway Authorities, and the Council were accordingly considering the printing of the proceedings of the Union in both French and English. At present, however, the difficulty was to obtain support to meet the cost of printing.

Tramway Finance.

Reviewing the reductions in wages since the war in financial matters, there was sometimes a tendency to sail too near the wind and yield to clamour for reduced fares. Transport undertakings should be self-sustained, but the last report of the Ministry of Transport on tramways had shown that in 1921-22 subsidies from the rates amounted to £371 303 as compared with £62 600 in 1913-14. Thus the subsidies amounted to six times as much as in 1913-14, whereas contributions to the rates were only two-fifths of what they were in that year. Nothing short of a substantial reduction in working expenses would justify a reversion to pre-war fares. However, in spite of post-war fares, tramways still formed the cheapest form of transport for the industrial public. Compared with 1913-14 the increase in passengers carried was 28·9 per cent., but the car-miles to carry the traffic had decreased by 2·02 per cent. It was of great importance that tramway undertakings should obtain some alleviation of the financial burdens placed upon them. The incidence of the cost of maintenance of the permanent way, in particular, was clearly inequitable. The unemployment insurance was also a heavy tax upon all insured trades, including tramways.

Public interest had been aroused by the extension of the trackless trolley system, on which Mr. Baker was to read a paper. Of the 28 local authorities who had obtained powers to work trackless trolley undertakings, nine actually carried passengers; 9 879 730 passengers were carried in 1921-22, a decrease of 7·11 per cent., but car-miles run had increased by about the same percentage.

Following the Presidential Address, Mr. A. Baker, general manager of the Birmingham Corporation Tramways, read a paper on "Birmingham's Experiment with Trolley Omnibuses." We give this in abstract below.

Birmingham's Experiment with Trolley Omnibuses.

By A. BAKER.

The announcement that in 1921 Birmingham had decided to adopt the trolley omnibus on one of its routes caused a mild sensation, and was interpreted by some as an indication of the coming end of tramways throughout the country. It was overlooked that tramcars in 1921 carried approximately 5 000 million passengers at a cost far below the rates charged by any other system. In reality there was no system yet devised that could cope with rush-hour traffic with the same ease and facility as tramcars.

The circumstances leading to Birmingham's decision were exceptional. The Corporation were faced by the reconstruction of a very large amount of permanent way, a matter of grave concern in view of the high cost of wages and material. They were, nevertheless, engaged in reconstructing main traffic routes, but they were disinclined to do so on some of the less busy routes. The Nechells route was of this type and had got into such bad condition that reconstruction cost would have been very heavy. In addition it was only a single route line tramway with loops running through narrow thoroughfares, and there was no possibility of street-widening. Hence some alternative system seemed expedient, and the trolley omnibus was selected.

Relative Merits of Trolley Omnibuses.

In comparing the merits of the system with petrol omnibuses the chief points to be considered were (1) carrying capacity; (2) operating expenses; (3) comfort of passengers. The double-deck tramcars that had covered this route could take 54 passengers, and it seemed desirable that the new vehicles should have about the same capacity. Most of the single-deck trolley omnibuses in use in this country would only carry from 20 to 30 passengers. But it was known that Mr. R. H. Wilkinson of Bradford was experimenting with a double-deck vehicle carrying about 50 passengers. Protection from weather was another advantage of the double-deck, as well as greater seating capacity.

The most important question was operating cost. On this point little information was obtainable, but the conclusion was formed that it would be below that of petrol omnibuses and approximating to that of tramway operation. The Committee, therefore, boldly decided to recommend the adoption of the trolley vehicle system. It was estimated that the cost of complete reconstruction of the Nechells tramway would be £90 000. It appeared likely that, after allowing for interest and charges on the loan for this work, there would be an annual loss of £3 340. On the other hand it was believed that the trolley buses would yield an annual profit of £3 122, as well as a saving in capital expenditure of £54 000.

Details of the System.

The proposal having been approved by the City Council, the work was put in hand and orders were placed for 12 trolley omnibuses. These provided seating accommodation for 51 passengers—26 in the lower saloon and 25 on the upper deck. The car weighed 7 tons 6 cwt., or 9 tons 18 cwt. when fully laden. The old tramway lines were then pulled up and the road surface restored, and the line was opened for traffic on November 22nd. The actual cost of this work was about £9 000—£6 000 less than the figure originally estimated. The new system immediately "took on" with the public, one good feature being the absence of jerks such as occur with gear change driven vehicles. The vehicles ran very smoothly and almost noiselessly. The author expresses the opinion that there is no vehicle which can compare with a properly constructed trolley omnibus for ease and comfort. The returns on this route immediately began to improve and the mileage has been increased.

Operating Costs.

In the original paper the author presents detailed costs of operation, arriving at the figure of 12·65d. per car-mile. This compares very favourably with the operating costs of motor omnibuses (15·41d.), and tramcars (14·82d.). It must be remembered that the vehicles were new and the full burden of maintenance has not been reached. But it is believed that operating costs will not exceed those of tramways. All the systems mentioned, however, have their merits. The author believes that in dealing with large volumes of traffic, tramways still hold the field, and the conditions determining when trolley omnibuses and petrol omnibuses respectively may be used may be summarised as follows:—

(1) In anticipation of an extension of an existing tramway, the trolley omnibus may be used. It is only necessary to plant poles and fit up overhead wires, which can be used afterwards for the tramways when rails are laid.

(2) The trolley omnibus may also be substituted for a single-line tramway where traffics are light and doubling the track is inconvenient, or if reconstruction costs are unduly heavy.

(3) On routes in suburban districts where some form of transport is needed but there is no likelihood of trams being required, the petrol bus should be used.

(4) The petrol bus may also be used to run cross-country routes and connect up the outer termini of tramways; such services have proved an unqualified success in Birmingham and are much appreciated.

During the reading of the paper Mr. BAKER said that the trolley bus route was the only one on which any increase in receipts had been made. Moreover, the trolley buses were running on a route where the fares had been reduced, as compared with high fares on the tramways, so that, had the fares been ordinary, the increase in receipts would have

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approximated to the increase in mileage. Everything had been charged against trolley bus operation. The result of operation showed that a balance of £3 023 was carried to profit and loss account for the period mentioned, and it would be agreed that these figures were very satisfactory.

DISCUSSION.

Mr. J. B. HAMILTON (Leeds) said this particular result might not be applicable to all undertakings, but he was delighted to find that the result of Mr. Baker's experiments with trolley buses had turned out so satisfactorily. Transport authorities were at a period in the history of transport when they had got seriously to consider all the various forms of transport and find out the facts as to the best means of transport, irrespective of whether it be tramways or buses or anything else. The improvement that had been made in trolley buses by the introduction of larger passenger carrying units was making that form of traction quite possible in places where, with the old single-deck vehicle with a capacity of 30 passengers, it was previously impossible. In Leeds there had been for a year and a half trolley buses with a carrying capacity of 59, which were absolutely irreproachable and certain in operation. These vehicles compared very favourably with the carrying capacity of many trams.

COUN. G. R. DAVEY (Ilford) said it was clear from the paper that in outside areas the trolley bus system could be used, but all tramway men would agree that there was nothing to beat tramways for busy areas.

ALD. W. GODBOLD, J.P. (Mayor of West Ham) asked whether Mr. Baker suggested that something should be contributed by the trolley buses to the maintenance of roads.

Trams Best for the Peak Load.

Mr. W. MURRAY (Walthamstow) said even in small under takings there were times of peak load when the tramcar with its overload capacity of nearly 100 per cent. was inadequate to meet the rush traffic. There was the danger, because of the average light loading, of people saying that trolley buses would be sufficient for all the needs, and of overlooking the rush traffic.

A Tramways Advocate.

Mr. H. P. STOKES (Plymouth) contended that on the figures in the paper it would have been cheaper to have reconstructed the tramways on the Nechells route in Birmingham, but what the trolley bus had done was to avoid the heavy road maintenance charges which tramways had to bear. The municipality itself, however, had still got to bear these road maintenance charges, and whether this was the right way to get out of what had been felt for many years to be very serious disadvantage was questionable. If this question of road maintenance was pushed to the extent it ought to be, and trolley buses and petrol buses were made to bear their fair proportion of road maintenance charges, the position would be this: add to the costs of operating trolley buses a fair road maintenance charge, and this type of vehicle showed no advantage whatever, even on such a route as the Nechells route at Birmingham, compared with the former operation of tramways.

ALD. F. SMITH (Liverpool) asked how would it be if trolley buses were used on ordinary roads instead of tramways. Would they be charged with excessive traffic or would they inflict upon the district an amount of repair entirely out of proportion with the present traffic?

ALD. TURNEY (Nottingham) thought the real crux of the matter lay in the fact that if the trolley bus system came to be universally adopted the burden of maintaining the roads would fall upon another section of municipalities and not upon the tramways.

Mr. R. BIRKETT (Southend) said the most serious objection to tramways was their noise. In Southend the buses were single-deck cars with pneumatic tyres and could not be heard. Overloading had a considerable effect upon spares. Under his Light Railway Order he could overcrowd to any extent, and he did. At rush times he overloaded to the extent of 100 per cent. With trolley buses overloading would be limited and the question of spares would become more serious.

Motor Bus Cheaper.

COUN. J. H. WHITTAKER (Todmorden) contended that a motor bus service could work at much lower figures than those presented by the author. Whether we liked to admit it or not the motor bus was the most potent competitor with tramways to-day, and we would not be facing the matter fairly if we under-estimated its possibilities.

Mr. C. BURGESS (Walsall) thought that the whole discussion ranged round the capacity of the trolley bus to deal with the load. In Birmingham the seating capacity of the trolley bus was nearly as great as that of the tramcars on many systems—51 passengers—and he could not see why the trolley bus could not deal with the rush traffic in the same degree as the tramcar. The cost of operating the trolley bus was about the same as that of the tramcar. The initial cost of installation was about half that of the tramways, or rather half the present cost of constructing the track. Tramways Committees up and down the country, when they went into the cost of reconstructing tracks, would want to know why trolley buses would not do the job.

A Double-Deck Trolley Bus.

Mr. R. H. WILKINSON (Bradford) said he had been operating trolley buses for about six months when he saw what they could be made into if the Ministry of Transport would allow him to increase the weights so that a substantial vehicle could be built and operated. He had some difficulty with the Ministry, but eventually they gave permission to experiment with one double-deck vehicle which weighed a little over 7 tons. It started running in 1920 and he had never had any complaint about it, but before coming to the meeting he looked up the figures and found that it had run 90 000 miles. A second vehicle—which was put into service nearly two years ago, and was fitted with six wheels, four being in front and steerable—had run 40 000 miles. Its seating capacity was 59 passengers; its actual capacity was 66 passengers, but a certain portion of the vehicle had been deliberately shut off and the seating capacity allowed was 59. There has been no trouble with either vehicle, and, of the two, the men preferred the six-wheel vehicle because it was easier to steer, although there was more weight on the steering wheels. Although the figures given in the paper for car maintenance were bound to rise, they were outweighed by the saving on road maintenance. He could confirm what Mr. Baker had said—viz., that the working expenses of the trolley bus would not exceed those of the tramcar. With regard to road maintenance, his two heavy vehicles had been running on a road made of tar macadam and operating a 10 minutes' service; there had been no ill-effects to the road surface, and he was satisfied that the £70 a year tax on the vehicles would quite easily cover the damage to the roadway.

Mr. C. I. BAKER (Ashton-under-Lyne) said the fact that an expenditure of £50 000 could be saved by not renewing the tramway tracks had convinced his Council that the trolley bus was the cheaper system. Where the cost of old permanent way had been repaid there was little doubt that the trolley bus was better than incurring the expenditure of reconstructing the tramway track.

ALD. T. CANBY (Huddersfield) asked for information as to the safety of trolley buses in comparison with tramways.

A Word for the Trams.

Mr. J. BARNARD (Bolton) thought the figures in the paper were a little too rosy in favour of the trolley bus. For instance, it was suggested that to reconstruct the Nechells route for tramways would have cost £30 000 a mile. This figure was 50 per cent. too high. Again, only £1 600 per car was allowed for the old cars. Therefore there had to be given to the credit of the trams a reduction in the cost of the reconstruction of track and a higher credit for the cars. In that event, there would have been a profit on working tramways on the Nechells route of about the same as was shown on trolley buses. Then there was the question of rating and road maintenance to take into account. At present the trolley buses paid a yearly tax of £70, but no contribution to road maintenance, and if they paid something on these two accounts then the comparison would be still less favourable to the trolley bus.

A paper on "Tramways as a Municipal Asset," by Ald. H. Clark, was then read, the discussion being adjourned until the following morning. This Paper we give in abstract below.

Tramways as a Municipal Asset.

By Ald. H. CLARK.

The controversy on the propriety of municipal trading which occurred in the early stages of municipal growth was illustrated by the granting of powers to local authorities to construct tramways, but not to run them. Huddersfield was the first authority to acquire powers to operate tramways. To-day the municipal running of tramways is accepted and the process of transferring them from

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private to municipal ownership goes on year by year. Nevertheless tramways should be self-maintaining, and in Scotland it is laid down by law and custom that they should be precluded from rate-aid.

On the whole the municipal administration of tramways has been justified. They have provided the cheapest and best form of urban passenger service. They have so far been mainly used for passenger-transport. But in one town at least they have been used to a limited extent for merchandise. Huddersfield undertakes the haulage of coal. Continental systems with long inter-urban connections are much in advance in this respect.

The false conception that tramways are out of date is controverted by the fact that the L.C.C. system had last year a balance surplus of £616 928, on a turnover of nearly £5 000 000, and after making provision for renewals there was a net surplus of nearly £240 000. In many instances motor-omnibuses are being used to serve as feeders for tramways. It might be found desirable for one dominant authority to control all forms of passenger road transport within a certain area. The chief proposal for the solution of the complex traffic problem of London follows these lines, and some such step is becoming increasingly needed in the provinces.

Taking an average for five typical undertakings last year the revenue is allocated as follows :—

Purpose.	Per £ of revenue. s. d.
Wages, etc.	8 8
Cost of materials	1 7
Electrical energy	2 8
Local rates—in respect of permanent way	0 5
In respect of buildings	0 1
Imperial taxes	0 8
Other miscellaneous expenditure	0 10
Interest on borrowed money	0 11
Debt redemption charges	1 0
Rent of leased lines	0 7
Balance available for renewals and other purposes	2 7
	20 0

It will be noted that about 43 per cent. is applied to wages of men who, in most instances, reside in the locality.

Some municipalities are approaching the position reached by Glasgow and are becoming practically free from debt. Others are less fortunate. But if all the undertakings were brought together and treated as one great enterprise, they would be able to give an exceedingly good account of their stewardship of public money and public convenience.

DISCUSSION.

COUN. T. WOFFENDEN (Huddersfield) thought it was high time that some definite steps were taken to deal with motor bus competition. In the case of Huddersfield, they had spent some £10 000 in getting powers to run motor buses in certain districts outside but had been compelled by the local authorities to spend some £7 000 in street widenings before receiving permission. In the meantime a private company had come on the scene and was actually running buses without having spent any money at all upon the roads. At present motor buses could go just where they pleased whereas municipal tramway authorities had not that same freedom.

Socialised Tramways.

COUN. V. L. MCENTEE, M.P. (Walthamstow) objected to the view expressed in the paper that the rider should pay the whole cost of his ride. He looked upon tramways in the same way as libraries, the fire brigade, and other municipal services. There were many people who did not use the libraries or the fire brigade, but they had to pay their share towards their maintenance, and as tramways were as essential to the public as these other services he saw no reason why they should not be treated in the same manner. The speaker also advocated municipal banks as a means of raising money for transport purposes more cheaply than is possible at the present time.

Tramway Commissioners Required.

Mr. E. S. RAYNER (Hull) advocated the appointment of some central authority, on the lines of the Electricity Commissioners, which would deal with the country comprehensively and make the best use of the various means of transport now existing. In that way we should not be handicapped, as was the case now, with artificial boundaries and it would then be possible to make the fullest use of existing facilities and so avoid useless and wasteful competition. That policy had been adopted with regard to electricity supply and there was not an electrical engineer in the country who would say that it had not been a wise one. Only in this way should we get efficient transport at the lowest cost.

COUN. J. G. FRAZER (Dundee) disagreed with the view expressed that tramways should permanently be a charge upon the rates, as suggested by the representative from Walthamstow, and added that it is no more possible to give 3d. tram rides for 2d. than it was to have a 4d. shave for 3d. Tramways must be revenue-producing and must not be allowed to come on to the rates.

ALD. F. SMITH (Liverpool) opposed the view that a body similar to the Electricity Commissioners should be appointed for dealing with transport problems and said that the transmission of electricity through cables was a very different matter from the transport of passengers in vehicles. He deprecated, too, municipalities going outside their own boundaries and urged that they should all try and do the best they could for their own ratepayers.

The last paper read was on "The Economy of New Car Equipment," by Mr. R. S. Pilcher (Manager, Edinburgh). This we give in abstract below.

The Economy of New Car Equipment.

By R. STUART PILCHER.

A progressive policy in car equipment is important, and any system of fares which would increase revenue by 1d. per car mile would be regarded as of great value. Yet there are differences as great as this in the costs of maintenance under different conditions.

Electric tramways have been in operation for 25 years, and the equipment on many systems is 15 to 25 years old. In few cases has there been a general scrapping of old equipments for the purpose of introducing new ones. From statistics collected by the author, it appears that the cost per car mile varies from 1d. to 4·29d.—a variation which, on the system of the Edinburgh Corporation Tramways, would make a difference of £102 812 per annum. In some cases high costs are due to local conditions, e.g., heavy gradients, etc., but the variations deserve discussion. In Edinburgh opportunities had been afforded of comparing new light weight equipments with the older stock, both running under the same conditions. In aiming at a light weight it is necessary to effect a general reduction, so that the position of the centre of gravity is not unduly disturbed. The total reduction is from 11 tons 2 cwt. to 9 tons 9 cwt. Truck and motor have been reduced by 11 cwt., body and top deck by 22 cwt., and the height is 4 in. less. From an experiment, illustrated by photographs in the original paper, it appears that centre of gravity is 4 ft. $11\frac{7}{8}$ in. from the rail level in the case of the light car, and 5 ft. $\frac{1}{8}$ in. in the case of the heavy car, so that an improvement has been effected. In addition the seating capacity has been increased from 54 to 60, and the speed on level from 16 to 18 miles per hour. The total weight reduction is from 456 to 354 lb. per passenger seat, i.e., 22 per cent.

Motor Design.

The motors, of the box frame inter-pole type, weigh 14 cwt. 3 qr. complete with gear and gear-case. The weight of the older motors was 15 cwt. 2 qr. and the horse-power only half as great. This great advance in the h.p. available for given weight and dimensions is due mainly to efficient fan cooling and the use of powerful interpoles. The average temperature of the light weight motor after 16 hours' running is 87 deg. F. as compared with 121 deg. F. on the older motors. The following data relating to the two types of motors are of interest :—

	Old type 25 H.P. Split frame. Cwt. qr. lb.	New type 50 H.P. Box frame. Cwt. qr. lb.
Weight of armature	4 2 0	3 3 0
Weight of gear case	1 1 10	1 0 0
Weight of motor (complete with gear case)	16 3 10	15 3 0
Weight per horse-power	75½ lb.	35 lb.
Gear ratio	4¾ to 1	4½ to 1
Speed on level	650 revs. per min.	850 revs. per min.
Temperature rise	121 deg. F.	87 deg. F.
Energy consumption (per car-mile)	1·24 kWh	1·18 kWh

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It is anticipated that the chief sources of economy will be as indicated in the following table :—

UPKEEP ON MOTORS.

	Cost per car old type. £ s. d.	Cost per car new type. £ s. d.
Lubricating oil per annum	1 13 6*	0 16 9†
Lubricating (wages) per annum ..	1 0 0	0 15 6
Overhauling armature bearings per annum (labour and material) ..	5 5 4‡	1 15 1§
Amature repairs per annum (labour and materials)	3 7 3	1 13 9
Energy consumption per annum, 44 051 car miles per annum ..	17 4 0	16 7 0¶
TRUCKS.		
Upkeep on trucks: saving in wheels (no reflanging of tyres) ..	8 9 10	None
Total	£36 19 11	£21 8 1

Saving per car per annum, £15 11s. 10d.

However, the comparison is incomplete as the introduction of the new equipment should reduce the maintenance of the permanent way and the longer wheel bases should lengthen the life of the tyres. Other advantages are the more rapid acceleration of the new type of motors, and their greater overload capacity. Seven new cars should do the work of eight cars of the older type and this alone means a saving in rolling stock of 12½ per cent. ; also a saving in drivers' and conductors' wages of £681 for each car saved, or 0·7d. per car-mile on the whole system. The total actual saving in motors and trucks plus this saving should be 0·78d. per car-mile.

The modern under-carriages of the single truck type provide for either a radial section or displacement of the wheels out of alignment when negotiating curves ; the single trucks are of the swing link of pendulum type with an 8 ft. 6 in. wheelbase fitted with 25 in. wheels. After 18 months' experience they appear to be wearing well and the life of the wheels should be as great as for the larger type. The tyres have the appearance of being able to wear out without being turned up to provide a new flange which, if confirmed by further experience, should mean a considerable economy. The problem of obtaining a more resilient car is being studied, and tests are being conducted with rubber packed wheels. Between tyre and centre there is inserted a ring of rubber 3½ in. by 1 in. provision being made for bonding tyre and centre together for electrical purposes.

Scrapping Policy.

In conclusion the author deals generally with the question of scrapping old systems. He suggests that an engineer is justified in recommending the substitution of old plant by new, if the resultant economies will meet any annual charges in respect of the displaced plant and consequential upon the new plant, and yet show a commercial profit. In this case the saving of 0·78d. per car-mile represents approximately £144 per car per annum. This sum, capitalised on a basis of 4½ per cent. for a 20 years' life, represents a capital of £1 515, which is more than sufficient to purchase a complete new car equipment, with all the other advantages which go with the provision of up-to-date rolling stock. If similar results can be realised on other tramway systems it becomes an economical policy to " spend money in order to save money."

DISCUSSION.

Mr. A. L. C. FELL (London County Council) said there was only one point in the paper with which he wished to quarrel, and that was the publication of the appendix showing cost of car repairs. In the case of Glasgow the figure was for mechanical repairs only and not for both mechanical and electrical repairs. On the other hand, the figure for the London County Council tramways was considerably less now than stated. In 1921-22, to which the figures related, most undertakings were struggling to get over the arrears of the war, and the London County Council figure for repairs had been reduced since then by at least 33 per cent. Another important point was that the labour side of the story must be taken into account. In London the cost of labour was much higher than in the provinces. The type of equipment must also be considered. In London he had to maintain both the trolley system and the conduit system and the cost of the double equipment added very greatly to the total cost. For these reasons he thought it undesirable to publish such a schedule as in the paper. It was an excellent thing to try and cut down weight, and the modern tramway motor enabled that to be done. He himself had recently installed larger motors weighing 34·2 lbs. per H.P. compared with 55·9 lbs. per H.P. for the older motors, and that made a considerable saving. On the general question of replacing motors on old tramcars, that was a matter which required to be approached with considerable caution. He was installing new motors on the best of his cars at a cost of £800 each, but the cars only cost £950 each originally, and, therefore, the question of whether it would be cheaper to have new complete cars must be considered.

Scrapping a Serious Matter.

Mr. H. P. STOKES (Plymouth) thought the question of scrapping cars and equipment was a very serious one for old undertakings. He had just ordered 20 new cars which weighed 306 lb. per passenger seat for the open top deck type as against 441 lb. in the case of the older cars. The new type of covered top deck cars only weighed 365 lb. per passenger seat. One of the greatest difficulties they were up against in connection with car design was the adding of frills. In the case of four-wheel trucks, for instance, pendulum and link gears provided a point to swing about and knocked the truck to pieces. He could show plenty of instances of the checker rail being chewed off as fast as it was put on through the use of pendulum gears and swinging links, and he felt that their salvation would be in the adoption of equal wheel bogey trucks with light four-motor equipments, and distributing the weight as far as possible. In this way it would be possible to attempt to solve the problem of permanent way renewals, which was often far more serious than that of car equipment.

Mr. H. MATTINSON (Manchester) urged Tramway Committeemen to listen sympathetically to proposals by their managers when they were recommending the scrapping of plant. No manager would recommend such a course unless he were satisfied it was necessary, but there was a British characteristic against scrapping plant, largely, he thought, because the equipments now in use, although old, were so good mechanically that people were loth to give them up.

Mr. W. M. MILNES (Wigan) said he did not think he was likely to follow Mr. Pilcher's suggestion and scrap his existing equipment, owing to the large capital expense involved and the fact that his equipments were in good order.

Mr. E. S. RAYNER (Hull) thought it was a self-evident fact that if they were going to fight motor bus competition, the tramways must give equally good service to the public. The services must be speeded up because they could not ask the public to use trams if the trams did not get the public from point to point at the same speed as buses. To do this, undoubtedly, some of the old equipments must go. Further, the authorities must be persuaded to increase the speeds at present allowed. It was an anomaly to have a vehicle which was rated on the top notch at 20 to 22 miles an hour and then to have a speed allowed in the city of 8 to 12 miles an hour.

* 12 gallons. † 6 gallons. ‡ On six months' basis. § On three years' basis. ¶ Reduction of 5 per cent. at 1·5d. per kWh.

Tenders for Municipal Electricity Plant.

Problems at Leeds and Bradford.

The Electricity Committees of Bradford and Leeds Corporations have both appointed sub-committees to consider what action should be taken in view of the fact that British firms' tenders for electrical plant are above those of Continental firms.

At Bradford the contract is for a new turbo-generator estimated to cost about £40 000. Tenders received from foreign firms are said to be less by £10 000 than those of home manufacturers, and it is upon this discrepancy that the sub-committee is reporting to the Electricity Committee this week.

The plant required at Leeds is a 10 000 kW alternator turbine and condensing plant, estimated to cost between £20 000 and £30 000. In the original tenders the prices quoted by the foreign manufacturers were so much below those of British firms that the Committee was unable to agree to give the contract to any British firm at the figures quoted. As the result of negotiations between the sub-committee and the English firms concerned it is now hoped that the reductions of the latter on their original tenders will be sufficiently substantial to enable the Committee to give the contract to a home firm. The reductions are understood to amount to about 15 per cent. of the former price.

In his annual report, Mr. P. P. Wheelwright, electrical engineer, Blackburn, states that the time has come when it is ESSENTIAL TO HAVE AN EXTENSIVE SHOWROOM, where the prospective consumer can see electrical apparatus in actual use, and at the same time the very latest and most efficient type for any purpose.

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Public Address Systems.*

By I. W. GREEN and J. P. MAXFIELD.

During recent years there have been great developments in electrical systems for amplifying the voices of public speakers and music, both in enabling the sound to reach a vast audience assembled at one spot, and in facilitating broadcasting to different localities. The two main requisites are faithful reproduction of sound and sufficient intensity. The acoustics of the place where the sound originates are important, and reverberation, echo, resonance and diffraction effects have to be guarded against.

Reverberation involves persistence of sounds, so that they become confused with succeeding ones; echo is reverberation in which there is a distinct interval between the original sound and the reflection. Resonance is chiefly important in arranging the pick-up apparatus or transmitter, and may arise if this is concealed in a small enclosure. Diffraction effects have been met in large areas surrounded by open work

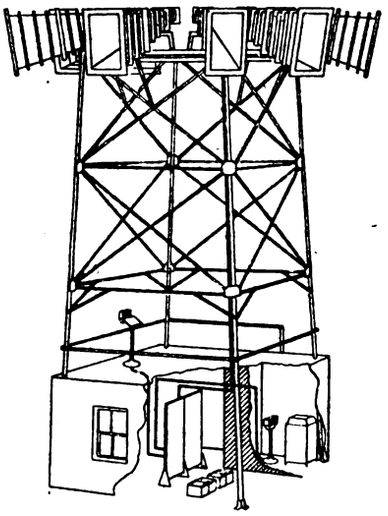

FIG. 1.

fences. Foreign noises may also be troublesome and the sound delivered by the system should be at least 10 000 times that of the noise. There is also apparent distortion of a voice when its intensity at the ears of a listener is too great, or too small; hence the amount of amplification must be regulated and the volume of sound kept within limits.

Means of Overcoming Noises.

The best solution is to try to make each unit of the system faithfully reproduce its input. The system, as now developed, comprises four units, a " pick-up " mechanism or transmitter, a preliminary amplifier unit (the speech input equipment), a second amplifier unit (the power amplifier) and a receiver-projector unit for transforming the amplified currents back into sound. In the original paper typical diagrams of sensitiveness and frequency are presented. A marked distortion of wave form occurs when the iron is worked beyond the straight line part of the magnetisation curve. In the case of amplifiers the maximum power obtainable is limited by the power output at which distortion occurs rather than the heat which can be dissipated.

A system which does not fail to reproduce equally all frequencies in the speech range by more than a ratio of 10 to 1 in reproduced power is indistinguishable from a perfect system. It has also been found that there must be uniform amplification over a range of frequencies from 200 to 4 000 cycles. When the lower frequencies are missing, reproduction sounds " tinny," when higher frequencies are missing it sounds heavy and muffled. Rough experimental data indicate that in an orchestra loudness may vary as much as 50 000 to 1. The present equipment does not operate satisfactorily over this wide range, but good results can be obtained by manual adjustment.

A Typical Installation.

A typical installation, as illustrated in Fig. 1, will cover an audience of 700 000. Sound leaving leaving the speaker's mouth is picked up by the transmitter on a reading desk type of pedestal, normally mounted at the front of the platform. The feeble currents from the transmitter are led by carefully shielded leads to amplifiers in the control room, usually beneath or to one side of the speaker's head. Up to 125 sq. ft. is required for this room. The amplified speech currents are then led to the receiver projector units, here shown arranged on the superstructure above the platform—a position which is favourable to producing the illusion that the voice comes from the speaker rather than the apparatus; also, in this position acoustic coupling between transmitter and projector (liable to cause singing) is reduced to a minimum. A smaller system suitable for an audience up to 50 000, with one tenth the power output of the former, has also been developed. A diagram of the equipment is shown in Fig. 2.

Transmitter Characteristics.

The output of the high quality transmitter is about 65 miles above zero level—i.e., the output from a standard telephone set connected to a common battery central office by a line of zero resistance. Under average conditions, the output of the transmitter is of the order of 10^{-8} W. This may be amplified as much as 120 million times, bringing the power up to a few tenths of a watt, and 17 miles above the zero level previously mentioned. The power amplifier increases this range to 40 miles, corresponding to about 40 W.

In early work an air-damped stretched diaphragm condenser transmitter, having a thin steel diaphragm 2¼ in. in diameter and another plate with an air film of 1/1000 in. between was used. This had a natural period of 8 000 cycles, well above the natural frequencies of the voice and gave good reproduction. But the small capacity (about 400 mf.) was a difficulty and made an elaborate shielding of the leads necessary. Subsequently a transmitter of the granular carbon type, using two variable resistance elements, was devised. This had equally good

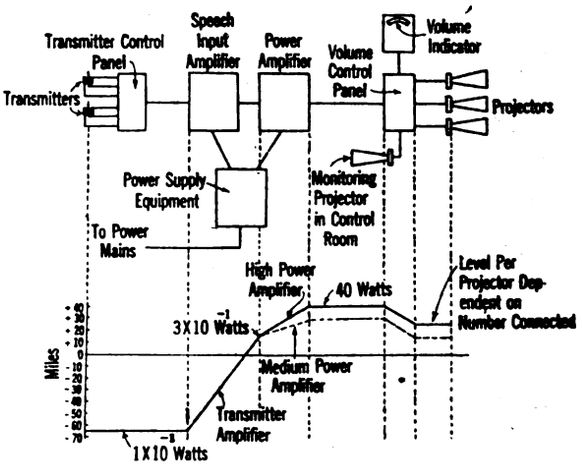

FIG. 2.

reproduction characteristics, and in view of the large amplification the low sensitiveness was not a serious drawback. In the original paper the authors show the assembly of the apparatus as a two-button element with a resistance path of about 100 Ω; this two-button method eliminates distortion due to the non-linear nature of the pressure resistance characteristics of granular carbon. It can be effectively used at a distance of 5 to 6 ft. from the speaker and has a practically flat frequency characteristic. No collecting horn or mouthpiece is needed.

Transmitting Arrangements.

The output from the transmitters is taken to a panel enabling the operator to switch quickly from one transmitter to another according to the positions of speakers. A combination of four units will provide for all conditions usually met with, two being speech input or transmitter amplifiers with different gains, and two power amplifiers of different ratings.

The first of the speech amplifiers is of the three-stage type. Two potentiometers provide adjustment of the gain over a wide range. Switching devices enable the output to be connected directly to the input of the power amplifier when the programme is to be transmitted to a local audience; or to be connected through a transformer to long distance lines to

* Abstract of a Paper read before the American Institute of Electrical Engineers.

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a distant audience, or to a radio-broadcasting station. The filaments of the tubes are supplied from a 12 V battery and the plate circuits obtain direct current at 350 V (or in special cases 130 V) from the power supply equipment. The maximum gain with this amplifier is 85 miles, which as a power ratio is 1·2 by 10^8. The maximum power output is approximately 0·3 W.

In practically all the larger installations the output from the transmitter amplifier is taken direct to a high power amplifier, which has a power amplification ratio of about 200.

Receiver Mechanism.

The loud-speaking receiver mechanism will carry several watts without distortion. A light spring-supported armature is mounted between the poles of a permanent magnet and passes through the centre of the coils carrying the voice currents. A light link connects one end of the armature to a diaphragm of impregnated cloth, corrugated to permit vibrations of large amplitude. A stamped metal cover protects the parts against mechanical injury and a cast iron case shields the whole apparatus from moisture. With this apparatus it is possible to project speech a distance of 1 000 ft. under ordinary weather conditions. For great distances a tapering wooden horn of rectangular cross section, about 10 ft. long, is used; but for smaller installations fibre horns are more suitable.

When the installation is of a size requiring a high power amplifier a vacuum tube rectifier, taking its supply at 110 or 220 V and delivering 750 V d.c., for the plate circuits is used. A potentiometer provides 350 V d.c. for the speech input amplifier tubes. Full wave rectification is obtained. A filter consisting of a large series reactance coil and bridged condensers is used to render the d.c. output suitable for this use. A step-down transformer supplies the filament of the power amplifier. For the larger installations the total power required is 1 500 W. For smaller installations, where the high power amplifier is not necessary a 350 V generator, driven by a suitable motor, taking about 600 W, suffices. Observers, equipped with portable telephone sets, are stationed at various points to communicate with the operator and advise him as to the effect of wind, etc., so as to maintain uniform distribution of sound.

The Use of Public Address Systems with Telephone Lines.*

By W. H. MARTIN and A. B. CLARK.

This Paper, which deals with the application of the public address system to telephone lines, so as to enable a speech to be heard simultaneously in several cities, is supplementary to the above article. A circuit which transmits without material distortion a frequency range from about 400 to 5 000 cycles can be used for speech. But the requirements for transmission of music are more exacting, and it is probable that in this case a range from 16 to 5 000 cycles is necessary. For transmission over short distances non-loaded cable circuits equipped with distortion networks or attenuation equalisers will give good results. The New York-San Francisco circuit, 3 400 miles long, has frequency characteristics very suitable for voice transmission though there is some loss of naturalness. In the original paper the author presents a diagram showing how by the use of attenuation equalisers distortion may be corrected. Maintenance of telephone power is also important. If the power is allowed to become too weak the extraneous power induced from parallel long circuits would tend to obliterate the telephone transmission; on the other hand, power must not be amplified so much that telephone repeaters are overloaded or severe cross-talk will be induced into paralleling circuits. Hence to keep the telephone power within proper limits requires careful adjustment, and in the public address system the use of a "volume indicator" of the type described in the previous article is very useful. Other defects to be guarded against include the "echo effects" which may occur on long telephone lines. Finally, when a large crowd has assembled to hear an address at some distant point, absolute reliability and absence of delay in establishing connection must be ensured. Connections must be made ahead of time, spare circuits in case of failure arranged, and a special operating force organised.

A Typical Circuit.

In the final section of the article the author illustrates a number of typical circuits for the transmission of addresses to a distance, amongst which that employed on Armistice Day, 1921 (Fig. 1) is of chief interest. It will be recalled that crowds at three different cities were addressed, and this necessitated somewhat elaborate arrangements. Thus, at Arlington three different transmitters were used respectively for musical selections, speeches made in the amphitheatre and addresses at the grave of the Unknown Soldier. Yet another transmitter was used by the announcer who kept the audience at New York and San Francisco advised of the proceedings. As the audience at Arlington was assembled partly in the amphitheatre and partly outside very careful location of the 21 projectors, so that all those present could hear, was necessary. Three transmitters were located respectively on the platform for the speaker in front of the boxes, for the singers and at the grave. Similarly at Madison Square, New York, fifteen, and at San Francisco seventeen, loud speakers were needed in order that all sections of the audience might hear clearly.

The methods which have been employed to connect public address system transmitters with toll lines are being used for the broadcasting by radio of speeches and music given at points remote from the radio station. In such cases the transmitter and its associated amplifier are operated and controlled in the same way as described above for toll lines. In some cases the radio station is in the same city as the place where the speech or music is given, and in other cases the two are in different cities. In the first case the output of the transmitter amplifier is carried to the radio station over non-loaded cable circuits which are equalised by means of distortion correction networks to have uniform efficiency over a wide frequency range, in some cases up to 5 000 cycles. Where the two points are in different cities, the non-loaded cable circuit goes to the toll office, and there is connected to the toll lines which are operated in the same manner as for loud-speaker use.

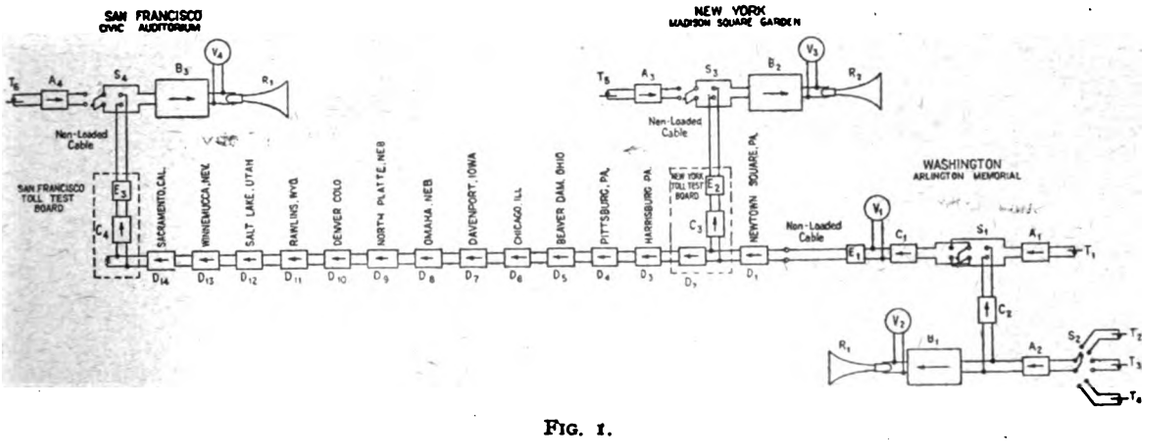

FIG. 1.

* Abstract of a Paper read before the American Institute of Electrical Engineers.

Aluminium Facts and Figures.

A new edition of "Aluminium Facts and Figures," which has just been issued by the BRITISH ALUMINIUM CO., presents a mass of useful information in a form which enables it to be carried in the vest pocket. It embodies most of the features of the larger-sized edition, and includes data upon applications not available for inclusion in the previous issue.

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Reviews.

Electro-Chemistry Related to Engineering. By W. R. Cooper. (London: Constable and Co.) Pp. xiv.+136. 12s. 6d. net.

This little book consists of seven chapters, in the last of which the author points out that chemical engineers in choosing a factory site will be largely influenced by the relative costs of electric power, freight of raw materials and freight of the finished product to the principal markets. He also points out that the importance of a cost depends on its being a large proportion of the selling price, rather than a large cost per ton of product, and illustrates his point by a table giving figures, based on U.S.A. conditions in 1921, of these costs in the case of a number of electro-chemical products.

The remaining six chapters are devoted to the consideration of seven problems requiring for their solution the co-operation of engineer and electro-chemist. Problem I.—Electrolytic Corrosion by Stray Earth Currents, arising from an earth return circuit on tramway and railway systems. In the U.S.A. serious trouble has arisen from this cause, but in the United Kingdom the Board of Trade regulations appear to have met the practical requirements of safety, although insufficient to prevent corrosion entirely. Problem II.—Effect of Superimposing Alternating on Direct Currents. Some curious results observed in the case of such superposition, which may play a part in corrosion, make this problem, in the author's opinion, worthy of investigation, and his own additions to the existing data from the subject of a paper recently read before the Faraday Society (Abstracted in The Electrician, Vol. XCI., p. 118, August 3rd, 1923). Problem III.—The Corrosion of Brass. This is considered mainly in connection with the brass tubes used in steam plant condensors, a matter of considerable industrial importance. The Cumberland process, the only one in which an external e.m.f. is employed to prevent such corrosion that has become important commercially, is dealt with. If sea water, or other water containing metallic salts in solution, be used for condensing, it is exceptionally important to prevent this cooling water from finding its way to the condensed steam, as the result of corrosion, and the author describes a very simple method of periodically testing for this. Problem IV.—The Deterioration of Electric Mains by Electric Osmosis, and the changes in cable-making by which it has been overcome, are briefly mentioned. Problem V.—Applications of Electric Cataphoresis. This is the converse of electric osmosis, being the transfer of particles of a porous material through a liquid. It is largely employed for removing various impurities from clay, and for separating the finer from the coarser particles in it. Problem VI.—The Electrical Precipitation of Dust, Smoke and Fume. This has been employed successfully for cleaning blast furnace gas, for the precipitation of acid mist in the concentration of sulphuric acid, for the recovery of valuable metallic compounds, and many other purposes. Practical details of the plant employed are given together with some interesting cost and other data. Problem VII.—Electro-Culture. The experimental work is interesting and appears promising, although not in the immediate future, for much still remains to be determined experimentally. The author informs us that, apart from the purely experimental work, the only serious applications in this country have been carried out by the Agricultural Electric Discharge Co., of Birmingham, who supply complete equipments.

The book is suggestive and should draw the attention of research students to byways awaiting exploration.

G. W. de Tunzelman.

Alternating Current Electrical Engineering. By W. Tolmé Maccall, M.I.E.E. (London: W. B. Clive. University Tutorial Press.) Pp. viii+493. 15s. net.

This is a companion book to the author's "Continuous Current Electrical Engineering," and is intended to serve as a text book on alternating current theory and practice for the usual three or four-year day course in electrical engineering, and for evening courses preparing for the Higher or Advanced National Certificates. But Mr. Maccall's main object has been to provide a text book which will cover the fundamentals of all branches of alternating current work, and there is certainly room for such a book, especially when we realise the extension of alternating current applications in recent years. We may say at once that Mr. Maccall has, in the main, succeeded in attaining his object and has well and truly laid foundations covering a much wider area than is usual, though no wider than is necessary. The book is divided into sixteen chapters, the first three dealing with general principles, series and parallel circuits and polyphase systems. There are then two very good chapters on a.c. instruments, including wattmeters and energy meters, in which the theory and mode of action and sources of error are dealt with more fully than is usual in a general text book—a valuable feature. These five chapters occupy about one quarter of the book, the remainder being given up to a discussion of the fundamental principles of action and use of transformers, generators, synchronous motors, induction motors, commutation motors, converters and rectifiers, together with chapters on a.c. traction, transmission and protection and a concluding chapter on harmonic analysis.

This briefly indicates the area covered, and it may be added that in, for example, the chapters on motors the author deals with phase advancing, cascade control, and polyphase commutation motors; in the chapter on conversion he deals with inductive regulation, with booster and split-pole rotaries and with the motor-converter. The chapter on transmission and protection is very helpful, and throughout the book there are ample references to original papers.

The general setting of the book is good, and we note with pleasure that there is less divergence in type than is usual in the average publications of this house. We note also with relief the absence of progressively numbered formulæ. The illustrations are numerous and good, though the method of numbering them—e.g., Fig. 16.07, indicating the seventh illustration of the sixteenth chapter—does not strike us as any improvement on consecutive numbering from the reader's point of view. There are plenty of worked examples and of questions with numerical answers.

We ought to have mentioned that the elements of the calculus have been used, but a large part of the book can be followed by those unable to employ it.

Mr. Maccall has produced a useful book and one for which there should be a good demand.

J. Paley Yorke.

Wireless at Home. By H. de A. Donisthorpe. (London: Percival Marshall and Co.). Pp. 46. 6d. net.

Wireless for the Home. By N. P. Hinton. (London: Sir Isaac Pitman and Sons). Pp. xii.+87. 2s. net.

One of the results of the popularising of wireless telephony has been the writing of many books, of which, indeed, there seems no end. Dumas at his speediest would not have rivalled the performance of some of those who recently have burst into print in the hope of catching the crest of the wave of public interest. And to those who spend laborious months in building serious scientific works the success of these enterprising people is a chastening thought. Men thank us for giving them what they want; not what we in our superior wisdom think they ought to want. The designers and builders of heavy plant can affect to scorn things called "popular," but the engineer who is more in touch with the public, and who, perhaps, wonders why the electric idea does not make greater headway would do well to read the cheapest and most popular of the radio telephony books. He may then see that their success is to a great extent due to an absence of that grandmotherliness so frequently ascribed to the Institution, yet in reality more characteristic of the electrical industry as a whole.

There is an enormous potential demand for electrical apparatus of every kind. The wireless "boom" may show us the way to come down from our superior perch and get more closely in tune with the purchasing public.

Wireless telephony is dividing itself into two broad sections. On the one hand there are those who wish to hear the broadcast programmes for the sake of the matter transmitted and for the general interest of the thing, and on the other hand there are many who find a most absorbing hobby in the building of wireless sets.

Both classes of reader will find useful all-round information in "Wireless at Home," which is a well balanced little survey giving an exceptional amount of definite and useful information in a small space—a welcome contrast from many of its prosy and hastily written contemporaries.

"Wireless for the Home" treats the subject equally simply and lucidly. Being carefully printed and illustrated and cloth bound, and written by a specialist in the design of receiving apparatus, it is the kind of book we can safely recommend to the likely buyer of wireless apparatus.

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Devastated London—and One Reason.

The Post Office Increases Telephone Facilities in the Metropolis.

1 and 3. Duct Laying in Edgware Road.—2. Mr. J. L. Brown, a Post Office sectional engineer, with Harry Wheatland, who claims to have laid the first ducts in England.—4. Duct Laying in Savoy Street, near the Institution Building.—5. Telephone Cable being drawn into the Ducts.—6. "The Griffin" amongst the Ruins.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

An Example of the New Vogue.

We have referred previously to the new vogue in lighting equipment and we illustrate a fitting marketed by the SLOAN ELECTRICAL CO., which is typical of this new fashion. The illustration also proves that when they are not limited to the "open bowl" designers can produce lighting units that are really attractive in design. This fitting is one of several in the Sloan catalogue, but

A TYPICAL SLOAN FITTING.

it is noteworthy because it is fitted with triplex glassware, and because the designer of the glass has succeeded in evolving a pleasing design. The list price of the fitting is 76s. complete with glassware and the metal work is in polished brass finish.

Contractors and retailers will do well, we venture to suggest, to take this new vogue seriously and display a selection of this type of fitting in their showrooms. The coming of the lighting season may see a change, but at present very few of these "new vogue" fittings are to be seen in the showrooms.

A "Simplex" Help to Contractors.

It is understood that this column is not devoted exclusively to notes on "merchandise to sell and profit by." We feel that we are rendering a service to the trade if on occasion we refer to other lines which are of importance, and are necessary to the greater progress which we all desire so much. It is for this reason that reference is here made to a booklet recently published by SIMPLEX CONDUITS, LTD., entitled "Wiring Systems for Electric Light and Power Installations." Primarily intended for consultants and works engineers, it is however, a well written treatise on a subject on which we have still much to learn, and contractors will benefit from its study. Copies can be obtained on request from the Simplex Co.

B.T-H. Seasonal Bargains.

In other trades it is the practice to make "off season" offers, but it is very rare practice in the electrical trade. There is, however, much to be said for the practice, and although it is a new experience for electrical buyers, they would be wise not to waste their time in doubtfully shaking their heads at this "modern notion," rather should they grasp the opportunity of acquiring some of the remarkable bargains in bowl fittings offered by THE BRITISH THOMSON-HOUSTON CO. Prices are so low that it will prove a good investment to

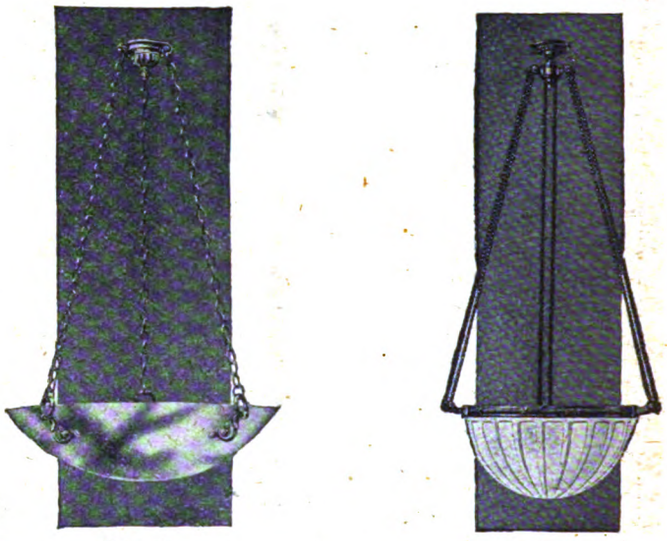


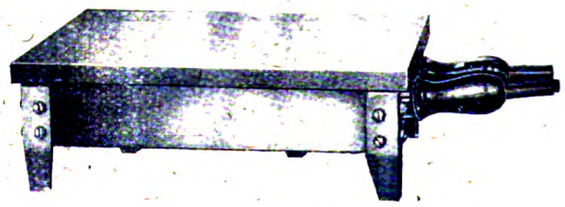
FIG. 1. FIG. 2.

TWO OF THE LATEST B.T-H. FITTINGS.

buy enough fittings to last through the season. The leaflet (No. 282) published by the Company reveals the fact that in spite of the keen prices the fittings are of good quality and of excellent design. This is proved by the two illustrations which we show on this page. Fig. 1, is supplied complete with a best selected alabaster bowl in a range of sizes from 12 in. to 20 in., and the nett trade price for the 12 in. size is 21s., other sizes being in proportion. Fig. 2 is a particularly appealing design which can be supplied in 12 in., 14 in. and 16 in. sizes. Prices for this fitting range from 22s. 6d., inclusive of the B.T-H. "Druid" hemisphere.

The Meaning of Credenda.

Trade names and titles are not always happily inspired. But the name "Credenda" proves the contrary of the proposition, and this has come about by the simple fact that the quality policy of the CREDENDA CONDUITS CO., has been persistently maintained. As is well-known, the word "Credenda" means "a belief—a faith—



A USEFUL INDUSTRIAL DEVICE.

a creed," and it well signifies the policy of the Company. We illustrate a cast iron hotplate for industrial purposes which the Credenda Co. manufacture. There are many fields which would reap good business if properly exploited. To name one field alone—hatters' shops which we all have to patronise, and watch our hats being "tuned up" on a gas heated hotplate!

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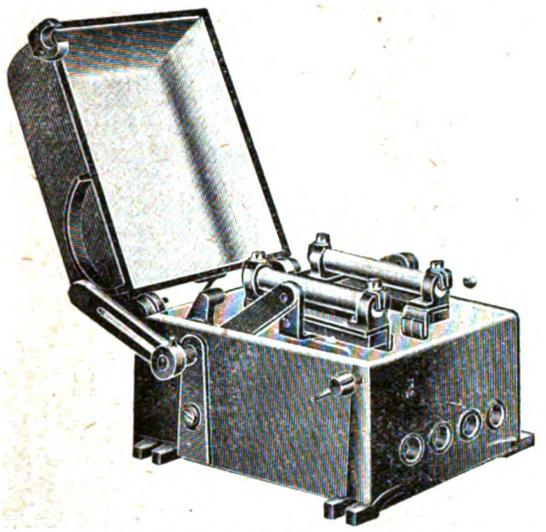
"Apex" Ironclad Switch and Fuse Gear.

The lines of switchgear of the more everyday patterns now on the market are almost as plentiful as blackberries. None the less the established makers with proved types hold their own, and are a sure index for the buyer. "Apex" Ironclad switchgear, manufactured by the FOSTER ENGINEERING Co., is a reliable apparatus



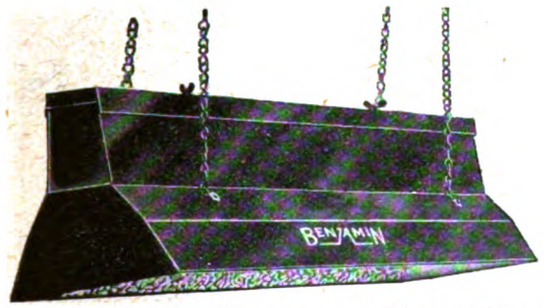
THE LATEST IO A "APEX" SWITCH.

which can be bought with confidence. We illustrate the "Apex" No. 98 which is a speciality of the "Apex" range. It has many features, a few of which may be summarised: (*a*) Foolproof and splashproof; (*b*) the switch can be wired from the top of the box or through it as required; (*c*) the switch has a patented parallel action with a 3 in. quick break divided over the contacts; (*d*) the fuses are easily rewired; (*e*) contact between fuses on the switch cannot be made when the cover is open; (*f*) however the switch is wired, the fuses are "dead" when the switch is off.

The switch is made in a 10 A rating at 500 V in both D.P. and T.P. A number of well-known factors market the "Apex" range.

Benjamin Propaganda.

"Window displays are the most direct form of advertising—and one of the most profitable. They show goods at a time when the consumer is able to act upon the impulse and make the purchase." With these thought-provoking words THE BENJAMIN ELECTRIC Co. preface their statement of the necessity of better shop window lighting in a leaflet (No. 625), which they have recently published.



AN INTENSIVE TYPE OF REFLECTOR FOR NARROW WINDOWS.

Obviously the dictum is written for the shopkeeper, and it is the duty of the contractor to see that it comes under the eye of every trader in his district or field of operation. We use the word "duty" deliberately, but it is also the *opportunity* of every contractor, and, by linking themselves up to the Benjamin publicity, contractors will find that better shop window lighting is something to sell and profit by. The leaflet shows several items of equipment. We illustrate an intensive type reflector designed for narrow windows. This reflector is also made in an extensive pattern for use in deep windows.

Enterprise and Judgment.

It has been commented on that, in these columns we often make use of the expression "enterprising retailers." We wish to make it clear that "enterprise" does not mean that buying should be done without judgment. There are a number of lines in electrical merchandising which require enterprise to sell them and extreme judgment in buying. One such line is "wireless parts." Many are waiting for the cat to jump out of the bag of politics into which the wireless industry has fallen, and enterprising retailers are planning many things. Some hope for this, and some hope for that. But those who hope for a large market for wireless parts must buy with caution and judgment. Several manufacturers of repute have good lines to offer the retailer. We would cite as an illustration the variometer made by the STERLING TELEPHONE Co. The instrument is well made, electrically and mechanically efficient and of high grade finish throughout. The rotor is wound on a moulded composition former possessing high insulating properties, the ends of the winding being soldered to spindle pins which feed through grooved wheels and silver spring contacts at top and bottom, to solder tag terminals. The stator is wound on a skeleton former

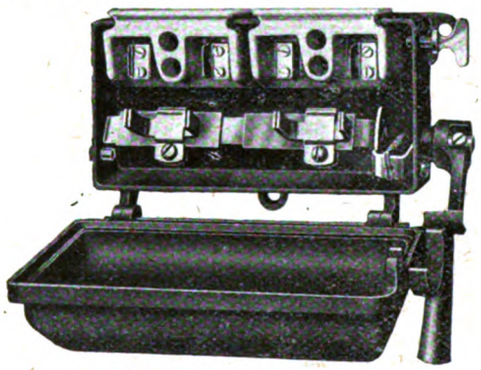
THE STERLING VARIOMETER.

consisting of moulded composition top and base, supported by four standards with tapped extensions for panel mounting; the ends of the winding are soldered to tag terminals top and bottom. The spindle is fitted with a moulded ebonite dial and milled knob. All metal parts are nickel plated. The variometer is listed at 21s. each, packed in a strong cardboard box lined with corrugated paper.

About the New "M.E.M." Switch.

We illustrate a new ironclad switch which has recently been placed upon the market by the MIDLAND ELECTRIC MANUFACTURING Co. The switch is of the "quick-make type," but is lighter in character than previous designs, so that in addition to its use on industrial installations, the new switch is particularly adaptable for house service work, and for heating and cooking apparatus, where a "fool-proof" switch of neat appearance is a real necessity.

The whole trend of development in ironclad switchgear of this type is along the lines of a "quick-make" action, because a switch with this action undoubtedly gives the user a feeling of confidence



A NEW "M.E.M." IRONCLAD SWITCH.

when switching on. For domestic installations there is an imperative need for contractors to use the "quick-make" switches entirely, and now that the M.E.M. offer this new range of "Memak" switches at a very competitive price (taking into consideration the high standard of quality) there is no excuse for not doing so. From the illustration it will be noted that in general the switch takes the conventional shape, but an inspection of a sample switch will reveal details of design which are unique. Particularly is this so with the wiring or leading-in holes. The wiring is done direct through the porcelain into the terminal blocks and the design is such that it does away with the objectionable loose bushes which are supplied with so many ironclad switches. The "Memak" range consists of double-pole and triple-pole switches in 15–30–50A at 500V, and also a series of combined switch and fuse units made in the same ratings.

IBBETSON AND Co. invite readers of THE ELECTRICIAN to ask for a copy of a new price list on "Universal" Electric drills which they have just published.

DORMAN AND SMITH announce the issue of a new complete catalogue, No. 99, of fuses, switchgear, accessories, fittings, etc. Many new lines are described, including cluster fittings with shielded terminals, crane control boards, 6A 3-pin connector with earth connection, shielded switches and fuses.

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Tramcar or Motor 'Bus?

Why Manchester Favours Electric Trams.

That the motor 'bus cannot be considered either as a practical or financial substitute for the tramcar is the expressed opinion of the Manchester Tramways Committee following the receipt of a report by the general manager, Mr. H. MATTINSON on the comparative utility of the motor 'bus and tramcar. The report, which is abstracted below, will be submitted to the City Council at its meeting on September 5th.

A few general comparisons are submitted to indicate the fundamental attributes each type of vehicle possesses, which are to be borne in mind in considering the adaptability of the particular vehicle for specific purposes. The largest motor 'bus at present seats 26 passengers inside and 28 outside—total 54 seated; with six standing the full capacity is 60 passengers. The largest tramcars seat 80, all under cover. With 12 standing the full capacity is 92 passengers. The modern tramcar carries all its passengers under cover, a development arising from our climate necessitating such cover over the major portion of the year. Many efforts have been made to design a cover-top 'bus, and it is doubtful if ever a satisfactory safe vehicle can be evolved for use in urban districts, as, having to operate on cambered roadways, its liability to overturn will be ever present, and the cant due to such camber renders it liable to strike lamp posts and other erections on the footpath edge.

The motor 'bus has a slight advantage in busy streets by reason of its ability to deviate its course around an obstruction, but the tramcar has the highest "average" speed over a reasonably long route, and a much higher rate of acceleration. Whilst the mechanical reliability of the motor 'bus has considerably improved, it cannot be compared with the tramcar, and, by the very nature of its construction, never can approach it for reliability.

In thick fog, motor 'bus services have to be entirely suspended, but the tramcar can proceed, as its position in the road is definite and known to all, and its location is evidenced by its gong. In snow it can travel long after the 'bus is held up. The braking efficiency of the tramcar is the highest of all vehicles and, moreover, can be applied by the conductor in case of failure by the driver. The sudden application of brakes on the other motor vehicles renders them liable to skid laterally, which cannot occur with a tramcar.

Mobility and Loading Facilities.

The motor 'bus has considerably more flexibility than the tramcar. It can move around other vehicles, or even change its route in the event of an obstruction. In practice, however, the value of this undoubted advantage does not often arise. A very great feature of the motor 'bus is its ability to draw up to the kerb to discharge and load its passengers, which cannot be done by the tramcar except at prepared refuges. A tramcar, however, by reason of its larger platform, can load and unload much quicker than a 'bus.

Whilst the cost per seat in each vehicle is nearly the same, only about half the seats of the motor 'bus are covered; consequently, having also smaller seating capacity per vehicle, three to four times as many 'buses, with garage accommodation, etc., would be necessary satisfactorily to perform the same duty as the tramcar.

Seeing that at least three times as many motor 'buses as tramcars are required to carry the same number of passengers under cover it must be admitted, the report continues, that 'buses on the streets three times as many as tramcars would cause more congestion in the central area, even though the tramcars are somewhat longer. It has been contended that the fixed direction of a tramcar adds to congestion owing to its inability to divert its route around another vehicle. This is debatable, and experienced opinion is agreed that the certainty of the position of a tramcar enables all other vehicles to pass and be passed with such confidence that it more than compensates for other limitations.

Broadly speaking, the operating cost per vehicle-mile is the same for 'buses and tramcars—staff, power, and maintenance being about the same per vehicle; but the tramcar performs double the duty, and thus not only operates at half the cost of the 'bus, but entails fewer units to perform the same work.

Trackless Trolley 'Buses.

With regard to the trackless trolley 'bus, the report states that this vehicle may be considered to occupy a stage between the independent motor 'bus and the tramcar, and has some of the merits and defects of each. It has not the full degree of flexibility of the motor 'bus, as it cannot vary its route, but it can deviate around an obstruction, and one vehicle out of order does not interfere with the rest of the service. Given sufficient traffic it operates more cheaply than the independent motor 'bus, is probably more reliable, but is not so economical as a tramcar when the density of traffic justifies the latter.

'Buses Supplementary to Trams.

As supplementary to tramways, 'buses have been used in a few instances, and now operate as such in London, although really as competitors. No doubt when a tramway route is "saturated," they would assist in transporting the excess passengers, provided they did not cause such added congestion along the route as further to restrict the progress of the tramcars, and so reduce their speed efficiency. Economically, in such an instance, they could not be operated at the same fares as the tramway.

To deal with the volume of Manchester traffic at the time of "peak" load requires 537 bogie cars in service, with a seating accommodation of 42 900; allowing a reserve of, say, 10 per cent., it requires 590 cars, with a total seating accommodation of 47 000. To provide the same seating accommodation would require 870 'buses, but, as more than half the seats would be uncovered (there being at the present time no satisfactory covered-top 'buses), it would require at least 50 per cent. more, or a total of 1 300 'buses, to give even reasonable satisfaction to the public, and still leave 25 per cent. of the passengers to travel in the open.

It is also pointed out that the advocates of abolition of tramcars are apt to view the thoroughfares void of tramcars, but do not visualise their necessary substitutes, i.e., three times as many 'buses as tramcars.

Summary.

To summarise the various aspects of the comparative utility of the three forms of public coveyance now available for adoption—and without reference to any particular locality where the conditions may considerably modify any first principles—it may be taken, the report concludes, that:—

(*a*) The motor 'bus is the best and most economic vehicle for any service not requiring a greater frequency than four vehicles per hour, operating on the basis of fares of three-quarters of a mile for 1d. Above such service it may be fairly assumed that the hours of operation and the average number of passengers per 'bus mile will increase, and a demand for a lower fare will arise, in which case

(*b*) The trackless trolley 'bus is the most economical for services from four to six vehicles per hour, carrying 17 passengers per mile at a fare of 1d. per mile, and operating 16 hours per day, conditionally on the period during which it is likely to operate justifying its introduction.

(*c*) The tramcar is undoubtedly the most generally satisfactory vehicle for services of six or more cars per hour, and when it can operate for 18 hours per day, carrying an average load of 25 passengers per mile and at fares based on 1 mile for 1d., the statutory fare on tramways.

(*d*) In the event of "saturation" of a tramway route, and the impossibility of providing a relief route, the motor 'bus may assist up to a point where it does not, by increasing the other vehicular traffic, act to the detriment of the progress of the tramcar.

(*e*) The exclusion of the tramcar from a central area is not practical nor economical until such area is large enough to justify a separate journey by another vehicle.

New Zealand Posts and Telegraphs.

£570 000 Profit in 1922.

In his report on the New Zealand Post and Telegraph Department for the year 1922–23, Mr. J. G. COATES, the Postmaster-General, states that the receipts amounted to £2 687 768 and the expenditure to £2 114 994, leaving a surplus of £572 774.

On March 31st last there were 2 307 telegraph offices in the Dominion. Three offices were converted from telephone to Morse and four from Morse to telephone. New test-boards were installed in eleven telegraph offices and forty-one offices were rewired. The conversion of existing Morse telegraph circuits to machine printing circuits has been extended during the year by the installation of the Murray multiplex machine-printing system between Wellington and Auckland.

In consequence of the carrying capacity of the telegraph lines having been substantially increased by the adoption of the machine-printing system, a number of lines previously required for telegraph traffic have been released and are now being utilised for long-distance telephone (toll) services. At one time during the year no fewer than four of the seven submarine cables across Cook Strait were out of action simultaneously, but with the use of the multiplex circuit between Wellington and Christchurch the telegraphic traffic was disposed of without suffering serious delay.

Telegraph Developments.

The machine-printing system will shortly be extended from Christchurch to Dunedin. Apparatus is also under order for linking up Napier with Auckland and Wellington respectively. These extensions, when completed, will release lines for telephone purposes between Wellington and Napier, Napier and Auckland, and Christchurch and the southern towns. Investigations are also being made regarding machine-printing telegraph systems intended for use on the less important circuits, with a view to forming a network that will provide more efficient methods of handling Press traffic than is possible with the Morse system.

A new submarine telephone cable has been laid between Auckland and Devonport, thus reducing the trunk line distance from eleven to three and a half miles, and considerably improving speech. During the year five of the Cook Strait cables were interrupted, four being out of action simultaneously. The repairs to these cables involved the recovery of fifteen miles and the relaying of approximately twenty miles of cable.

The number of forwarded and radio messages shows a decrease of 1·74 per cent. and 1·84 per cent. respectively. The amounts earned by New Zealand show a decrease under both headings of 8·44 and 12·38 per cent. respectively. The number of words of forwarded radio Press telegrams increased from 90 718 to 107 293. The erection of a self-supporting galvanised steel tower, 165 ft. in height, at Radio-Wellington, to replace the two wooden masts erected in 1912, is now in hand and will be completed shortly.

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Death of Mrs. Hertha Ayrton.

A Distinguished Woman Scientist.

We regret to record the death last Sunday at New Cottage, North Lancing, Sussex, of Mrs. HERTHA AYRTON, the widow of Prof. W. E. Ayrton, and the first woman member of the Institute of Electrical Engineers.

Born at Portsea, the daughter of Mr. Levi Marks, she received her early education in London, leaving school at the age of sixteen to take up teaching work. After spending some years in this pursuit, she entered Girton College, where she took honours in mathematics. While at Girton Mrs. Ayrton invented a sphygmograph for recording the beats of the pulse, which, however, she abandoned on finding that a similar instrument had already been devised. Upon her return to London she took out a patent for her line-divider, an instrument for immediately dividing up a line into any given number of equal parts.

(*Photo by Russell.*

MRS. HERTHA AYRTON.

It was not until 1884 that Mrs. Ayrton turned her attenton to electricity, and in the autumn of that year she entered Finsbury College as a special student. There she met Prof. Ayrton, then Professor of Electrical Engineering, to whom she was married the following year.

First Experimental Work.

For several years ill-health prevented her from doing much practical work, but in 1893, during her husband's absence in America, she assisted in the completion of a series of experiments on the electric arc. The paper based on these and other experiments which Prof. Ayrton read at the Electrical Congress in Chicago was unfortunately destroyed by fire, but Mrs. Ayrton's interest in the subject was so great that she determined to give an abstract of the points noted in the paper and to continue the investigation herself. This was done, and the results obtained were embodied in a series of articles which were published in THE ELECTRICIAN during 1895 and 1896. These, with further researches on the arc, arranged in book form, were published in THE ELECTRICIAN series early in 1902. The book contains amplified accounts of the papers on the arc read by Mrs. Ayrton at the meetings of the British Association in 1895, 1897 and 1898, on "The Hissing of the Electric Arc," read by her before the Institution of Electrical Engineers in March, 1899, on "The Light Emitted by the Continuous Current Arc," read before the International Congress of Electricity in Paris in August, 1900; and on "The Mechanism of the Electric Arc," read before the Royal Society in June, 1901.

"Hissing of the Electric Arc."

The paper on "The Hissing of the Electric Arc," besides procuring for Mrs. Ayrton the honour of being elected a member of the Institution of Electrical Engineers, was further rewarded by an extra premium of £10; while the paper on the light of the arc shared with one submitted by M. Blondel, the honour of a special vote of thanks from the Secretary of the International Congress before which it was read.

During 1902 a certificate was sent in in favour of Mrs. Ayrton as a candidate for the fellowship of the Royal Society, but it was decided that the Society held no power to elect a woman.

Mrs. Ayrton was the first woman to receive the Hughes medal—in 1906—for her own unaided researches on the electric arc and on the nature of sand ripples. She is probably best known to the general public as the inventor of the Ayrton Fan, a wood and canvas device widely used in the war for clearing trenches and dug-outs of poison gas.

The body was cremated at Golders Green on Thursday.

Wireless Demonstration Vans.

An Ingenious Travelling Station.

There are several points of interest in the fitting up of the wireless demonstration van of L. MCMICHAEL, LTD., an illustration of which was reproduced in our previous issue. The van itself is a one ton Ford with electric lighting and starting, which is a useful wireless adjunct.

The aerial has been ingeniously combined with the luggage carrier on the roof and acts as a fitting of utility to the car as well as an essential part of the wireless equipment. It is actually a two wire open aerial, the lead in being taken through the roof via a weather proof insulated lead-in tube to the lightning arrester earthing switch.

Earthing is via the car chassis, which is also the negative of the l.t. battery. Actually the aerial-earth system is a large condenser, the dielectric being the space between the plates or roof aerial and frame (chassis) earth. Auxiliary earthing has been provided for by means of a plug and earth pin having a length of flexible wire, enabling the earth pin to be pushed into the banks of a ditch or similar suitable earth. The plug fits a socket mounted on the chassis. In practice it has been found that no appreciable benefit is obtained by using this extra and actual earth under normal conditions.

Mounting of the Apparatus.

The l.t. supply for filament lighting comes from the car lighting and starting battery situated under the car. Actual connection is via a plug fitted inside the van. A shelf and cupboard to take the apparatus itself has been fitted to the partition immediately behind the driver's seat and on the shelf is mounted the wireless receiving apparatus, which consists of the M.H.B.R. broadcast receiver and amplifier, together with a new control panel and extra h.f. unit. The loud speaker is a separate unit, and is so arranged that either the high resistance or low resistance instrument and transformer can be used. It can be stood in the van, on the roof or on the roadside as circumstances dictate. The aerial-earth earthing switch is a standard McMichael production and is operated by pulling cords with red and black knobs.

In this car, as in nearly all automobiles, the negative l.t. supply lead is via the frame, and for this reason no negative l.t. lead is provided as its path is via earth or frame (chassis) and it is therefore redundant.

A cupboard underneath the apparatus houses the h.t. units, l.r. loud speaker, transformer, valves, h.f. plug in transformer and tuning units, etc., whilst the car is travelling. Specially boxed and padded, they are held securely against road damage.

N.A.S.E.'s Visit to Greenford.

Electrical Installation at Lyons' Works.

A large party of members of the NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS recently visited J. Lyons & Co.'s factory at Greenford, Middlesex. Although electricity is largely used for power and lighting in the works, the method of its application does not seem to call for special comment. The feature which rather surprised us was the smallness of the demand for current to operate the whole of the machinery and supply light in a group of buildings as large as a small town and housing the gigantic industry carried on by the firm.

Alternating current is taken from the Uxbridge and District Electric Supply Co. at 20 000 V, and the present load is about 515 kW, but the factory has only been open about two years, and a visitor who, like ourselves has spent over two hours traversing the various departments, might well be dismayed by the prospect of repeating the tour when the demand reaches the anticipated figure of 2 500 kW. The current taken from the Uxbridge Company is reduced by static transformers to 415 V for power and 220 V for lighting. Pirelli cables bring the current in to the high tension switchboard, made and equipped by the General Electric Co., and distribution is controlled from a switchboard constructed by Lyons & Co.'s own staff. In the various departments there are G.E.C., Electric Construction, Metropolitan-Vickers and Brittain's motors, varying from very small sizes up to 75 H.P. and driving a Waygood-Otis lift, a transporter and machines for cocoa grinding, chocolate mixing, rolling, cutting, moulding and packing, tea mixing and packing, cardboard-box making, and many other operations. Amongst other equipment is Ellison's switchgear, Isler's air compressors, and air conditioning and drying equipment supplied by the Carrier Engineering Co. The electric driving of the larger machines is done by means of belting from counter-shafts, the individual drive being used in the case of some of the smaller machines. At the outlet of each of the large hoppers in which tea is mixed by means of revolving arms there are five large magnets which retain any nails or metal fragments that may have found their way into the tea during packing or unpacking, and the catches effected by these magnets are surprisingly large. In the chocolate, marzipan and other confectionery rooms, the boiling pans are heated by gas, but electricity is now being adopted for supplying heat for operations on the work tables.

ELECTRIC COOKING APPARATUS and electric fans are to be included in the furnishing of new air liners for Imperial service.

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Imperial Notes.

AUSTRALASIA.

Electricity Supply in South Australia.

The proposal of PORT AUGUSTA (South Australia) COUNCIL to borrow £3 000 for electricity supply works has received the consent of the Minister of Agriculture.

The Nymboida Scheme Approved.

The proposal to expend £100 000 upon the NYMBOIDA hydro-electric scheme to supply light and power to Grafton and South Grafton (N.S.W.) has been approved by the Governor-in-Council.

A Surplus on N.S.W. Tramways.

According to the annual report of the New South Wales Railway Commissioners, electric tramways showed a surplus of £5 534, the revenue being £3 598 714, with working expenses of £3 092 306, the interest charges amounting to £500 274.

Bulk Supply for Boulder (W. Australia).

BOULDER COUNCIL will in future take part of its requirements of electricity from the Kalgoorlie Electric Power Corporation, and generate the remainder by means of suction gas-driven plant. The Council has decided to sell its existing steam-driven plant.

Toowong Electricity Supply.

TOOWONG (Queensland) COUNCIL has obtained an Order-in-Council authorising the borrowing of £30 000 for electricity supply in Toowong. The town is at present supplied to a great extent by the Tramway Trust, which has refused to sell its Toowong supply to the Council.

A Municipal Hydro-Electric Project.

MULLUMBIMBI (N.S.W.) COUNCIL contemplates the construction of hydro-electric works. Mr. Corin (engineer to the Public Works Department) thinks sufficient water can be obtained from Wilson's Creek, and he recommends that the dairying district surrounding the town should be provided for in the scheme. In New Zealand 12 000 dairies are run by electricity.

Electrical Developments in New Zealand.

A three-phase system of electricity supply has been substituted for the plant previously in use at PUKEKOHE (New Zealand). The new plant includes a 100 kVA alternator direct coupled to a 120 H.P. suction gas engine and a 45 kVA alternator belt driven from a 56 H.P. suction gas engine. An 80 kVA unit is to be added shortly. The expenditure on the scheme will amount to £40 000.

Modified Preference for British Goods.

SYDNEY (N.S.W.) Council has decided that in future a preference of at least 15 per cent. shall be given to British goods purchased by the Council compared with goods produced in other countries. A few weeks ago it was decided that no imported goods other than British should be bought for the electricity department, but it was found that in some cases the lowest British tenders exceeded the lowest tenders received by over 200 per cent.

American Electrical Branch Works in Canada.

Referring to the fact that American companies continue to erect branch works in WESTERN ONTARIO, H.M. Trade Commissioner at Toronto states in a report that two of the most recent additions are the United States Light and Heat Co. and the Dominion Insulator and Manufacturing Co. The latter firm is one of two insulator manufacturers in Ontario which specialise in high voltage work. Clay is imported from the parent company prepared ready for use in the Canadian works.

INDIA.

Calcutta Electricity Supply Progress.

From a progress statement of the Calcutta Electric Supply Corporation just to hand, the company appears to have developed considerably during the last few years. In 1916, with 9 461 connections, the company sold 23 575 211 kWh, the gross revenue being £237 353, whereas by 1922 connections had increased to 12 882, the gross revenue being £519 201 on sales of 51 598 579 kWh. A further increase is shown in the figures for the three months ended March 31st last, during which period the sales of energy were 2 981 456 kWh in excess of the sales for the corresponding period last year.

Telephone Extensions in Calcutta.

The BENGAL TELEPHONE CORPORATION is issuing £300 000 in 7 per cent. (tax free) cumulative shares at par, one-third of which are ear-marked for the Oriental Telephone and Electric Co. of London—the principal shareholders in the Bengal Telephone Corporation. This new capital issued, states a Calcutta Correspondent of "The Times," will bring the telephone within easier reach of people with small means. Large changes have been effected since the war in this direction. The old magneto system, with its exchange in a rented building, has given place to the central battery system in a permanent building. Two fine buildings have been erected for new exchanges and afford the possibility of doubling the number of connections. The shares now issued are to finance these two exchanges, also a cable scheme for South Calcutta. The present outlay is intended to provide for the equipment of 12 225 exchange lines, with the possibility of accommodating 27 625 lines by the extension of the same exchanges.

Foreign Notes.

EUROPE.

Electrification of Rural Districts in Sweden.

The final report of the committee for the ELECTRIFICATION OF RURAL DISTRICTS in Sweden states that about 3 700 000 acres of Swedish land under tillage are now electrified; this represents nearly half the cultivated area. According to "Lloyd's List," the capital invested amounts in all to 200 000 000 kr., estimated according to the pre-war level of prices. The annual cost, following the electrification carried out up to the present, is reckoned at from 25 000 000 kr. to 30 000 000 kr.

The A.E.G.'s Reported American Agreement.

We understand from a correspondent that the ALLGEMEINE ELEKTRIZITATS GESELLSCHAFT has entered into a working agreement with the American General Electric Co., one of the objects of which is understood to be the mutual exchange of all patents and discoveries, and technical information of every kind. Joint action is to be taken with regard to the execution of foreign contracts. It is stated that many of the leading German concerns have been forced to curtail their experimental departments on account of the present high costs, and this is said to have been particularly the case in electrical engineering. The agreement now concluded specifically provides that the fine laboratories of the American company shall be at the disposal of the A.E.G. It is stated that it is intended to take full advantage of this arrangement, and that a staff of research workers from the A.E.G. will leave for New York shortly.

Electricity Supply in Norway.

According to a recent report the ELECTRICITY SUPPLY UNDERTAKINGS established in Norway total 293. Up to June 30th, 1921, 510 million kr. had been invested in them, and so far 60 million kr. have been written off for depreciation. The undertakings established in towns have been able to provide larger amounts for that purpose than the others, as they were built more cheaply at a time when building costs had not risen to the later extravagant level. The actual book value of these works amounted in 1921 to 450 million kr., and their combined generation of energy was estimated at 300 000 kW. The revenue for 1920-21 amounted to 53 million kr., and the expenditure to 49 million kr., excluding provision for interest, etc., on works not yet completed. Since 1921 very large additions have been made to many of the power stations, and the total capital invested in this industry on January 1st last is estimated at 1 000 million kr.

Netherlands Trade in Electrical Goods.

According to the American Consul-General at Rotterdam, all items in the DUTCH EXPORT LIST for the first quarter of 1923, with the exception of telegraph and telephone apparatus and electric wire and cables, showed an increase in volume. Most of the former customers in cables bought less, but sales were increased in South America. Sales of electric light bulbs were increased by almost a third, and while France, Great Britain, Belgium, Spain, and several other European countries increased their purchases, the chief progress was made in Argentina, Brazil, and other South American countries, in Canada, Australia, South Africa and other British colonies. Sales were also effected in the Philippine Islands. In the import list, all items, with the exception of lead insulated wire and cables and wireless installations, showed decreases. In the former there was an increase in imports from Great Britain, Germany and other countries, but a loss of trade on the part of Sweden. Germany continued to dominate the trade in all lines, including wireless installations, but a great falling off in the imports of generators, motors, dynamos and transformers resulted in the greatest loss to that country. Germany also lost over half its trade in telegraph and telephone supplies, some of it being taken by Belgium and Sweden, while other countries had a large share of the trade in wire and cables, at the expense of Germany. The total imports of electrical goods into the Netherlands during the first three months of 1923 were 6 101 metric tons, as compared with 6 790 tons during the first quarter of 1922; while exports of similar goods were 2 322 metric tons and 1 714 metric tons respectively.

ARGENTINA.

Market for British Electrical Goods.

According to a correspondent of the "Manchester Guardian," the consumption of electrical goods and accessories in the Argentine is large and offers considerable scope for greatly increased sales of British goods. In dynamos and electric motors Italy has been offering goods at keenly competitive prices, whilst Germany and the U.S.A. are also well in the field. In oscillating desk fans, the 12 in. and 14 in. sizes with standard black enamel finish are most acceptable. Insulators of porcelain, faience or earthenware are being largely supplied by Germany. The demand for arc lamps has practically ceased, as incandescent lamps are taking their place. The latter are sold on a very small margin of profit. The most popular lamp is made in Holland, but British manufacturers have also to compete with American makes. The bulk of the lamp sockets used are of the German keyless type, brass and porcelain, and the Edison key socket.

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Electrical Equipment of Ships.

The Installation of the New s.s. "Minnewaska."

On the Atlantic Transport Co.'s new s.s. "Minnewaska," which sails on its maiden voyage to-morrow (Saturday), the whole of the thirty-six winches are electrically operated and electricity is installed in almost every branch of the interior working of the ship. In the kitchen the baking of bread and much of the cooking is done in electric ovens, and the electrical service machinery in the galley includes a dough mixer, potato peelers, dish washers, and knife cleaners. All the principal engine-room auxiliaries are electrically driven, including the main circulating pumps, there is an electric lift to enable the engine-room staff to move from the engine-room to the boat deck, and the water-tight doors are of Harland and Wolff's electric power-operated type, and are capable of all being controlled simultaneously from the bridge. In addition to an elaborate loud-speaking telephone installation from the bridge to various parts of the ship for navigating purposes, there is an ordinary telephone system in connection with the engineers' and stewards' rooms.

Oil fuel is employed, and the electrical installation consists of four 400 kW turbo-generators; there is also an emergency dynamo of 75 kW driven by a Diesel engine.

Forty Years Ago.

"The Electrician," September 1st, 1883.

INSULATING WIRES.—Mr. E. T. Truman has recently patented a composition for insulating wires, which is made up as follows:—By mixing ozokerit with black lead, carefully dried, and gutta percha in the proportions of about ·3 of ozokerit to 10 parts black lead and 15 of gutta percha. The number of his patent is 5 757 for 1882.

* * *

ELECTRIC LIGHTING IN PRINTING WORKS.—We understand that Messrs. Fletcher & Son have decided to have their extensive printing establishment lighted by electricity on the Ferranti system. The work will be carried out by the Hammond Electric Light and Power Supply Company (Limited). We also understand that this company has obtained the order for the wiring of the Gilmour Institute, Alexandria, N.B.

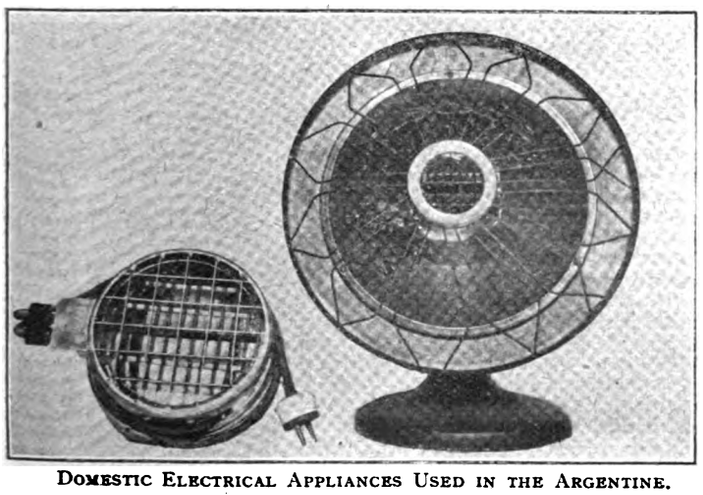
* * *

HOLBORN RESTAURANT.—The Edison Company have for several months lighted a considerable portion of this restaurant with about 800 lamps, and arrangements are now in progress for laying down plant for upwards of 1,000 additional 16-candle lamps. The plant employed will be similar to that used at Messrs. Gatti's, but of proportionately larger capacity. When lighted throughout, the Holborn Restaurant installation will be the largest of its kind hitherto made.

Electrical Goods for Foreign Markets.

Foreign Samples Exhibition in London.

Many manufacturers are regular visitors to the permanent exhibition of goods made and sold in various foreign countries established at the Foreign Samples Department of the Department of Overseas Trade at 7, Old Bailey, London, E.C., but there are many more who have not had the advantage of seeing at first hand the type of article in demand or in use in countries with which they are endeavouring to do business. To these the large and constantly



DOMESTIC ELECTRICAL APPLIANCES USED IN THE ARGENTINE.

increasing number of specimens should be of considerable assistance, particularly as the goods are in certain cases loaned to manufacturers who contemplate making goods of a similar type for export.

The pedestal heater shown on the right of the accompanying illustration is a representative sample of the apparatus made in the Argentine for sale in that country, while the boiling ring is typical of the goods made in the United States and sold in the Argentine. These and other electrical samples have recently been added to the exhibition.

The Floodlighting of Hoardings.

Direct Lighting from a Distance.

For the illumination of advertisement hoardings the method of having floodlights mounted on brackets projecting from the top of the hoarding is well known. This method is employed where the hoarding is of small or medium dimensions, and its location renders the use of bracket mounting necessary, but the scope of such an arrangement is naturally limited.

When large hoardings lying well back from the road or otherwise conveniently situated are to be lighted, it is possible to mount direct type floodlight projectors some distance in front. Very con-

HOARDING ILLUMINATED BY DIRECT TYPE FLOODLIGHT PROJECTORS.

siderable economy in current consumption is thus effected and an extremely even illumination can be obtained. An example of this method of floodlighting can be seen at the hoarding in Wellington Street, London, facing Waterloo Bridge, a photograph of which we reproduce herewith. The hoarding is 40 ft. square, and is illuminated by a battery of five G.E.C. floodlights, type I.E.2/93, three being equipped with 500 W "Osram" gasfilled lamps, and the remaining two with 300 W lamps. The current consumption therefore is approximately 1·3 W per sq. ft. The uniformity of the illumination is apparent from the illustration which is reproduced from an untouched night photograph, while the intensity leaves nothing to be desired. As further testimony to the efficiency of the installation and the skill of the photographer it may be mentioned that the background of the "John Bull" panel at the top is painted in yellow, a notoriously difficult colour to photograph.

The floodlight projector has a substantial copper housing, lined inside with high-grade mirror glass, and is said to be particularly suitable for floodlighting installations where a horizontal beam can be used.

"When Daylight Fades."

A New E.D.A. Folder.

Bearing the title "When Daylight Fades," a new 4-page folder with an attractive cover in colours issued by the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION advises its readers to "use electricity." "Light by electricity," it says, and adds: "keep the summer sun a-shining in your home on the chilly days and dismal nights of winter. Pure as sunlight, next in brightness, yet always at your command, electric lighting is the natural substitute for daylight, and is drawn from the same source, the sun. Electricity used for lighting gives you a complete service. There is nothing to prepare before or to clear up after. Just touch the switch, the light appears—strong and bright for the finest work, mild and soft for rest and beauty; always under control, safe and silent. On the threshold of winter, consider the illumination of your home. Electricity is easy to instal in cottage, villa or mansion. Lamps and fittings are at your service for every class of work." Finally, the reader is advised to "seek skilled advice at your local electric shop and secure the best light at the least cost."

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Electrical Measuring Apparatus.

A New Portable Instrument.

A new portable combination electrical measuring instrument—known as the "Avometer"—is designed to give direct and accurate readings covering the following wide ranges:—*Current*—1 mA to 12 A, in three ranges: 0–12 A, 0–1·2 A and 0–·12 A. *Pressure*—1 V to 600 V, in three ranges: 0–12 V, 0–120 V and 0–600 V (or up to 1 200 if required). *Resistance*—0 O to 5 000 O. The set comprises a moving coil wound on a thin aluminium holder to a resistance of 20 O. It is pivoted by means of polished steel

THE "AVOMETER."

points, working in jewels, and the coil moves within narrow gaps between the poles of a powerful permanent magnet. A knife-edge pointer is fitted to the movement and the whole is made as light as possible and perfectly balanced. Two non-magnetic hair springs are fitted for the purpose of conveying the current to the coil, and, torsionally, for the return of the pointer to zero.

Dial Calibration.

The dial is provided with an inset mirror to prevent parallax errors and is marked with two scales. The top scale is calibrated to read direct in ohms from 0 to 5 000, while the bottom scale is divided into 120 divisions, each approximately one mm. in length, for reading the various values in amperes and volts. The moving coil is permanently shunted by means of wire wound on flat non-conducting material. To minimise the heating effect, when heavy current is being measured, use is made of a very heavy gauge of wire on a portion of the shunt. Another portion of the shunt is wound on a semi-circular holder, and, by means of a sliding contact arm, connection is obtained at the desired point, thereby acting as a potentiometer in the ohmmeter circuit. The apparatus is contained in a polished oak case, provided with a leather carrying handle. The window over the scales is of ample dimensions, and is mounted in an aluminium frame.

The switches and lead terminals are mounted on an ebonite sheet, fitted on the lower portion of the face. All contacts are made inside the case, which is claimed to be completely dust proof. A flexible two-way cord, fitted with spring connection clips, is supplied with each instrument.

The switch governing the different scales and valves is clearly marked and is provided with a spring click operating at each stop; the rheostat and adjusting switches are also clearly marked. The rheostats are of special design, wound on well insulated metal holders, which allow for heat to be quickly dissipated over a large surface.

Avoiding Incorrect Readings.

The makers, the AUTOMATIC COIL WINDER AND ELECTRICAL EQUIPMENT CO., claim that the principle on which the various circuits of the "Avometer" are connected up, is such that there is no danger of obtaining incorrect readings due to faulty contact in the shunt circuit. The movement is practically "dead beat" and each scale is individually and carefully calibrated to agree with the readings of standard instruments.

Any one of the ranges comes into circuit simply by turning the switch (left-hand knob) to the relative position; no alteration of the testing leads being necessary. The set may be used for measuring the current passing through any piece of apparatus. If it is desired to regulate the amount of current, the rheostat (right-hand knob) may be moved to a position to allow for this.

To ensure that the readings are accurate over the whole length of the ohmmeter scale, means are provided for compensating for any variation in the voltage or internal resistance of the battery, fitted inside the instrument and connected in the ohmmeter circuit. A quick and easy method is available for checking and, if necessary, making an adjustment. The "Avometer" should be particularly useful for testing out circuits, locating faults, tracing and measuring stray currents, intermittent joints, etc., as in every case the resistance of the circuit or the amount or pressure of the current is directly read on the scale.

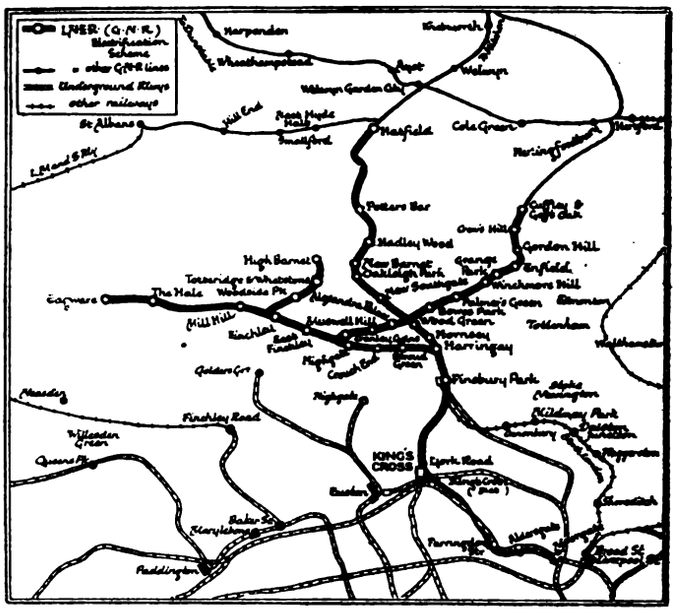
Suburban Railway Electrification.

Proposals of the L. and N. E. Railway.

In connection with its recent announcement of the intention of the directors of the London and North Eastern Railway to undertake the electrification of the suburban lines of the former Great Northern Railway, "Modern Transport" states that a report, setting forth the practical considerations involved, and recommending the system of electrification to be adopted, will be submitted for the approval of the full board of directors of the company in October. Such approval having been obtained, a clause, or clauses, empowering the company to carry out the work and to operate electric trains, will be embodied in the London and North Eastern Railway Bill for the coming Parliamentary session.

Extent of the Electrification.

From the accompanying map, reproduced by courtesy of our contemporary, it will be seen that the electrified lines will radiate from King's Cross to Edgware, High Barnet, Hatfield, and Cuffley—representing a total route mileage of approximately thirty-eight miles. Further extensions may be carried out later, though it is



MAP SHOWING THE EXTENT OF THE INITIAL ELECTRIFICATION OF THE SUBURBAN LINES OF THE GREAT NORTHERN SECTION, LONDON AND NORTH EASTERN RAILWAY.

understood that the company does not favour the running of electric trains to outlying suburbs, as is done by the London Midland and Scottish Railway in the case of Watford. It is interesting to note that the electrification of the line to Edgware will enable the L. and N.E.R. to compete for through traffic to the City with the London Underground Railways.

A further point of interest lies in the fact that the company already has in hand the enlargement of the King's Cross terminus. An old power station is being removed, the engine shed is being improved, and additional engine sidings laid down immediately to the north of the station, whilst additional platform accommodation is being provided for suburban traffic. The new line between Cuffley and Stevenage will shortly be opened, and will then form an alternative route to the main line between Wood Green and Stevenage. Though there is no intention at the moment to electrify this section beyond Cuffley, there is a possibility that at a later date the electrified lines will be extended as far as Hertford.

Longevity in Electrical Appliances.

Ten Year Old Hot Plate's First Repair.

In forwarding an electric hot plate to the JACKSON ELECTRIC STOVE CO. for repairs, a Liverpool contractor states that the hot plate has been taken from an electric cooker supplied ten years ago, and that the cooker has been in continual use for a family for the whole of that period, this being the first repair of any sort that has been required.

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Electricity Supply.

Extensions and Developments.

ILFORD Urban Council is deferring action on a proposed agreement to take a bulk supply of electricity from West Ham.

DUDLEY Board of Guardians has decided to instal electric lighting and power in the workhouse at an estimated cost of £1 255.

BURNLEY Electricity Committee is considering electricity schemes which will probably involve a capital expenditure of over £60 000.

RADCLIFFE (Lancs) Council proposes to substitute alternating current distribution for the direct current system in that portion of its area north of the Bury and Bolton railway.

ST. PANCRAS Borough Council has received sanction from the Commissioners to borrow £8 794 for services, meters and wiring, and £70 255 for a 5 500 kW turbine, boiler plant, etc.

GLASGOW Electricity Committee has agreed to receive a deputation of the ratepayers who are protesting against the proposal to erect a sub-station at the corner of Battlefield Road and Overdale Avenue.

The COLCHESTER borough surveyor has been instructed to submit to the Unemployment Grants Committee a preliminary statement of a scheme for the erection of a new power station at Hythe, estimated to cost £100 000, on the understanding that the furnishing of the proposals will not commit the Council to carry out the work.

CLITHEROE Town Clerk has reported the result of an interview with the Lancashire Electric Power Co. regarding the supply of electricity to Clitheroe. It was resolved that Mr. Hawtayne, electrical engineer, be instructed to advise the Council what to do regarding the supply of electricity in the borough and as to the preparation of a scheme for submission to the Electricity Commissioners.

It is stated that the delay in proceeding with the central converter station at HOVE, concerning which there was a local inquiry early in the year, is due to certain correspondence between the Electricity Commissioners and the Corporation in reference to important financial points which do not necessarily affect the question of the objection to the site. The local authorities regard the outstanding differences as capable of settlement at an early date.

It has been decided to approach the Corporation of Accrington with the object of putting speedily in hand the provision of electricity mains between the two boroughs which will enable either authority to supply the other in case of necessity. The Committee has also decided to recommend the Town Council to apply to the Unemployment Grants Committee for an extension of this authority's offer of a grant towards a scheme for the provision of mains in the Rosegrove District.

Alterations in Charges, etc.

STIRLING Town Council has reduced the charges for electricity as under from April 1st last: Private lighting, 6d. per kWh; power, 4d. to 1½d.; heating, first 160 kWh per quarter, 2d., and 1½d. beyond.

The question of extending the two-part system of charging for electricity for domestic purposes to houses other than those occupied by tenants of Corporation houses has been considered by the Propaganda Committee of the Electricity Committee of GLASGOW Corporation. It was agreed to recommend that the system should be extended to the larger houses on the basis of a fixed charge per annum on the rental of the consumer's premises, plus a running charge of ½d. per kWh for current consumed.

MAIDENHEAD Town Council has made the following reductions in the charges for electricity:—Within the borough: Ordinary lighting, 9d. to 8d. per kWh; basement lighting, 7d. to 5d.; higher rate of the maximum demand tariff, 1s. 1d. to 1s.; higher rate of the two-rate tariff, 9d. to 8d.; pre-payment tariff, 10d. to 8d.; ordinary power, 3d. to 2½d.; ordinary power contracts, reduction of ½d. per kWh. Ex-borough districts: Ordinary lighting, 9½d. to 8d.; ordinary power, ½d. per kWh above the rates within the borough.

Tapping New Areas.

MACDUFF Town Council is considering a scheme for taking a supply of electrical energy from Aberdeen.

BANCHORY Town Council is considering an electricity scheme for the town at a cost of from £9 000 to £11 000.

SOUTH MIMMS District Council has applied to the North Metropolitan Electric Supply Co. for terms for a supply to the district and to Potters Bar.

THORNE Parish Council has decided to communicate with Pease and Partners, of Thorn Colliery, with reference to a supply of electricity for the parish.

PREESALL Council is making application to the Fleetwood District Council to ascertain if they would supply the district with electricity in bulk, and if so upon what terms.

With a view to securing a supply of electricity for the district, the BETHESDA Council has appointed a committee to conduct a local canvass to ascertain the nature and volume of the demand.

Inquiries and Orders.

OLDHAM Town Council is to take over the Special Orders made to the Crompton, Royton, and Lees urban councils.

CUCKFIELD Rural District Council has decided to withdraw its opposition to the Burgess Hill and District Electricity Special Order.

Application is being made to the Electricity Commissioners for an Order authorising BLACKPOOL Corporation to supply electricity in the Marton Council's area at a price 15 per cent. above the rates charged in Blackpool.

The Minister of Transport proposes to confirm the BILLINGHAM Electricity Special Order. Objections to the Secretary, Ministry of Transport, by September 17th.

The Minister of Transport proposes to confirm the WICKFORD AND DISTRICT AND THE MALMESBURY Electricity Special Orders. Objections to the Secretary, Ministry of Transport, Whitehall, London, by September 10th.

BLEAN Rural Council has decided to object to the application of the Whitstable Electric Co. for an Order fixing the maximum prices to consumers, which includes minimum charges for the summer and winter quarters, on the ground that such charges are unfair to the consumers.

HAWARDEN Council has been granted a Special Order to supply electricity in the district. With regard to the application of the Corporation of Chester for permission to supply electricity to a number of premises situated in the rural district of Hawarden, the Commissioners came to the conclusion that, in the special circumstances of the case, the consent of the Hawarden Council must be regarded as unreasonably withheld, and the Commissioners had decided to grant the Chester Corporation the Order for which they had applied. The Order granted to the Chester Corporation remains in force until the Hawarden Council is able to provide the industrial premises concerned with electrical power on reasonable terms.

Miscellaneous Supply Items.

GRAVESEND Town Council has decided to join the Electrical Development Association.

A deluge of rain resulted in a temporary failure of the electricity supply at LYTHAM ST. ANNES last week.

RAWTENSTALL'S borough electrical engineer is arranging for an exhibition of domestic electrical appliances to be held from September 8th to 15th.

LIVERPOOL Corporation Electricity Department has received a large number of inquiries as to the cost of installing electricity for lighting, heating and other services, in response to a recent newspaper advertisement.

The SOUTHGATE (London) section of the new arterial road, which was informally opened a few weeks ago, is without light owing to the inability of the Council to guarantee a profitable return to the electricity supply company concerned.

The Salaries and Wages Committee of the Burnley Town Council has informed the Electricity Committee that the conditions of service as to sick pay and holidays for the technical staff of the Electricity Department should be those obtaining in the Corporation administrative service generally.

Personal Items.

Mr. THOMAS EDISON, according to a report from Michigan, has been taken ill on a camping trip, but his condition is not regarded as serious.

Mr. VAN HORN ELY, president of the American Electric Power Co., is spending several months in Europe studying traffic and other problems in various countries.

Mr. ERNEST WHITBY, of 33, Newhall Street, Birmingham, has been appointed sole selling agent in Birmingham and district for Switchgear and Cowans, Ltd., of Old Trafford, Manchester.

Mr. D. JENKINS has relinquished his position as manager of the Swansea district for the Metropolitan-Vickers Electrical Co. and has entered into partnership with P. J. Plevin and Partners, consulting engineers, 4, Working Street, Cardiff.

Mr. WILLIAM FREDERICK CHARLES H. WOODWORTH, electrical engineer, of Smethwick, was married on August 11th, at St. Augustine's Church, Holly Hall, to Miss Ida Annie Powell, only daughter of Mr. J. H. Powell, of High Street, Holly Hall.

Miss F. MAY ELLIOTT, only daughter of Mr. J. W. Elliott, lamp sales manager of the Edison Swan Electric Co., was married on August 24th, at St. Martin's-in-the-Fields, London, to Mr. Richard Michael Clark, M.C., second son of Mr. and Mrs. Clark, of Brentwood, Essex.

Mr. E. V. B. BRICE, British Consul at Santiago de Cuba, who is now on a visit to the United Kingdom, will be pleased to interview electrical firms interested in trade with Cuba, particularly Eastern Cuba, at the Department of Overseas Trade, from August 28th to September 8th, inclusive. Applications for appointments should be addressed to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, quoting the reference No. 8622/F.L.

Blackburn Electricity Committee has appointed Mr. B. A. M. COOPER, of London, to be mains superintendent in succession to the late Mr. T. WALLWORK. Originally there were 48 applicants for the post. Mr. Cooper served in the Blackburn electricity department from 1912 to 1918, leaving to take an appointment as mains constructional engineer with the Electric Power Co. In 1921 he went to Johnson and Phillips, Ltd., London, where he has acted as supervisor of main laying.

Mr. E. S. HASLAM has resigned from his position as deputy electrical engineer to the Penang Municipal Commission and Mr. THOMAS ROGERS, chief assistant engineer has been appointed to succeed him. Mr. Rogers left the Shanghai Municipal Council in May, 1922, to become chief assistant engineer at Penang. Mr. W. J. WILLIAMS, the chief engineer and manager, was chief assistant engineer in the Electricity Department, Shanghai, prior to taking up his present appointment in June, 1920.

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Tenders Invited.

GREAT BRITAIN.

WHITEHAVEN AND WEST CUMBERLAND INFIRMARY.—Electric lighting of Whitehaven Castle, now being converted into a hospital. Particulars from the secretary.

BETHNAL GREEN (LONDON) GUARDIANS, September 4th.—Telephone instruments for Administrative Offices. Specification may be seen at the Administrative Offices, Bishop's Road, Bethnal Green, E.2.

EAST HAM BOROUGH EDUCATION COMMITTEE, September 5th.—Electric light wiring of Hartley Avenue, Kensington Avenue, and Lathan Road schools. Tender forms from Mr. F. R. Thompson, Town Hall, East Ham.

SLEAFORD URBAN DISTRICT COUNCIL, September 5th.—Pair of feeder cables. Specifications from the Resident Electrical Engineer, Electricity Works, Sleaford.

INDIA STORE DEPARTMENT, September 7th.—Hard drawn copper wire, copper weld wire and g.i. wire. Forms from Branch No. 11, Belvedere Road, London, S.E.1.

EDINBURGH CORPORATION, September 10th.—168 tramway poles and scrolls, etc. Specification from the Tramways Manager, 2, St. James Square, Edinburgh.

HORNSEY CORPORATION, September 10th.—Low-tension switchgear for North Road, Highgate, sub-station. Forms of tender, etc., from the Borough Electrical Engineer, Tottenham Lane, Hornsey.

ISLINGTON (LONDON) GUARDIANS, September 11th.—Six months' electrical supplies and engineers' goods. Forms of tender from the Clerk, St. John's Road, Upper Holloway, N.19.

MANCHESTER CORPORATION, September 11th.—(*a*) Steel girder tramway rails; (*b*) steel tramway poles; (*c*) span wire brackets for tramway poles; (*d*) copper bonds for tramway rails. Specifications from the General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

CHESTERFIELD CORPORATION, September 12th.—Electrically-driven indirect-draught plant, with starting and regulating gear dampers, etc., for the electricity works. Specification, etc., from the General Manager, 172, Chatsworth Road, Chesterfield.

STOKE-ON-TRENT CORPORATION, September 12th.—Two 200 000 gallon cooling towers with cooling ponds and accessories. Specification from the Borough Electrical Engineer.

WESTMINSTER GUARDIANS, September 12th.—Electric lamps and fittings and engineers' sundries. Forms of tender from the Clerk, Princes Row, Buckingham Palace Road, S.W.1.

GREENWICH (LONDON) BOARD OF GUARDIANS, September 13th.—Tubing for electric light wires, at Woolwich Road Institution. Tender forms from Mr. Alfred Roberts, surveyor, 92, London Street, Greenwich.

ABERDEEN CORPORATION, September 17th.—Forty tons per hour coal-handling plant for the Electricity Department. Specification from the Engineer and Manager.

INDIA STORE DEPARTMENT, September 21st.—Cable (lead-sheathed, etc.) and lubricating oil. Forms of tender from Branch No. 14, Belvedere Road, Lambeth, S.E.1.

IRELAND.

DUBLIN CORPORATION, September 12th.—Repairs to furnace tube of Lancashire boiler at Fleet Street electricity works. Forms of tender, etc., from the City Electrical Engineer.

GOVERNMENT OF NORTHERN IRELAND.—September 12th.—One year's supply of wireless telegraph stores and materials to the Police. Forms of tender, etc., from the Secretary, Ministry of Home Affairs (Maintenance Branch), 5, Corn Market, Belfast.

Later Shop-Window Lighting.

B.E.D.A.'s New Campaign.

The results of the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION'S campaign for the later lighting of shop windows was so successful last year that it is to be extended during the coming autumn and winter with, we expect, still more favourable results. A series of advertisements has been prepared, and these will appear during September, October and November in about a score of selected trade journals covering a range from catering to toys, and including cabinet making, clothes and sports. A pamphlet pointing out why dark windows do no business, and urging supply undertakings and contractors to consider the possibility of extending the later lighting of shop and store windows in their districts, has also been prepared, and the facts given therein should be carefully studied by all concerned. For there can be no doubt that the small expenditure necessary to keep the window alight and active until the small hours will be amply repaid by the increased business obtained.

Obituary.

Mr. Gordon Bryant.

We regret to record the death early on Thursday, the 23rd inst., at Acle, of Mr. GORDON BRYANT, borough electrical and tramways engineer of Great Yarmouth. Mr. Bryant went to Yarmouth a little over 28 years ago as assistant engineer, and succeeded Mr. Ranken as chief engineer in 1898. He was in his 50th year, and is survived by a widow and four children.

Tenders Accepted.

UPTON BOARD OF GUARDIANS has accepted the tender of Hall Bros. for electric light wiring and fitting at £147.

The tender of the Cavan Electric Co. has been accepted for re-wiring at the CAVAN COUNTY HOME HOSPITAL, at £175 10s.

For electric wiring, etc., at Myopes school the tender of Smith and Croft, £113 7s., has been accepted by BRADFORD CORPORATION.

THORNABY-ON-TEES CORPORATION has accepted the tender of Pickersgill and Sons for electric light wiring at the Town Hall, at £89 10s.

CHESTER BOARD OF GUARDIANS has accepted the tender of L. Walworth for re-wiring and tubing at the Institution, Hoole Lane, at £224.

MARYLEBONE (LONDON) ELECTRIC SUPPLY COMMITTEE recommends that, subject to the approval of the Oerlikon Co. and the General Electric Co., as regards their respective 8 000 kW turbo-alternator sets, the tender of Heenan and Froude for closed circuit air coolers for the two sets at £2 520 be accepted.

The English Electric Company has secured a contract for the electrification of the Campos de Jordão railway, owned by the GOVERNMENT OF SAO PAULO, Brazil. "The Times" Trade Supplement states that the work will include the electrification of an existing metre-gauge railway, the supply and erection of some 15 miles of 30 000 V, 50 cycle three-phase transmission line and about 30 miles of overhead catenary construction for 1 500 V, on the d.c. system, the construction and equipment of a sub-station, and the building of motor coaches. The 30 000 V current will be transformed down to 2 000 V, and converted to d.c. 1 500 V by a 500 kW synchronous motor generator. The electrical equipment of each motor coach will comprise four motors, each wound for 750 V. The motor coaches are to be equipped with hand, air, rheostatic, and electro-magnetic track brakes.

Telegraph and Telephone Notes.

DENMARK now has one telephone for every twelve inhabitants.

According to the Soviet Press, 185 000 gold roubles have been allotted for the reconstruction of RUSSO-PERSIAN TELEGRAPHIC COMMUNICATION.

The accompanying illustration, taken outside the offices in Queen Victoria Street of the Controller of the LONDON TELEPHONE SERVICE, forms an interesting example of legitimate and useful publicity on behalf of a State institution. Placed in a prominent position at the entrance to the building this notice is easily read by passers-by on the other side of the road. The figures are fitted in a groove in the card, thus allowing any increase in the number of telephones in use to be recorded without delay. Incidentally, the Postmaster-General wishes to correct the widespread impression which exists that an initial charge is made for installing a telephone. During the war a uniform surcharge of £4 on new installations was made; but this charge was abolished more than two years ago. The present rental includes the cost of installing the telephone, and no other preliminary charge is made on that account.

An agreement has been signed by the directors of the Italian Cable Co. and the Western Union Telegraph Co. finally settling the conditions for the laying and management of a DIRECT TRANSATLANTIC CABLE between Italy and the United States.

Australian cable users are protesting against the high terminal charges, which are stated to be 5d. a word, compared with 1d. in New Zealand and 1½d. in the United Kingdom.

Two representatives of the U.S. Government are in London negotiating with an English firm for the laying of A NEW CABLE between Seattle and Alaska. The length of the cable required is nearly 2 000 miles.

Reuter's Agency is informed that the Commercial Cable Co. laid the American end of THE WORLD'S GREATEST CABLE last Saturday at Far Rockaway, Long Island, and will lay the British end to-day (Friday) at Weston-super-Mare. Three British cable ships, the "John W. Mackay," the "Colonia," and the "Faraday," are engaged in this work. The cable, which is expected to be in actual operation by September 15th, is the largest ever manufactured for deep-sea operations, more than 4 000 000 lb. of copper, 1 800 000 lb. of gutta-percha, and some 80 000 miles of iron and steel wire of various sizes being used.

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Electric Traction.

Tramway Extensions and Developments.

Residents in the Poppleton Road district of YORK are continuing their agitation for the extension of the tramway service to that area.

To facilitate working during rush hours an additional terminus at St. Peter's Square has been added to the MANCHESTER tramway system.

Since the acquisition of the Paisley tramway undertaking and the Glasgow Underground Circular Railway the GLASGOW tramway system has a mileage of nearly 130 miles, practically all of which is double track.

The LONDON County Council is applying for an extension of time for the construction of the following lines of tramways :—Junction line between Clerkenwell and Farringdon Roads ; junction line between Dulwich and Norwood Roads ; junction line between Mare and Well Streets, Hackney ; and tramways in Eltham Road and High Street, Eltham.

Fares, Receipts and Passengers.

During the week ended August 18th traffic receipts on LONDON tramways controlled by the "Underground" group totalled £41 357, a decrease of £6 586 compared with the corresponding week last year.

DUNDEE Tramways Committee has adopted a season ticket scheme with the following rates :—1d. stages, 11s. per calendar month, or 30s. per quarter ; 1½d. stages, 14s. or 42s. ; 2d. stages, 17s. or 51s. ; 2½d. stages, 20s. or 60s. ; 3d. stages, 23s. or 69s. ; 4d. stages, 90s. 3d. per qnarter.

Official returns of 34 of the principal tramway undertakings in the United Kingdom, as published by "The Tramway and Railway World" for the week ended August 11th, give total receipts of £361 184, or £13 407 more than in the corresponding week of last year. The total length of track included in the returns was 1 948 miles. Receipts this year were at the rate of £185 8s. 2d. per mile of single track, and last year at the rate of £178 10s. 7d., thus showing an increase for the week of £6 17s. 7d. per mile open.

Electric Railway Items.

Traffic receipts on the MERSEY Railway during the week ended August 18th were £4 293, bringing the total receipts for the year to date to £149 238.

The electrified portion of the MIDI RAILWAY, between Pau and Tarbes was inspected by engineers recently, when, it is reported, an electric train made a trial run at a speed of 68 miles an hour.

The Admiralty Magnetic Observatory is to be removed from GREENWICH as it is feared that the proposed electrification of the Southern Railway's lines near the Observatory will tend to interfere with delicate observations.

MILAN Town Council, states the Genoa correspondent of the "Financial Times," has accepted the offer of a Franco-Spanish group already holding a concession for the Genoa Tube Railway for the construction of underground railway works. The first trunk is expected to cost 150 000 000 lire, and will be begun before November and completed within three years. Initial traffic is estimated at 20 000 000 passengers.

Miscellaneous Traction News.

Mr. A. J. Roberts, who inaugurated the BURTON-ON-TRENT tramway service in 1903, has died, aged 69.

GLASGOW Tramways Committee proposes to grant an honorarium of 100 guineas to Mr. T. C. F. Brotchie for preparing the new tramway guide.

It is reported that the Compañia de Ferrocarriles Vascongados, of BILBAO, has requested authorisation to electrify its lines and has commenced negotiations with certain firms in order to obtain estimates. The system measures 158 kilometres.

BERLIN Town Council is said to have decided to close the Berlin tram service temporarily in order to make an attempt to place it on a more satisfactory basis. The losses have lately amounted to 60 000 000 000 marks daily, which the town has been paying in the form of subsidies.

As a result of the official return on the fall in the cost of living, which governs the wages agreement made in September last, there will be a reduction this month in the WAGES OF TRAMWAY EMPLOYEES. Men's wages will be reduced by 1s. a week, youths' by 6d., and trolley boys' by 3d.

Engineering and Machinery Exhibition.

Further Exhibits of Interest to Electrical Industry.

In addition to the list of exhibitors at the Shipping, Engineering and Machinery Exhibition, given in our issue of August 17th, the following firms have also taken space : W. and T. Avery, Ltd. ; Babcock and Wilcox, Ltd. ; Burlectas, Ltd. ; Diamond Blower Co. ; Graphite Products, Ltd. ; E. Green and Son ; Hobdell, Way and Co. ; Hollings and Guest, Ltd. ; James Howden and Co. ; the Lanston Monotype Co. ; Ruston and Hornsby, Ltd. ; Rawlplug Co. ; Serck Radiators, Ltd. ; Stothert and Pitt, Ltd. ; Variable Speed Gear, Ltd. ; Wailes Dove Bitumastic, Ltd. ; Walker Crosweller and Co. ; W. R. Patents, Ltd. ; and the Yorkshire Copper Works, Ltd.

The Exhibition opens to-day (Friday), and will remain open until September 22nd. The official visit of the Cable Makers' Association takes place on September 13th, and that of the Institution of Electrical Engineers on September 21st.

Wireless News.

Broadcasting Committee's Proposals.

Although the report of Sir Frederick Sykes's committee on broadcasting has been in the hands of the Postmaster-General for several days, the recommendations have not, at the time of going to press, been made public. From a number of "intelligent anticipations" published this week it is gathered that the Committee recommends the abolition of the British Broadcasting Co.'s royalty system and the substitution of a single licence with a fee of 10s. per annum, of which 7s. 6d. would go to the Broadcasting Co. This would do away with the condition that holders of licences must buy sets made by firms in the B.B.C., and bearing their stamp.

In regard to the question of imported sets and parts, the Committee, it is understood, offers no specific recommendations, holding that it is a question of policy to be decided only by Parliament. As the Committee is only an advisory one the Postmaster-General is not bound to accept its recommendations, and whether he accepts or rejects all or any of them is not likely to be known until the reassembly of Parliament.

Wireless for Ships' Lifeboats.

A new type of wireless installation for ships' lifeboats will be exhibited at the Shipping Exhibition, which opens at Olympia to-day (Friday), by the Marconi International Marine Communication Co. This set is so compact as to be capable of being placed between the after-thwarts of a lifeboat. The receiver embodies the principle of a direction finder, so that should sailors who have been forced to take to the lifeboats be successful in establishing wireless communication with a rescuing ship, even though the latter be not equipped with direction-finding apparatus, the lifeboat may inform the rescuer of her bearings, and guide her towards the boats. The aerial consists of a single wire supported by light spars, which can be shipped in sockets attached to the stern and stern posts, and erected after the boat has been launched. The range of communication on a wave length of 600 metres is no less than 50 miles. To the top of the wireless compartment a powerful electric light is fitted. This serves the double purpose of enabling other lifeboats to keep in touch at night with the boat carrying the wireless installation, and attracting rescuing ships towards the boats during the hours of darkness.

Military Wireless Operations.

In the army manœuvres during the last week or so the new military wireless sets have been thoroughly tested, and the "C" set, with a range of from 20 to 60 miles, has been successful for communication between divisional and brigade headquarters. The light "A" set, which can be carried in mule panniers, has linked up brigade headquarters to battalions, and wireless telephony between "contact" aeroplanes and various land formations has been utilised. Telephonic communication between tanks on the move has been shown to be possible if the tanks are not more than five or six miles apart.

Austrian Wireless Services.

The Austrian Government announces that both wireless telephony and wireless telegraphy are to be retained as State monopolies. The right to develop wireless services between Austria and other countries has been leased to the Marconi Co. According to the Vienna correspondent of "The Times," negotiations are pending with regard to an inland service, particularly as to broadcasting and ordinary wireless telephony, which has so far remained entirely neglected in Austria. The concession in this case, the Government states, will only be granted to an Austrian firm or an amalgamation of such firms under the condition that exclusively Austrian machinery and appliances are installed. A number of applications for concessions have been received, and a decision in the matter will be arrived at early in October. The concessionaires will be entitled to fix their own tolls and rentals, in which the Government will participate on a percentage basis. Large revenues are anticipated by the Government from this source, as tolls are to be levied in gold crowns.

Irish Broadcasting Negotiations.

The Postmaster-General has had several conferences with the Irish firms interested in broadcasting, and has placed before them an outline of the scheme which he would be disposed to sanction. The firms in question have, however, failed to agree among themselves, and the Postmaster-General is therefore reconsidering the situation. In the meantime applications from any genuine manufacturing firms, who have not hitherto applied, will be received.

Wireless News in Brief.

MARCONI'S WIRELESS TELEGRAPH Co. has presented a two-valve wireless receiving set to the Royal Berkshire Hospital, Reading.

Having seen the plans of the proposed AVEBURY WIRELESS STATION, the Wilts Archæological Society intimates that it does not see sufficient grounds at present for offering opposition to the scheme.

A WIRELESS RECEIVING SET has been installed at the Shoreditch Public Library. The corporation claims to be the first municipal authority to introduce wireless in libraries for educational and scientific purposes.

Arrangements are well advanced for the SCOTTISH NATIONAL RADIO EXHIBITION, organised by the Radio and General Publicity Co., which is to take place in St. Andrew's Hall, Glasgow, from September 3rd to 8th.

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Companies' Reports, Dividends, etc.

DAVIS AND TIMMINS.—The directors recommend an interim dividend on the ordinary shares at the rate of 6 per cent. per annum, free of tax.

PENNSYLVANIA WATER AND POWER CO.—The usual quarterly dividend of 1¾ per cent. has been declared, payable on October 1st to shareholders of record on September 14th.

Joint Stock Companies.

The following companies were struck off the Register of Joint-Stock Companies on August 17th :—Accumulator Trust, Appareil Magnetique Company, British Electrical Winders, North Staffordshire Electro-Therapeutic and Massage Co., Printing Telegraph Accessories, Veitch Institute of Electro-Therapeutics.

Supply and Lighting.

MELBOURNE ELECTRIC SUPPLY CO.—A half-yearly dividend on the 8 p.c. cumulative first preference shares is payable, less tax, on September 1st.

ADELAIDE ELECTRIC SUPPLY CO.—Declaration is made of a half-yearly dividend on the 6 p.c. cumulative preference share, payable, less tax, on September 1st.

COUNTY OF LONDON ELECTRIC SUPPLY CO.—Recent rumours of a possible share bonus distribution in the near future are officially denied, nor is such a step even contemplated by the directors.

ELECTRIC LIGHT AND POWER SUPPLY CORPORATION.—At the annual meeting of the Electric Light and Power Supply Corporation in Sydney, the chairman, (Mr. W. H. Matthews) presiding, the report and balance sheet were adopted, and the dividend of 10 per cent. was approved. Sir A. J. Gould was re-elected a director.

CHARLTON (VICTORIA) ELECTRIC SUPPLY CO.—The balance sheet presented at the recent meeting of the Charlton Electric Lighting and Power Co., showed receipts for the year ended May 17th, 1923, of £1 788, and net profit £415 compared with £316 last year. A dividend of 7½ per cent. and a bonus of 2½ per cent. have been paid.

SOUTH WALES ELECTRICAL POWER DISTRIBUTION CO.—An extraordinary meeting will be held at Cardiff on September 6th to consider a provisional agreement between the South Wales Power Co. and the Distribution Co. The agreement provides for the revesting in the Distribution Co. of the powers, rights and property of that company hitherto vested in or exercised by the South Wales Power Co. The agreement further provides (in the event of the principle of revesting being duly confirmed) a scheme for the exchange of the preference shares and ordinary stock of the company for ordinary shares of the South Wales Power Co.

New Companies.

ENGINEERING UNITS, LTD.—Private. Cap., £2 000 in £1 shares. Mechanical and electrical engineers, etc. Solicitor: H. L. Wilson, 8, Derby Lane, Coventry.

WHITBY AND CHANDLER, LTD.—Private. Cap., £3 000 in £1 shares. Dealers in gutta percha, ebonite, mica, electrical and other machinery, etc. Reg. office: 30, The Wicker, Sheffield.

CLAYTON AND JAMES, LTD.—Private. Cap., £2 000 in £1 shares. Manufacturers and factors of, agents for and dealers in electrical machinery, etc. Reg. office: 31-33, High Holborn, London, W.C.

BRADSHAW'S REINFORCED CONCRETE CO., LTD.—Private. Cap., £2 000 in £1 shares. To take over the business of F. W. Bradshaw and Co. Reg. office: Windsor House, Victoria Street, London, S.W.1.

BARRETTS CASTINGS CO., LTD.—Private. Cap., £3 000 in £1 shares. Manufacturers of castings, electrical engineers' requisites, etc. Solicitors: Neve, Beck, Son and Co., 21, Lime Street, London, E.C.

ATLAS WIRELESS CO., LTD.—Private. Cap., £1 500 in £1 shares. Manufacturers and designers of wireless apparatus, scientific and electrical instruments, etc. Reg. office: 78, Richmond Road, Kingston-on-Thames.

RADIO SUPPLIES, LTD.—Private. Cap., £10 000 in £1 shares. Manufacturers of and dealers in wireless telegraphs and telephones and all component parts thereof, etc. Reg. office: 234, High Holborn, London, W.C.1.

BATTISCOMBE AND HARRIS, LTD.—Private. Cap., £8 000 in £1 shares. Suppliers of electric fittings and electrical work for domestic and other purposes, etc. Reg. office: 18, Laurence Pountney Hill, London, E.C.

J. HALDENBY AND CO., LTD.—Private. Cap., £1 000 in £1 shares. To carry on the business of manufacturers of and dealers in plant, machinery and general equipment for power stations, etc. Reg. office: 53, Ankle Hill, Melton Mowbray.

NORTHERN GENERAL SUPPLIERS, LTD.—Private. Cap., £1 000 in £1 shares. Manufacturers of, agents for and dealers in wireless sets and instruments or parts, and all other electrical goods for lighting, heating, telephony or telegraphy, etc. Solicitor: W. L. Oxley, 12, Paradise Square, Sheffield.

W.P.T., LTD.—Private. Cap., £150 in £1 shares. To manufacture, deal in and instal plant, etc., for the transmission of electricity or electric power with or without the use of wires, or other conductors, and for the direction and checking of electrical energy distributed without such conductors, etc. Reg. office: 15, Bedford Row, London, W.C.1.

ACCUMULATOR CHARGING CO., LTD.—Private. Cap., £1 000 in 950 participating preference shares of £1 and 1 000 ordinary shares of 1s. To supply, fix or maintain all electric generators, batteries, lamps, engines, motors, converters, meters, or other electrical plant and appliances, etc. Solicitors: Ashurst, Morris, Crisp and Co., 17, Throgmorton Avenue, London, E.C.2.

HIGHTENSITE AND EBONITE MANUFACTURING CO., LTD.—Private. Cap., £15 000 in £1 shares. Manufacturers of ebonite and "Hightensite," manufacturers, importers and exporters of and dealers in ebonite, vulcanite, and all kinds of hard and other rubber, gutta percha, and other like substances, etc. Registered office: 54, Conduit Street, London, W.1.

WATES BROS., LTD.—Private. Cap., £5 000 in £1 shares. Manufacturers of and dealers in all kinds of electrical and scientific apparatus and instruments. Manufacturers and factors of, agents and concessionnaires for and dealers in telegraphs and telephones and in all apparatus connected with wireless telegraphy, etc. Solicitor: C. C. Dennis, 3, Lincoln's Inn Fields, London, W.C.

Business Items.

BURNDEPT, LTD., have removed their administrative and executive departments to Aldine House, 13, Bedford Street, Strand, London, W.C.2.

MAWDSLEY'S, LTD., electrical engineers, Dursley, Gloucestershire, have appointed Mr. Alexander H. Munday, of 41, Chichester Street, Belfast, as their agent for the whole of Ireland.

W. T. GLOVER AND CO., LTD., of Trafford Park, Manchester, inform us that they have recently opened branch offices and stores at 14, Long Millgate, Manchester—telephone no. City 6230/3—where large stocks are held of their standard sizes and grades of V.I.R. wires, cables and flexible cords.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Raw Materials for the Furniture Trade: Timber"; "Notes from the Home Journals"; "The Buying of Timber."

THE CHEMICAL AGE.—"Notes on the Nitrogen Position in Germany"; "The Determination of the Viscosity of Cellulose"; "Acetylene as a Commercial Synthetic Agent."

THE EUROPEAN COMMERCIAL.—"The Leipsic Fair: Past History and Future Developments"; "New Turkish Shipping Regulations"; "The Czecho-Slovakian Textile Industry."

THE FRUIT GROWER.—"Railway Facilities for Soft Fruit: Growers' Protest"; "Asparagus Fern for Market"; "Potato Importations."

GARDENING ILLUSTRATED.—"Winter and Spring Flowering Stocks"; "Preservation of Cut Flowers"; "The Fuchsia as a Climber."

THE GAS WORLD.—"Monthly By-Product Supplement"; "Gas Oil Supplies"; "Empire Patents."

THE HARDWARE TRADE JOURNAL (Special Colonial Issue).—"A Review of the Trade Situation and Opportunities in British Colonies and Dependencies; "Hardware Specialisation for Retailers"; "Colonial Timbers for Hardware Purposes."

Prices of Metals, Chemicals, etc.

TUESDAY, August 28.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£66 10 0	—	10s.
Electro Wirebars	„	£70 0 0	—	5s.
H.C. Wire, basis	per lb.	10d.	—	—
Sheet	„	10½d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2d.	—	—
Brass 60/40—				
Rod, basis	„	7½d.	—	—
Sheet, basis	„	10d.	—	—
Wire, basis	„	10½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 7 6	—	2s. 6d.
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
Lead Pig—				
English	„	£25 15 0	5s.	—
Foreign or Colonial	„	£24 10 0	10s.	—
Tin—				
Ingot	„	£190 15 0	£4 10 0	—
Wire, basis	per lb.	2s. 6½d.	¼d.	—
Aluminium Ingots	per ton	£115 0 0	—	—
Spelter	„	£32 12 6	—	12s. 6d.
Mercury	per bottle	£8 17 6	—	5s.

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2¾d.
„ (Roll-Brimstone)—„ £8 5s. *Sulphuric Acid* (Pyrites, 168°) per ton, £7 10s.
Copper Sulphate.. „ £26
Boric Acid (Crystals). „ £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 4d.; plantation 1st latex, 1s. 4d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

COATES, Jno., 5, Peel Terrace, Sheffield, electrician. £21 7s. 10d. July 5th.

IDEAL ELECTRIC SUPPLY CO., Russell Street, Keighley, electricians. £21 19s. 6d. July 18th.

UNIVERSAL LIGHTING CO., 206, High Street, Hounslow, electricians. £14 10s. July 4th.

Bill of Sale.

EASTES, Charles Colbran, 20, Kingsley Road, Wimbledon, electrician. August 15th. £50.

Deeds of Arrangement.

BIRD, William, and EWINGS, John James George, trading at 44, High Street, Exeter, 11, The Parade, Exmouth, and 73, St. Thomas Street, Weymouth, as BROOKING AND CO., electrical engineers. Filed August 21st. Trustee W. F., Kightly, 110, Cheapside, E.C., I.A. Secured creditors, £224; liabilities unsecured, £3 617; assets, less secured claims, £4 753

BLACKBURN, George Hornby, 7, Crown Street, Bolton, 18, Broadway, Douglas, Isle of Man, and 25, Heaton Avenue, Bolton, electrical engineer. Filed August 21st. Trustee, R. M. Smethurst, 21, Spring Gardens, Manchester, C.A. Liabilities unsecured, £1 876; assets, less secured claims, £1 137.

CARTWRIGHT, John Leslie, and GEE, Horace Charles, trading at Victoria Works, Springfield Lane, Salford, as J. L. CARTWRIGHT AND CO., and at 22a and 24, London Road, Manchester, as VICTOR BEST AND CO., electrical manufacturers and suppliers. Filed August 22nd. Trustee, A. Hodcroft, 7, Brazennose Street, Manchester, C.A. Liabilities unsecured, £8 679; assets, less secured claims, £5 090.

WRIGHT, Russell Victor, trading as WRIGHT BROS., 38a, Cross Street, Sale, and 330, Glasgow Road, Clydebank, N.B., electrical engineer. Filed August 24th. Trustee, G. H. Blair, 4, Chorlton Street, Manchester, I.A. Liabilities unsecnred, £698; assets, less secured claims, £273.

Receiverships.

FLACTEM WIRELESS, LTD.—H. Bottomley, of 31, Regent Park Terrace, Leeds, was appointed receiver on August 13th under powers contained in trust deed dated March 16th, 1923.

WIRELESS INSTALLATIONS, LTD.—J. S. Bird, of 36-38, Victoria Street, S.W.1, was appointed receiver and manager on August 10th under powers contained in debentures dated May 3rd, 1923.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

ECLAT ELECTRIC MANUFACTURING CO., LTD., London, S.W.—Registered August 16th, £6 000 debentures secured by Trust Deed dated August 10th, 1923; charged on Spencer Lamp Works, Spencer Hill Road, Wimbledon, also general charge.

LIVERPOOL ELECTRICAL ENGINEERING CO. (1923), LTD.—Registered August 14th. £800 debentures dated August 3rd, 1923; general charge. *£800. August 8th, 1923.

NORTHWICH ELECTRIC SUPPLY CO., LTD. Registered August 2nd, charge, to bank; charged on properties at Northwich, with fixtures, etc. *£25 810 debentures. May 3rd, 1923.

PREMIER ELECTRICAL ENGINEERING CO., LTD., Stalybridge.—Registered August 18th, £500 debentures (filed under section 93 (3) of the Companies' (Consolidation) Act, 1908), present issue £200; general charge. *Nil. September 1st, 1922.

URBAN ELECTRIC SUPPLY CO., LTD., London, S.W. Registered July 31st. Trust Deed dated July 27th, 1923, securing £350 000 debenture stock with power to issue a further £150 000; general charge. *£371 849. May 30th, 1923.

WHALEY (RICHARD), LTD., Manchester, manufacturers of wireless apparatus. Registered August 4th, £666 debenture, to W. C. Barraclough, 61, Bridge Street, Manchester, and another; general charge.

WIRELESS ACCESSORIES STORES, LTD., London, S.E.—Registered August 4th, £200 debentures to A. Martin, Melrose, Finchley Park, North Finchley, wireless engineer; general charge.

YERA ELECTRICAL, LTD., London, W.C.—Registered August 8th, £200 debentures (filed under sec. 93 (3) of the Companies (Consolidation) Act 1908), present issue £125; general charge.

Satisfactions.

RUSHMORES (1919), LTD., London, W.C., electrical manufacturers.—Satisfaction registered August 17th, £111 000, registered December 1st, 1920.

TORPOINT ELECTRIC SUPPLY CO., LTD. Satisfaction registered July 31st, £1 089, registered February 16th, 1917.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.],

RHODES FITTINGS CO. (THE), LTD., 224, Upper Thames Street E.C.4.—Liabilities of £685 against assets of £162 were disclosed at the statutory meeting last week of creditors in this voluntary winding-up. It was reported that the company was formed in 1921, with a share capital of £500 in 500 ordinary shares of £1 each, of which 170 shares had been issued. The object of the company was to carry on the business of manufacturers of all kinds of machinery, tool makers, iron and brass founders, and general agents for electrical fittings, etc. The accounts for the first year showed an expenditure of £1 754, while the sales, etc., were £1 373, or a loss for the year's working to April 30th, 1922, of £381. The failure of the company was attributed to insufficiency of working capital. The liquidator pointed out that the stock which consisted mostly of wireless apparatus and glass ware, had to be removed from the company's premises and one of the creditors said he would house the stock free of charge until it could be disposed of to advantage. The voluntary winding-up was approved, with Mr. C. H. Whatley as liquidator. The following are creditors:—C. B. Davis, Cash and Co., £81; T. Saveker, £23; General Electric Co., £43; Jeary Electric Co., £10; Shrimpton and Sons, £29; Arcut and Co., £11; Polden and Co., Ltd., £218; L. Robinson, and Co., £38; Re-Echo Wireless Co., £107; Cressall, Mfg. Co., £17; Atwood and Co., £17.

WALL, Gordon, and WALL, Harold, trading as WALL BROS., electrical engineers, High Street, Clacton-on-Sea. Creditors were called together in London on August 24th, when a statement of affairs was presented which showed liabilities of £1 665 (£1 435 to the trade), from which had to be deducted £28 5s. for preferential claims, and net assets estimated to realise £695, a deficiency of £970. No offer of a composition was submitted and it was decided that the estate should be dealt with under a deed of assignment with Mr. E. H. Hawkins, of Poppleton, Appleby and Hawkins, 4, Charterhouse Square, E.C., as trustee, together with a committee of three of the principal creditors.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Bankruptcy Information.

ALEXANDRIA, A. C. (Mr.), lately carrying on business at 10, Iddesleigh House, Caxton Street, Westminster, London, electrical engineer. Receiving order, August 20th. Creditor's petition. First meeting, September 3rd, 11 a.m., and public examination, December 19th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

BAPTY, Samuel Lee, and MILES, Neville, wireless instrument manufacturers, carrying on business in partnership at Avenue Works, Avenue Road, Willesden Junction, N.W. Receiving order, August 21st. Debtor's petition. First meeting, September 4th, 11 a.m., and public examination, December 19th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

ELLIOTT AND CO., J. E., 12, Broad Street, Oxford, electrical engineers. Receiving order, August 20th. Creditor's petition.

METCALF, Charles Frederick Mason, trading as C. F. METCALF, 8, Cow Green, Halifax, electrical engineer. Receiving order, August 23rd. Debtor's petition.

Notice of Dividend.

WYNESS, Thomas Reginald Watt, and BALE, George Wilfred, trading as WYNESS AND BALE, 13, Commercial Street, Brighouse, electrical engineers. First and final dividend of 5s. 1½d. per £. payable September 1st, 1, Albion Street, Boar Lane, Leeds.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

200 573 R. B. RANSFORD, (SCOVILL MANUFACTURING CO.) Metal anodes for electro-deposition and processes of producing same. (11/4/22.)
200 575 FULLER'S UNITED ELECTRIC WORKS, and L. FULLER. Galvanic batteries. (12/4/22.)
200 578 SIEMENS BROS. AND CO., W. H. GRINSTED, and H. T. BODY. Automatic telephone systems. (12/4/22.)
200 584 R. PECHKRANZ. Electrolysis of water. (13/4/22.)
200 593 E. SCHRODER. Electric seam-welding machines. (18/4/22.)
200 594 E. SCHRODER. Electric butt-welding machines. (18/4/22.)
200 597 BRITISH THOMSON-HOUSTON CO., and H. C. WHEAT. Suspension devices suitable for electric lamp fittings. (19/4/22.)
200 598 BRITISH THOMSON-HOUSTON CO. (INTERNATIONAL GENERAL ELECTRIC CO., INC.) Electrically heated device. (19/4/22.)
200 599 A. GRAUEL. Electrically heated glass furnaces. (19/4/22.)
179 158 A. BADERNA. Electric cut-outs. (28/4/21.) (Addition to 177 169.)
180 648 SIEMENS U. HALSKE AKT.-GES. Alternating current rectifiers. (24/5/21.)
179 175 FALLIMENTO SOC. ANON. MANIFATTURA L. DUCA IN LIQUIDAZIONE. Electric head-lights for automobiles. (28/4/21.)
200 619 W. E. SHOKE. Electric plug connectors. (29/4/22.)
200 624 W. SYMES, R. GAYTER, and METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Planing or like machines. (1/5/22.)
200 625 H. S. COWX. Metallic electric conduit systems and the like. (2/5/22.)
180 655 BRITISH THOMSON-HOUSTON CO. Electron-discharge devices. (24/5/21.)
180 662 METALLURGIQUE ELECTRIQUE. Electric relays. (21/5/21.)
180 663 METALLURGIQUE ELECTRIQUE. Electric relays. (25/5/21.) (Addition to 180 662.)
200 639 R. W. STRAWSON. Electrode holder for use in electric welding. (12/5/22.)
200 643 H. WADE, (MILLS NOVELTY CO.) Process of and apparatus for telegraphically reproducing pictures and the like. (16/5/22.)
200 645 R. T. SMITH, and R. C. BOOKLESS. Wireless systems and apparatus. (17/5/22.)
200 652 A. C. NOBBS. Electric motor attachment for bath chairs, tricycles and the like. (25/5/22.) (Addition to 167,092.)
200 654 F. J. HOLMES, and HART ACCUMULATOR CO., LTD. Terminals for electric batteries, particularly for miners' lamps. (25/5/22.)
200 671 H. LUCAS, and O. LUCAS. Brush holders for dynamo electric machines. (14/6/22.)
200 673 H. E. HADWEN, and H. WILLIS. Anti-vibration devices for armoured electric flex and flexible gas tubes. (19/6/22.)
200 707 A. P. WELCH. Holders for thermionic valves. (19/7/22.)
200 720 R. H. BARBOUR. Electric controllers. (4/8/22.)
185 102 WESTERN ELECTRIC CO. Carrier wave receiving systems. (24/8/21.)
200 731 G. A. PENROSE. Maintenance and cleansing of secondary batteries. (12/10/22.)
200 737 SIEMENS U. HALSKE AKT.-GES., and SCHMIDT G. Vacuum tube devices. (19/2/23.)
190 125 TELEGRAPHIC GES., SYSTEM STILLE. Magnetic sound recording and reproducing machines. (10/12/21.)
197 913 G. BUHLER. Self-regulating electric striking apparatus for clocks. (20/5/22.)
191 749 C. H. F. MULLER, (firm of). Electric discharge devices. (14/1/22.)
200 774 WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO. INC.) Electron discharge devices. (22/1/23.)
193 386 BRITISH THOMSON-HOUSTON CO. Electric arc welding systems. (16/2/22.)
200 775 C. H. F. MULLER, (firm of.) Röntgen-tube apparatus. (22/1/23.)
200 781 T. LENAGHAN. Automatic telephone systems. (16/1/22.) (Divided Application 1360/22.)
200 555 F. B. COLLINHAM and C. J. A. OWEN. Driving-mechanism of electric generators. (5/9/22.)
200 845 T. LENAGHAN. Automatic telephone systems. (16/1/22.)
200 849 DRAKE AND GORHAM and A. H. ST. C. WATSON. Electric supply system. (17/1/22.)
200 850 S. L. PRICE. Incandescent electric lamps. (17/1/22.)
200 854 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Leading in wires for electric incandescent lamps, vacuum tubes, and the like. (20/1/22.)
200 857 H. J. ROUND. Wireless telegraph receiving systems. (21/2/22.)
200 869 A. STUBBS and METROPOLITAN-VICKERS ELECTRICAL CO. Control of turbine-driven electrically-operated winding plant and the like. (16/3/22.)
200 871 S. J. LEVI and H. ROTTENBURGH. Portable electric lamps. (18/3/22.)
177 522 A. J. JULLIN. Regulating arrangements for dynamos. (26/3/21.)
200 876 A. REYROLLE AND CO. and R. W. BILES. Protective systems for electric conductors. (22/3/22.)
200 885 E. SCHRODER. Electric heating and welding apparatus. (18/4/22.)
194 649 SAFETY CAR HEATING AND LIGHTING CO. Storage batteries. (11/3/22.)
180 642 WESTERN ELECTRIC CO. Inductance devices. (21/5/21.)
200 895 F. B. HOLT and METROPOLITAN-VICKERS ELECTRICAL CO. Connection of electric cables to electrical apparatus. (19/4/22.)
200 896 H. KAUFMANN. Magneto-electric machines. (19/4/22.)
200 905 B. R. CHARLES. Electric heating fabric. (20/4/22.)
200 911 N. W. MCLACHLAN. Telegraphic contact-making relays. (20/4/22.)
200 913 H. WADE (GOULD STORAGE BATTERY CO.). Manufacture of storage battery separators. (20/4/22.)
200 918 J. JONES. Electrical machinery, applicable more especially to squirrel cage rotors. (21/4/22.)
178 859 LANDIS AND GYR AKT.-GES. Casings for electrical-measuring instruments. (21/4/21.)
194 250 PHILIPS' GLOEILAMPENFABRIEKEN. Electric lamps with light-diffusing globes. (28/2/22.)
200 925 ELECTRO-MECHANICAL BRAKE CO. and M. J. PATTISON. Electric controllers. (21/4/22.)
200 927 SIEMENS BROS. AND CO. and A. GORDON. Telegraph instruments. (22/4/22.)
200 928 SIEMENS BROS. AND CO., D. A. CHRISTIAN, and W. G. PATTERSON. Metering of calls in telephone systems. (22/4/22.)
179 178 O. P. CRAMER. Thermal cut-outs. (27/4/21.)
179 189 W. H. SIMMS (BUREAU D'ORGANISATION ECONOMIQUE, SOC. ANON.). Phase-increasing apparatus employed for example to supply current-rectifying devices. (28/4/21.) (Convention date not granted.)
200 949 G. S. HELLIWELL. Dynamo lighting sets for cycles and the like. (1/5/22.)
200 954 WATTS, FINCHAM AND CO. and F. W. JOLLY. Portable electric lamps particularly intended for use in mines and other places where explosive gases are present. (2/5/22.)
195 337 FORGES ET ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE JEUMONT. Loading coils for telephone lines and the like. (27/3/22.)
200 963 M. W. W. MACKIE. Dynamos and motors. (8/5/22.)
200 965 A. D. CLARKE and P. O. KNOWLES, Jun. Outlet boxes, inspection boxes, and the like for electric circuits. (10/5/22.)
200 974 CLARKE, CHAPMAN AND CO. and R. C. HARRIS. Electrical control gear (18/5/22.)
200 977 D. MACADIE. Electrical measuring instruments. (20/5/22.)
200 981 H. L. THOMAS. Multi-layer electrical inductance coils. (27/5/22.) (Cognate Application 21 836/22.)
200 989 C. L. BROWNE and S. H. HEYWOOD AND CO. Electrically-operated lifting-blocks. (2/6/22.)
200 993 A. ORLING. Inscribing the cases of electrical instruments. (9/6/22.)
200 995 A. JONES. Electric furnace. (13/6/22.)
200 996 BRITISH INSULATED AND HELSBY CABLES, LTD., F. MERCER, and W. HOLTUM. Elimination of overhearing or cross-talk in telephone circuits. (14/6/22.)
201 010 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Dynamo-electric machines. (30/6/22.)
201 014 C. F. ELWELL, LTD., and B. E. G. MITTELL. Control of wireless amplifying apparatus. (5/7/22.)
201 019 J. E. PHILLIPS. Carbon holders for use with arc lamps. (10/4/23.)
183 135 U. ELLERO and P. ELLERO. Transmission and reproduction of photographic images by means of the usual telegraphic, telephonic, and radio-telegraphic apparatus. (18/7/21.)
201 026 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Automatic reclosing circuit breaker systems. (13/7/22.)
201 038 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Systems of electrical distribution. (28/7/22.)
201 044 G. WINTER and R. WINTER. Electrical plug switches. (31/7/22.) (Addition to 179 319.)
186 588 AKT.-GES. BROWN, BOVERI, ET CIE. Process of igniting metal vapour electric rectifiers. (29/9/21.)

APPLICATIONS FOR PATENTS.

August 13th.

20 507 E. V. APPLETON. Wireless receiving device.
20 516 CALLENDER'S CABLE AND CONSTRUCTION CO., and S. J. BRYCE. Electric junction box.
20 517 CALLENDER'S CABLE AND CONSTRUCTION CO., and S. J. BRYCE. Wiring systems.
20 561 L. WINKELMANN. Vacuum tube and method for producing predetermined rays.
20 575 A. J. GARROD and S. RADCLIFF. Thermionic valves. (24/1/23 Australia.)
20 582 METROPOLITAN-VICKERS ELECTRICAL CO. Resilient driving connections. (22/8/22 U.S.)
20 586 BRITISH THOMSON-HOUSTON CO. (General Electric Co., N.Y.) Insulators.
20 588 SIR C. S. FORBES. Electric sound amplifying apparatus.
20 594 K. KATAUMORI. Batteries.
20 596 M. P. FAVRE-BULLE. Electric watch. (11/8/22 France.)
20 597 M. P. FAVRE-BULLE. Striking mechanism for electric clocks. (11/8/22 France.)
20 604 MARCONI'S WIRELESS TELEGRAPH CO. Horns for reproduction of sound. (9/9/22 U.S.)

August 14th.

20 606 R. F. TUNMER. Holders for crystals of wireless apparatus.
20 609 G. A. GREGORY. Prevention of short-circuiting at sparking coil connections
20 624 N. A. BRYDON. Wireless telegraph apparatus, etc.
20 636 R. CAPARROS. Incandescent lamps.
20 637 ELECTRIC CONTROL, LTD., and O. ELLEFSEN. Starters for electric motors, etc.
20 643 WESTERN ELECTRIC CO. Switching devices.
20 647 H. LYONS. Crystal holders for wireless sets, etc.
20 664 COVENTRY AUTOMATIC TELEPHONES, LTD., and A. W. WILMAN. Telephone systems.
20 665 COVENTRY AUTOMATIC TELEPHONES, LTD., and J. E. COLLYER. Telephone systems.
20 670 ENGLISH ELECTRIC CO. and R. A. R. BOLTON. Overload circuit breakers.
20 679 BRITISH OIL AND CAKE MILLS, LTD., and S. R. LINES. Electric sign.
20 686 D. HOLT. Emergency device for electric lamps.
20 699 L. LOMBARDI. Electric soldering or welding tool.
20 700 L. LOMBARDI. Electromagnetic ovens for treatment of composite metals, etc.
20 702 COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATERIELS D'USINES A GAZ. Wireless receiving apparatus. (4/9/22 France.)
20 725 R. F. BOSSINI. Electrolytic rectifiers for alternate currents.
20 778 J. ANDERSON. Electromagnets.

August 15th.

20 711 A. W. WILLIAMS. Multi-core electric cables.
20 712 D. MURRAY. Telegraph printer.
20 722 C. M. PATTISON. Electric switch, etc.
20 744 WESTERN ELECTRIC CO. Continuously loaded submarine cables. (7/2/23 U.S.)
20 746 W. HICHEL and O. PFEISCHER. Electric safety fuses.
20 762 EXPRESS LIFT CO. and J. H. MEACOCK. Electric brakes.
20 768 BRITISH THOMSON-HOUSTON CO. (General Electric Co., N.Y.) Induction motors.
20 778 G. ELLISON. Electromagnets.
20 783 G. W. HEATH. Variable electric condensers.

August 16th.

20 797 P. L. DAVIES and T. WOODS. Electrical inductances.
20 802 A. C. MCLACHLAN. Switchboard for wireless receivers.
20 812 J. WILSON. Transmitting photographs by wireless telegraphy, etc.
20 815 J. G. STIRK. Electric motors for planing machines, etc.
20 818 R. PRITCHETT. Variable resistance.
20 819 R. G. CAVE. Inductance coils.
20 827 P. ATKINS. Wireless receiving apparatus.
20 828 F. FOULGER. Tapped plug-in coil.
20 833 SIEMENS BROS. AND CO. and C. R. RIFFER. Heat coils for protective devices.
20 834 C. W. HIRST. Circuit breaking and making devices.
20 844 H. P. T. LEFROY. Electric circuit arrangements.
20 856 P. W. HARRIS. Electric coils.
20 858 G. R. WILLIAMS. Wireless telegraph apparatus, etc.
20 859 and 20 860 LANDIS AND GYR AKT. GES. Electricity meters. (18/8/22 Switzerland.)
20 862 SOC. DES GRANDS REVEAUX ELECTRIQUES. Arch for electric railways (5/9/22 France.)
20 863 METROPOLITAN-VICKERS ELECTRICAL CO. and H. E. NORTH. Control systems for motors of electric railway, etc., vehicles.
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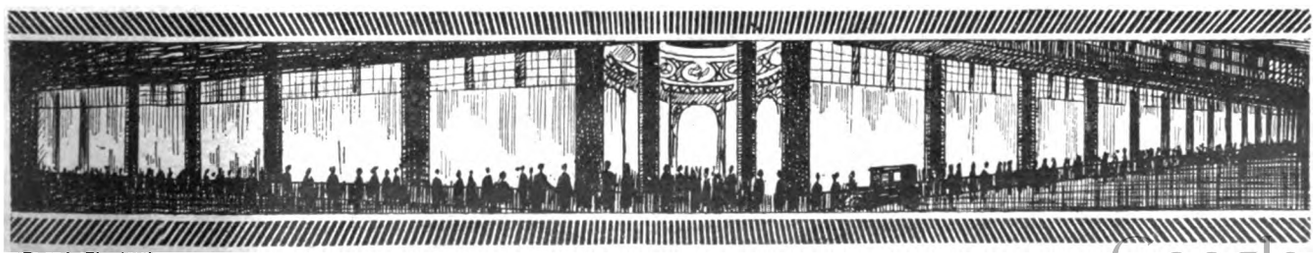

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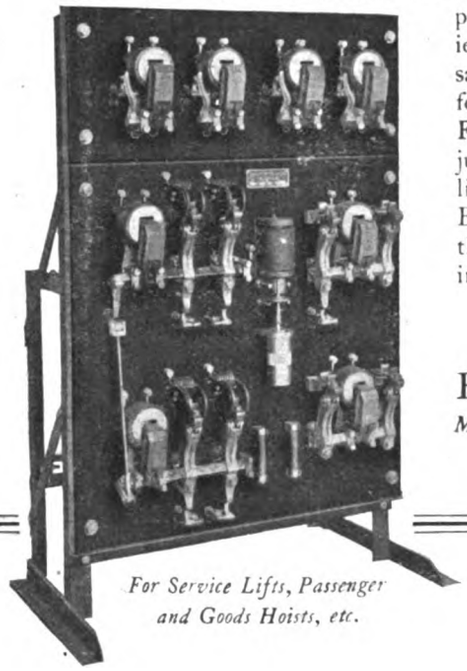

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THE ELECTRICIAN

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Notes of the Week.

Automatic Telephony Standardisation.

In his criticism of Mr. Aitken's latest book on "Automatic Telephony" which has just been published by Ernest Benn, Ltd., our reviewer calls attention to the description of the British Post Office standard dial which, as he says, represents the first step of any magnitude towards standardisation in automatic telephony that has been made in this country. Our telephone administration is often blamed by the unthinking for many faults, among them the lack of enterprise they have shown in the adoption of automatic methods. But apart from financial considerations and the difficulty of maintaining a service while a change over is made this slowness may be explained by a desire to attain some degree of standardisation in essentials before any irrevocable step forward is made. A moment's thought will show how wise this policy is. It does not matter in adjacent generating stations or even in the same generating station that current is supplied from sets which differ in details of design, but it would matter a great deal if two adjacent automatic telephone exchanges contained apparatus of a kind that made inter-working impossible. We believe that the Post Office Engineering Department realise this and that standardisation is being sought, not only in the subcribers' instruments, but in much of the exchange equipment as well. We agree with our reviewer that the time, ingenuity, and thought which are now spent on improving individual systems might be directed towards obtaining a greater degree of standardisation. It is only in that way that true progress can be secured.

"Aerials."

The traveller by train through the suburbs of London or any other large town has an unrivalled opportunity for seeing the backs of houses, and if he is at all observant he cannot fail to have been struck by a change which has recently taken place in their outward appearance. That change is due to aerials. They are attached to chimneys, to walls and to roofs. They are of all shapes, sizes and designs, being alike only in that they exhibit undoubted signs of amateur construction and erection. But the most significant thing about them is their number. Hardly a house seems without one. And unless those who inhabit houses near railway lines have greater wireless tendencies than those who do not, we can only suppose that the unseen aerials are equally numerous. We are also told that many wireless enthusiasts have for quite intelligible reasons omitted to erect outside aerials, in other words that their aerials are unseen in a wider application of the term. And therefore we arrive at the conclusion that the electrical industry has once again struck big business by which it would be wise to profit, a big business which by all accounts recent thunderstorms will have done much to assist. At present we know there is a "slump," and we hope that the Postmaster-General will come to a decision as to the future without delay. One thing is clear, if he does, there is plenty of outlet for yet another electrical application.

Women and Electrical Progress.

It has been truly said that men plan houses and women dwell in them. It is becoming equally true that men generate electricity and women use it. Electrical engineers would therefore do well to recognise and avoid a pitfall which has done much to retard progress and to convert many a woman in these hard times into a domestic drudge. For it will hardly be denied that had women been taken into consultation before most of our present-day houses were designed and built a large number of the mistakes for which the householder has to suffer either in worry, health, or increased expense would not have been made.

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We propose to assist our readers to avoid this pitfall. In our annual autumn trade promotion number, which this year will be published on September 28th (three weeks to-day), there will be a series of articles contributed by women on the different ways in which electricity can help them in their work and in their lives. These articles, because their point of view will be fresh, and because we feel certain that in this matter the supplier and the user should work in close consultation, will be worth study by our readers. We believe it is the first time in electrical journalism that the articles in any issue have been largely contributed by women; but we make no apology for this revolutionary change. The future of electricity depends upon the development of the domestic load and upon the increased use of cookers, heaters, vacuum cleaners, washers, irons, kettles and other apparatus which will be worked by electricity and which will reduce to a minimum the immense amount of degrading toil which now is necessary in our houses. Women are alive to the necessity of a change from present conditions; they realise that electricity will bring about that change more quickly and more efficiently than anything else. They are enthusiastic enough. It is for electrical engineers to become enthusiastic too, and to enlist the aid of women to bring about this beneficial and far-reaching revolution.

Electricity and the Home Journals.

AN interesting phase of post war journalism is the genesis of a number of periodicals dealing with domestic matters. These journals differ very much in character. Some mainly contain fiction leavened with a few articles on cookery and decoration, while others are full of informative articles and useful hints on all those thousand and one tasks connected with the house and garden which we once paid other people to do but now have to perform ourselves. Typographically these journals are excellent, and their very attractiveness must ensure their being widely read. For all these reasons domestic or household periodicals are worth the attention of electrical engineers. They are read by the people who will make a success or a failure of all work that is being done to develop the domestic load, and their attitude towards electricity as a factor in the home is therefore a matter of great importance. At present this attitude may be most correctly described as friendly but neutral. As will be seen from the review of the current issues which we give on another page, electricity is by no means neglected, though in dealing with it the price bogey is not altogether absent. The articles are written by amateurs, but they are in no sense of the word extravagant, and their chief fault is that they deal in generalities rather than in details. This can easily be changed. We have no doubt that the editors would welcome articles written by experts for popular study; and we have no doubt the readers would welcome them too. Here, then, is a field for propaganda ready to hand which it would be most unwise to neglect. We have the goods: the trouble is to bring them to the attention of the buyers and to show them what they will do. In these journals lies an excellent means of doing both.

Electrical Shop Windows—A Hint.

DURING the coming (or perhaps we ought to say the present) winter electrical engineers will have an excellent chance of taking their own medicine. Is it too much to expect that proper arrangements will be made by every supply authority that has a showroom and by every manufacturer and contractor that has a shop window to ensure that that window is properly arranged and that it is kept adequately lighted from dusk to midnight? We are afraid it is; yet there should be no doubt as to the selling value of the lighted shop window even after the shop is closed. For as the light house attracts the bird and the moth, so does the lighted window attract the human being, male and female, though with less painful after-results. This has been realised by many large shopkeepers and by a few small ones, but much education is still wanted. This education is to be provided, we are glad to see, by the British Electrical Development Association during the next few months. The least electrical engineers of the categories we have mentioned above can do is not to provide counter propaganda by failing to illuminate their own shop windows but they ought to do something positive as well.

Cheaper Light.

ELECTRIC light is by now so well established as a means of illumination for practically every class of work that the price of the lamps is perhaps not so important a factor in its development as in the case of cooking equipment or of electricity itself. Nevertheless, if the price of the lamps is kept low more will be used, they will be renewed more often and the better results, which are generally recognised as being necessary, will be more often obtained. For all these reasons we are glad to be able to announce that on September 1st the Electric Lamp Manufacturers' Association of Great Britain reduced the price of standard gasfilled lamps for 100 to 140 V and for 200 to 260 V circuits. This is the third occasion since 1920 that the price of these lamps has been reduced and the reduction on this occasion is due to improved factory efficiency, the labour charges remaining the same as they were twelve months ago. These lamps are what may be called "trustified." They are also fully protected by patents and are therefore free from competition. Yet the price has been reduced more than once. As a result, of course, good progress has been made and the trade in gasfilled lamps now represents more than half the trade in metal filament lamps.

Power Station Economy.

The Electricity Commissioners have often been accused of dilatoriness. In commenting on this criticism we have pointed out that the delay which has occurred in bringing the electricity districts into being is less the fault of the Commissioners than of those local bodies and individuals who would benefit most from the reorganisation. That the Commissioners themselves are not intrinsically slow is shown by the publication this week of the analyses and summaries of the returns of fuel consumption and kilowatt hours generated which are made by authorised undertakers under the provisions of Section 27 of the Electricity (Supply) Act of 1919 and of the returns furnished by railway and tramway authorities and by certain non-statutory undertakings. These returns apply to the year ended March 31st, 1923, and include all the statutory supply and tramway and railway undertakings in the country with most of the non-statutory undertakings. It is hoped that in subsequent years more of the non-statutory undertakings, some of which are of considerable size, will send in data, though of course they are not obliged to do so. But the more complete these returns are the more valuable they will be.

When it is considered that the information upon which these analyses are based has first to be collected and prepared by the individual undertakings and then examined and collated by the Commissioners, it will be agreed that they have been published at the earliest possible moment. The returns for the year ended March 31st, 1922, were not available until about six months ago. They were noticed in THE ELECTRICIAN of April 13th, 1923, so that the saving in time has been considerable and is a testimony not only to the promptness of the primary compilers but to that of the Commissioners themselves. Sir ALFRED MOND and others might note and recant.

Scope of the Anaylses.

The returns published in April were based for the first time on the electricity districts which have been established instead of on the "Coal Transport Reorganisation Scheme" of areas. This course has also been followed in the present

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returns, which deal with 451 out of 532 stations, and direct comparison between the two is therefore possible. Of the stations not included 23 were not in operation (it would be interesting to know more about these) and in 58 the whole or the major proportion of the output was generated by waste heat or water power.

While in other respects the form of the two returns remains substantially the same, an interesting change is the publication of the names of the leading undertakings in the tables relating to fuel consumption and thermal efficiency. This is a change which has been advocated by ourselves and the technical Press generally and it is an improvement for more than one reason. It is only right that the undertakings which have obtained the best figures should receive the benefit of the advertisement and should play their part in inciting others to emulate or surpass them. Publication, moreover, prevents speculation and allows credit, or the lack of it, to be laid at the proper door.

Improved Coal Consumption and Thermal Efficiency.

In the return for 1921–22 the highest thermal efficiency for generation by steam and the lowest coal consumption was obtained in one of the two stations in the country that generated more than 200 000 000 kWh per annum. The figures were 17·2 per cent. for thermal efficiency and 1·74 lb. per kWh generated. This result was, we believe correctly, ascribed to the Carville Station of the Newcastle-upon-Tyne Electric Supply Co., and this station again heads this group with the same coal consumption and the slightly higher thermal efficiency of 17·8 per cent. In passing we may mention that there is one more station in this country generating more than 200 000 000 kWh than there was last year, which is a satisfactory sign of development. Another station (Dunston) of the same company heads Group B (stations which generate between 100 000 000 and 200 000 000 kWh per annum) with figures of 1·91 lb. per kWh and 16·5 per cent., while it is interesting in view of the rumours that have been flying about to find that the North Tees, also a Newcastle Co., station heads Group C (stations with an output between 50 000 000 and 100 000 000 kWh) with figures of 1·73 lb. and 17·15 per cent. This is therefore the most economical station in coal consumption in the country. In the group for stations which generate between 25 000 000 and 50 000 000 kWh annually the new Rotherham station heads the list for thermal efficiency with a figure of 16·7 per cent., being bracketed with the Blackburn Meadows station of the Sheffield Corporation with a coal consumption of 1·98 lb. per kWh generated.

Results from Smaller Stations.

The figures in Group B compare favourably with the best for last year, which were 1·98 lb. and 15·25 per cent. respectively. But the best figure for coal consumption in the country has risen from 1·7 lb. to 1·73 lb., though the thermal efficiency has improved from 16·5 to 17·15 per cent. None of the stations in the other groups drops below 2 lb per kWh in coal consumption or rises above 16 per cent. for thermal efficiency, though the figures of 2·05 lb. and 15·4 per cent. obtained at Hackney and of 2·4 lb. and 2·82 lb. obtained by the Brompton and Kensington Electricity Supply Co. and the Finchley Urban District Council respectively are worthy of mention. In some of the lower groups there is a sad falling off, and the best that can be done in Group L (stations generating between 100 000 and 250 000 kWh per annum) is 10·75 per cent. for thermal efficiency with 2·64 lb. of coal per kWh generated. It is true there are only nine stations in this group, but even so, those nine might conduct a little competition among themselves to try and achieve something better. To assist towards this end the Commissioners might next year publish the worst as well as the best figures in each group, though we fear they would not then find it so easy to obtain consent to the disclosure of the names. Another competition might be conducted between the municipal and the privately owned stations, for it is surprising to find how a larger proportion of the highest in each class are in the latter category considering how far they are numerically outnumbered.

High Figures in Oil-Driven Stations.

As last year, the figures for thermal efficiency in the steam-driven stations pale before those where oil is the fuel employed. These stations have, of course, a comparatively low output, the largest falling into Group H (between 1 000 000 and 2 500 000 kWh generated per annum). The best in this group is the station of the Electricity Co. of Macclesfield, where the thermal efficiency is 28·1 per cent. and the fuel consumption 0·65 lb. per kWh generated. These figures are, however, surpassed by the East Anglian Electricity station at Felixstowe, in Group I, where figures of 29·1 per cent. and 0·63 lb. were obtained. Thermally speaking, this station is therefore the most efficient in the country. The gas producer stations are not noticeably more efficient than the steam stations. The largest of these are also in Group H, the one with the highest thermal efficiency being the station of the Guernsey Electric Light and Power Co. The figures here are 1·55 lb. per kWh generated and 16·5 per cent. The best steam station for thermal efficiency in this group is that of the First Garden City Co. at Letchworth, where the figure is 9·95 per cent., while the best for fuel consumption is the Southern Railway Co.'s station at Southampton with 5·21 lb. per kWh generated.

Fuel Consumption Reduced.

In the report for 1921-22 the returns of 396 steam stations with a total output of 4 732 824 434 kWh were analysed. The total fuel consumption of these stations was 6 577 587 tons, or an average of 3·11 lb. per kWh generated. In the present report the returns of 392 stations are analysed, with a total output of 5 456 020 960 kWh. The total fuel consumption of these stations was 6 788 306 tons, or an average of 2·78 lb. per kWh generated. In 1921–22 the returns of 60 gas producer stations were analysed as against 61 in the present report. The total kilowatt hours generated increased from 14 952 709 to 15 286 383, and the fuel consumption from 17 668 to 18 437 tons. The average fuel consumption per kilowatt generated increased from 2·64 to 2·7 lb. In both 1921–22 and 1922–23 the returns of 52 oil-engine stations were analysed. The total kilowatt hours generated decreased from 31 551 075 to 28 067 320, and the total fuel consumed from 29 396 to 21 545 tons. The average fuel consumption decreased from 2·08 lb. to 1·72 lb. per kWh generated. These are significant and interesting figures.

Increase in Waste Heat Generation.

A startling change is the large increase in the number of kilowatt hours generated in waste heat stations, the rise being from 54 628 405 to 183 854 306 kWh. Only one station has been added since last year, but as this is a "composite" station herein may lie the explanation. The number of kilowatt hours generated in destructor stations rose from 17 728 350 to 20 663 798 kWh, and in water power stations from 29 107 036 to 31 823 031 kWh; but in gas-engine stations using town gas it fell from 3 874 029 to 3 002 687 kWh. Of the total electricity generated in the country 95·08 per cent. was generated in steam stations (as against 96·88 per cent. in 1921–22), 0·26 per cent. in gas producer stations, 0·49 per cent. in oil-engine stations, 3·21 per cent. in waste heat stations, 0·36 per cent. in destructor stations and 0·55 per cent. by water power, the remainder by gas engines using town gas.

As compared with the corresponding figures of the previous year the total output showed an increase of 17·5 per cent., whereas the total fuel consumption increased by only 3 per cent. The saving in the fuel consumption of steam stations was 10·6 per cent., a result worth noting both as a matter for congratulation and as an incentive when it is remembered that a quantity of some 7 000 000 tons is involved.

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Tooth Frequency Iron Losses in Slip Ring Induction Motors.

By D. B. HOSEASON, A.M.I.E.E.

It is well known that the actual iron loss in rotating electric machines is always higher than the loss estimated on a basis of the maximum flux density, impressed frequency and specific loss in the raw material. The increase is generally termed the "added" loss, and in the case of induction motors is chiefly due to manufacturing defects, such as burred punchings, and tooth frequency flux variations. In high speed slip ring machines, especially those having open slots in the stator, it may occasionally be observed that the iron loss is lower with the rotor open circuited and stationary than with it short circuited and running light near synchronism, even though in the former case the rotor iron is subjected to the impressed frequency. In such machines then it is clear that the tooth frequency losses are of the same order as the stator fundamental frequency losses, or losses due to the impressed frequency, and the two should consequently receive equal consideration when the machine is being designed.

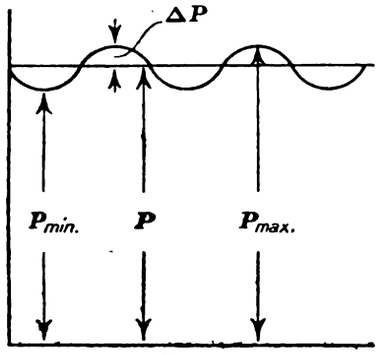

FIG. 1.

The various forms of iron loss occurring in induction motors are:—

(1) Fundamental frequency losses in the primary core and teeth due to the main flux.
(2) Losses due to the leakage fluxes.
(3) Losses due to the variation of the permeance of the main magnetic circuit, commonly called "pulsation losses."
(4) Swinging, surface or "pole face" losses in the tips of the stator and rotor teeth.
(5) Rotor losses due to the main field at slip frequency.
(6) Stator and rotor losses due to the minor fields.

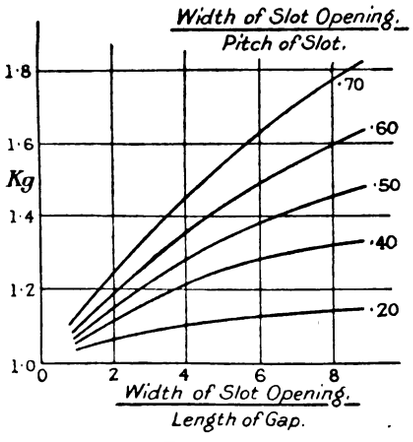

FIG. 2.

Influencing the above in some degree are manufacturing effects and such factors as radially induced m.m.f. and revolving flux variation, all of which tend to alter the specific loss in the completed machine from that in the raw material. Of the various forms of loss probably the first, third and fourth are the most important and deserve consideration in machine design.

The cause of flux pulsations is the variation in permeance of the magnetic circuit from the primary core to the secondary core, as the teeth and slots of the rotor pass the stator teeth and slots. The total permeance for a pole arc need not necessarily change, although the path opposite individual teeth may vary considerably; in fact, pulsations in permeance over a complete pole arc will only produce ripples on the magnetising current and will not affect the total flux per pole. Pulsations in the core flux as a whole do not occur. Pulsations in core flux do, however, occur

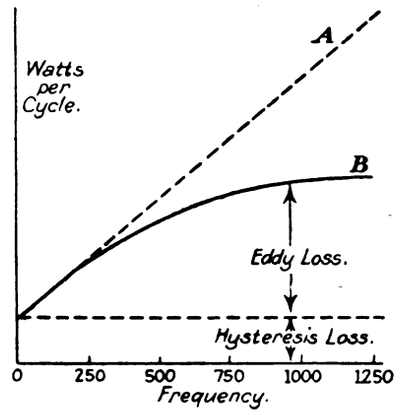

FIG. 3.

as a result of the flux pulsations in individual teeth and take place in that portion of the core in the immediate vicinity of the tooth in which they have their origin. Surface ripples are the result of the contraction in gap flux opposite the teeth of either the stator or rotor of the machine, and losses due to these are similar to the pole face losses in d.c. machines.

Tooth Frequencies.

The frequencies of the flux variations producing both forms of loss are dependent upon the number of slots in a machine and the rotor speed.

If S_2 = the number of rotor slots, then the frequency of the ripples in the stator = $\frac{S_2 \times \text{r.p.m.}}{60}$ cycles per sec.

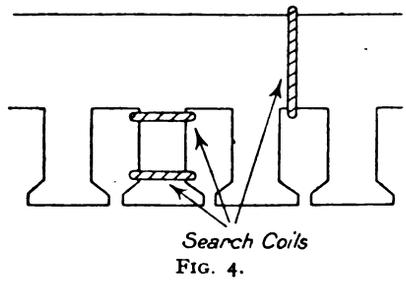

FIG. 4.

If p = number of pairs of poles

f = applied frequency, then rotor speed = $\frac{60f}{p}$ revs. per min.

and the frequency of the ripples in the stator = $\frac{S_2 \times 60f}{60p} = \frac{S_2 f}{p}$

Similarly the frequency of the ripples in the rotor = $\frac{S_1 f}{p}$

where S_1 = the number of stator slots.

Effective Amplitudes.

In the case of the pulsations the amplitude of the variation in permeance is a constant and the amplitude of the flux variation will vary according to the variation in m.m.f. In any primary tooth the m.m.f. alternates with the impressed frequency and the amplitude of flux pulsation will also change similarly. In a rotor tooth the amplitude of flux pulsation will alternate with slip frequency and be constant at synchronism. Surface ripples behave in a similar manner, the percentage contraction in gap flux being a constant. The actual gap flux changes with the line frequency in relationship to the primary and with slip frequency in relationship to the secondary; consequently, the actual

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amplitude of flux contraction will alternate at these frequencies in each case.

The amplitude of any ripple in permeance superimposed upon a constant permeance can be represented by ΔP in Fig. 1.

If P = the average permeance
$P_{max.}$ = the maximum permeance
$P_{min.}$ = the minimum permeance; then

$$P = \frac{P_{max.} + P_{min.}}{2} \text{ and}$$

$$\Delta P = \frac{P_{max.} - P_{min.}}{2} \text{ thus}$$

$$\frac{\Delta P}{P} = \frac{P_{max.} - P_{min.}}{P_{max.} + P_{min.}}$$

The term $\Delta P/P$ has been called K_p for convenience and gives the ratio of the amplitude of permeance variation to the average permeance.

One method of deducing the value of K_p from the actual slot dimensions of a machine is to take the maximum and minimum iron surfaces opposite a tooth as being proportional to the maximum and minimum permeance of the path opposite that tooth. By applying this first to the stator and then to the rotor, figures are obtained which, though not correct, give a comparative idea of the amplitudes in the two parts.

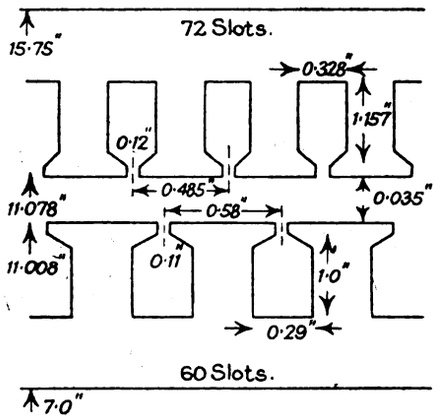

FIG. 5.

Disadvantages of the Method.

Any quantity obtained by a process which entails the difference of two large quantities is in practice very liable to give serious errors in the result, and as the amount of iron surface opposite a tooth is itself only an approximate indication of the permeance of the path opposite, the results obtained by this method are considerably in error.

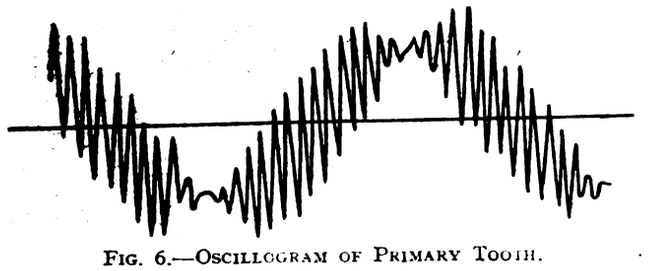

FIG. 6.—OSCILLOGRAM OF PRIMARY TOOTH.

The method is, however, occasionally useful for comparative purposes. One improvement is to use Carter's curves or formula for gap contraction (Fig. 2) and take the effective maximum and minimum amounts of iron opposite a tooth —i.e., taking the effective tooth face widths of either the stator or rotor as being the slot pitch divided by the constant K_g.

In some cases this method will give practically correct figures, but in others only approximately correct results. The curves given in Fig. 2 are intended for use in the case where a slot opening comes opposite a tooth tip, but in practice cases occur in which a slot opening is faced by another slot opening. The gap contraction in the latter cases will be greater than that given by Fig. 2.

The above method does not enable the exact value of K_p to be obtained in every case, but, if its limitations are understood, it does enable an idea of the order of the amplitude to be obtained and the better of two alternative slottings to be determined.

It has already been pointed out that surface losses are very similar to the pole face losses that occur in salient pole machines and Carter's formula.

$$K_g \left(\frac{1}{2} - \frac{1}{\sqrt{4 + \frac{S^2}{G^2}}}\right)$$

gives the effective amplitude of ripple where

K_g = gap contraction coefficient, Fig. 2.
S = width of the opposing slot opening.
G = the gap length.

Machines on which it was known that the tooth frequency losses were of the same order as the fundamental frequency losses were tested and the two forms of loss separated by the following method.

Method of Testing.

The stator was supplied at full voltage and the power input measured, first with the rotor open circuited and stationary and then with it short circuited and running light. The friction and windage loss was obtained by the usual method of reducing the voltage, plotting a curve of watts input against volts and producing the curve back to cut the "watt" axis at zero voltage. The supply was next put on the rotor at the necessary voltage to give the same flux per pole as in the first case. The stator was short circuited, the rotor allowed to run light and the power input again measured. Care was taken that the rotor revolved in the same direction on both occasions in order to ensure that there was no change in friction and windage. The three readings obtained, after correction for copper loss and friction and windage loss, form the resultants of three equations containing three unknowns: (1) Stator fundamental frequency loss, (2) rotor fundamental frequency loss, (3) stator and rotor tooth frequency losses,

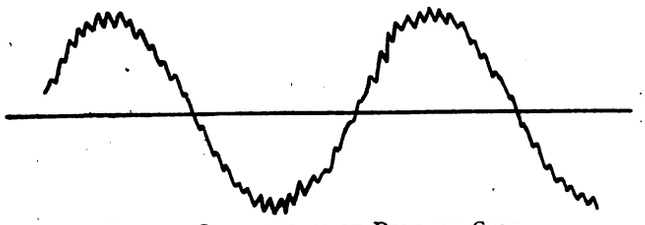

FIG. 7.—OSCILLOGRAM OF PRIMARY CORE.

and having three unknowns and three equations, by solving, it was possible to find the quantities required.

The variation of tooth frequency losses with both density and frequency was also observed by the above method, and the results indicated that the total watts followed approximately the 1·5th power of the density and made practically a straight line law with the frequency. These results appear rather unusual in view of the tooth frequencies which were of the order of 1000 cycles per sec., and it might have been anticipated that there would be a preponderance of eddy current loss following a square law.

Reference to a number of articles,* however, dealing with iron loss under similar conditions, shows that the results are not inconsistent, and it appears highly probable that the familiar curve of watts per cycle and frequency shown by curve A in Fig. 3 should be modified for the higher frequencies to something similar to curve B in the same figure.

Examination of Flux Pulsations.

In order to examine the flux pulsations a machine was obtained and two search coils wound round one tooth, one

*(1) "Data and Tests on a 10000 Cycle Alternator." B. G. Lamme. "Trans. A.I.E.E.," May, 1904.
(2) "Magnetic Behaviour of Iron at Very High Frequencies." H. W. McLachlan. "J.I.E.E.," 1916, p. 480.
(3) "The Testing of Transformer Steels." Lloyd and Fisher. "Trans. A.I.E.E.," vol. 28, p. 439.

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at the tip and one at the root, and another round the core in the positions shown in Fig. 4. The machine was wound for 4 poles and the actual dimensions of the punchings are given in Fig. 5. Oscillograms were taken first with the stator as primary and then with the rotor as primary, and the results are given in Figs. 6, 7, 8 and 9. The oscillograph was a Duddell high frequency oil bath type, and although the ratio of resistance to reactance for the search coil circuit was high, a certain amount of damping was bound to occur. The oscillograms give the wave form of the e.m.f. generated in the search coil and the actual flux form will be the integral of this. If we assume that the m.m.f. in a tooth is following a sine law and the permeance of the path for that tooth has also a sine ripple superimposed upon it then the flux variation in the tooth will be :—

$$\Phi_t = \Phi_M \sin wt + K_p \Phi_M \sin wt \sin K_f wt.$$

Where K_p = the ratio of the amplitude of pulsation to that of the fundamental.

and K_f = the ratio of the frequency of pulsation to the fundamental frequency.

Now e the e.m.f. generated in the search coil is $K\frac{d\Phi}{dt}$, where K is a constant depending on the actual conditions.

$$e = K\frac{d\Phi}{dt} = Kw\,[\Phi_M \cos wt + K_p K_f \Phi_M \sin wt \cos K_f wt + K_p \Phi_M \cos wt \sin K_f wt].$$

Thus, ignoring the third term in the brackets, it will be observed that the ripple in e.m.f. is proportional to $K_f \times K_p \Phi_M$, and to obtain from the oscillogram the correct proportion of the flux ripple in relation to the fundamental flux wave, the amplitude must be divided by K_f.

Making the various necessary corrections the amplitudes obtained from the oscillograms are :—

Fundamental ..	.. 100	per cent at	50	cycles per second.
Pulsations in teeth	.. 3·2	,,	1 500	,, ,,
Pulsations in core	.. 0·27	,,	1 500	,, ,,

The oscillograms for the two search coils on the tooth were identical and showed that the same flux variation occurred over the whole length of the tooth from root to tip.

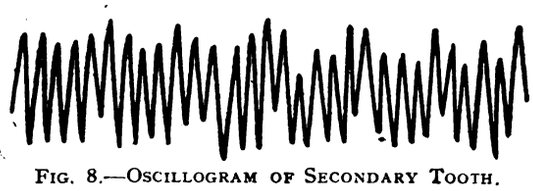

FIG. 8.—OSCILLOGRAM OF SECONDARY TOOTH.

A Further Test.

As a further check on the above and to obtain more data on the influence of the dimensions of the slotting, another test was carried out. The search coil was connected to an electrostatic voltmeter and with full voltage applied to the stator the open circuited rotor was moved round slowly by screw tackle, readings being taken periodically of the voltage generated in the search coil. A curve was then plotted showing the voltage variation in the search coil for various positions of the rotor throughout several slot pitches. This voltage variation is, however, proportional to the flux variation due to the rotor slotting and, consequently, by taking the maximum and minimum voltages a value was obtained for K_p. This test was carried out upon rotors having the same number of slots as given in Fig. 5, but with various sizes of slot opening, the stator being the same in every case.

Width of Rotor Slot Opening	Test	Value of K_p Estimated Method No. 1	Method No. 2
0·11 in.	3·75 per cent.	17·5 per cent.	5·2 per cent.
0·15 in.	6·8 per cent.	26·0 per cent.	8·9 per cent.
0·2 in.	10·0 per cent.	38·0 per cent.	14·0 per cent.
0·25 in.	13·2 per cent.	48·0 per cent.	20·0 per cent.

The estimated figures have been obtained by the two methods described previously.

Method No. 1 by simply taking the maximum and minimum amounts of iron.

Method No. 2 by using Carter's curves.

There is a fairly considerable difference between the test and the estimated values of K_p, even where the latter have been obtained by Method 2. This is due to the fact that in each case there is flux fringing from one tooth side to the side of the tooth opposite and, as already pointed out, Carter's curves, Fig. 2, are intended for fringing from one tooth side to the face of the opposite tooth, that is, through 90 deg. only.

No tests have been carried out to check Carter's formula for the amplitude of the surface ripples as the results obtained by Hele-Shaw, Hay and Powell* confirm the original formula upon which this was based.

An examination of the conditions existing in a machine having either semi-closed or open slots will show that it is possible when choosing the slots to completely eliminate pulsation losses from either the stator or rotor, but not from both. Surface losses will always exist to some extent

FIG. 9.—OSCILLOGRAM OF SECONDARY CORE.

in both parts of the machine. It is not customary to use fully open slots in both the stator and rotor as the pulsation losses would be excessive if this were done. For the pulsation losses to be a minimum in a machine having open slots in the stator and semi-closed slots in the rotor, the stator should have the greater number of slots and the rotor tooth face width should approximately equal the stator slot pitch.

On account of the low resistance short circuited turn round each tooth of the squirrel cage rotor, flux pulsations in machines fitted with such rotors do not behave in the same manner as in the slip ring motor, and the case of the squirrel cage motor requires special consideration.

Electric Signalling in Mines.

Progress in European Pits.

M. Maurice Le Bas, in a Paper read before the recent Engineers' Congress at Liège, remarks on the comparatively small number of mines in which electric signalling is adopted, and attributes this to the aloofness of many mine-owners, conservatism and the desire to avoid new troubles. Only 78 replies were received to a *questionnaire* on the subject sent recently to 300 collieries and metal mines in France, Belgium, the Saar and Dutch Limburg. The statistics obtained show that 65 pits in France and 21 in Belgium are equipped with mechanical signalling only, and 40 in both countries have mechanical signalling supplemented by telephones and electric bells. Seventeen have complete electrical systems in normal service, eight have been recently, or are being, equipped with electrical apparatus, and six had their electrical equipment destroyed during the war. Twelve mines have not yet adopted electric signalling, and the owners of seven are opposed to such a system. Four collieries in Dutch Limburg are using electric signals with success, and two have been equipped too recently to enable an opinion to be formed. Some concerns, though generally satisfied with their electrical systems, recommend greater simplification and endeavours to secure increased robustness of apparatus, which it is important should be watertight. All users agree that electrical signalling is quicker and safer than mechanical signalling.

Post Office Pneumatic Tube System.

The Post Office system of pneumatic tubes, through which telegraph messages have for some years past been sent from one Post Office to another in London and from the Houses of Parliament to the Central Telegraph Office, is being developed by the construction of extensions from the Houses of Parliament to the various Government Departments and to Downing Street. As the "Birmingham Post" suggests, in time more and more local telegrams will travel by pneumatic tube, and the question will arise whether the Post Office is justified in charging for them on the basis of the number of words.

* "Hydrodynamical Electromagnetic Investigations regarding the Magnetic Flux Distribution in Toothed Core Armatures." Hele-Shaw, Hay and Powell. "J.I.E.E.," 1904, vol. 34, p. 21.

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A New Pattern A.C. Starter.

Ingenious Overload Restraining Device.

The principle of the embodiment in a single ironclad unit of all the components necessary for the control of a particular direct current motor has long been known as an essential feature of the switchgear manufactured by BROOK, HIRST AND CO. This principle has been applied to alternating current control gears which is now being manufactured in the "straighton" and star-delta types in both wall and pillar arrangements and in the autotransformer and rotor types in the pillar construction only. Our illustrations show examples of this equipment and are almost self-explanatory. For it is hardly necessary at this stage to call attention to the hollow assembly case which allows easy connection and great accessibility to the "safety first" isolator in the base or to the excellent arrangements made for connections, as these are well-

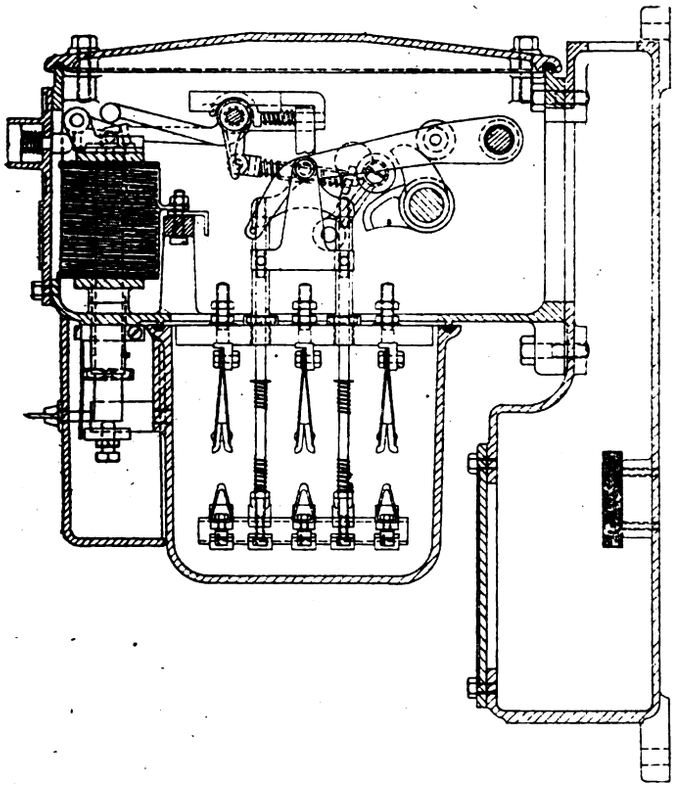

FIG. 1.

known features of all this firm's products. But a few words may be said about the overload device, which introduces an item of new practice into a.c. switchgear design.

Full Protection During Starting.

The circuit breakers on all the a.c. starters we have mentioned are provided with a "no-volt" release and with either two or three overload trips. These are free to operate during either starting or running independent of the position of the ratchet handle. As is well known, the starting current of a three-phase motor is greatly in excess of the full current and the trips must be so arranged that they do not operate during starting unless the normal starting current is exceeded by some predetermined amount. This can be effected by time lags, which means a loss of sensitiveness, or by cutting out the trip altogether, which is a confession of failure.

Both these pitfalls are, it is claimed, avoided by the use of the restraining device which we illustrate in Figs. 1 and 2. This consists of a series of solenoids, one for each phase, the travel of whose core can be set to a predetermined range in accordance with working conditions. During starting, however, this range is increased by another definite amount, the plungers being raised by crossbar and cam, shown in the lower part of Fig. 1, when the starting operation is completed. The effect of this is to allow the full starting current to pass without the trip being operated, but at the same time a dangerous excess of starting current which causes them to work as usual. Full protection for the motor during starting is therefore assured.

Main Features of the Design.

The starter comprises a circuit breaker which is closed first, a switch which connects the stator windings in star

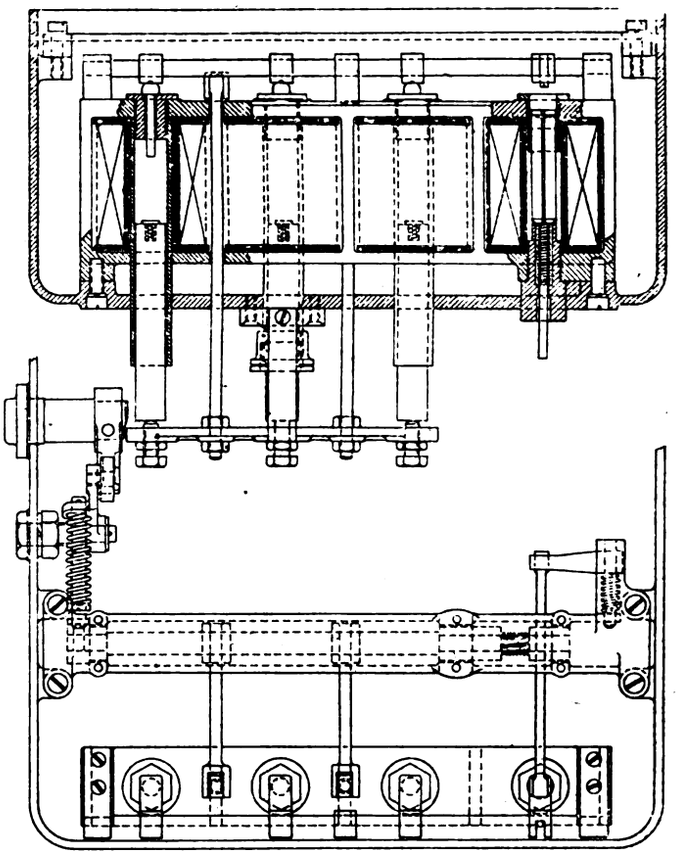

FIG. 2.

during starting and a switch for changing over from star to delta when running. All switches are of the triple pole oil-immersed type.

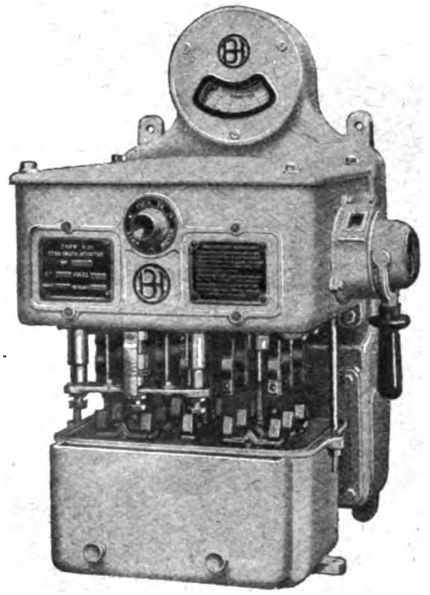

FIG. 3.—VIEW OF ONE OF BROOK, HIRST A.C. STARTERS.

The circuit breaker is fitted with a free handle and is held in place by a trigger. This trigger is released when the overload coils are drawn up, when helical springs open the circuit breaker. The starting operations are effected by a free handle device which ensures that everything is done in proper order and time.

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Shipping, Engineering and Machinery Exhibition.

Representative Display at Olympia.

The SHIPPING, ENGINEERING and MACHINERY EXHIBITION which opened at Olympia, London, on Friday last, and will remain until September 22nd, is representative of the progress that has been made in design and manufacture during the past few years. It is not, of course, exhaustive, but it enables visitors, of whom we feel sure there will be a great many, to obtain much information regarding recent developments.

An interesting section is that devoted to the propulsion of ships. Examples are to be found of the reciprocating engine, turbine and the Diesel engine, but nothing is to be seen of any system of electrical propulsion, which is a pity. On the other hand, it is evident that the electric motor is becoming more and more widely employed for the operation of auxiliaries as well as, of course, for machine tools and other equipment. About 40 firms are showing electrical apparatus as their primary feature, but motors, switchgear, and other gear are to be found as part of the necessary equipment of many other stands.

To hold an exhibition of this kind at the present time should be of the very greatest advantage to all concerned. Trade is bad, and unemployment is unfortunately increasing—conditions which are not likely to be assisted by the political and industrial state of Europe. On the other hand, once matters settle down, as they must, there will be a great demand for goods of all kinds, and it should be the first duty of British manufacturers to ensure that when that demand occurs their products shall receive the first recognition. The exhibition will, we hope, be a useful means to that end.

Transmission Line Apparatus.

Among the exhibits of the SPRECHER AND SCHUH Co., of Aarau, Switzerland, represented in this country by Mr. J. B. Rudkin, is a mast transformer cabin (Fig. 2) for transmission line work. This cabin is shown mounted between two parallel poles, in accordance with the arrangement adopted in practice, and wires stretched across the stand correspond to the transmission line. The transformer cabin is composed of sheet iron. The high tension line terminates on top of the cabin in bushings which consist of porcelain insulators with connecting bolts passing through the centre. The primary of the transformer is protected by three high tension expulsion type fuses, whilst the secondary and distribution lines are protected by porcelain hand type fuses. Doors on each side of the cabin give access to the interior, and a folding platform and safety rods contained in an earthenware protecting tube.

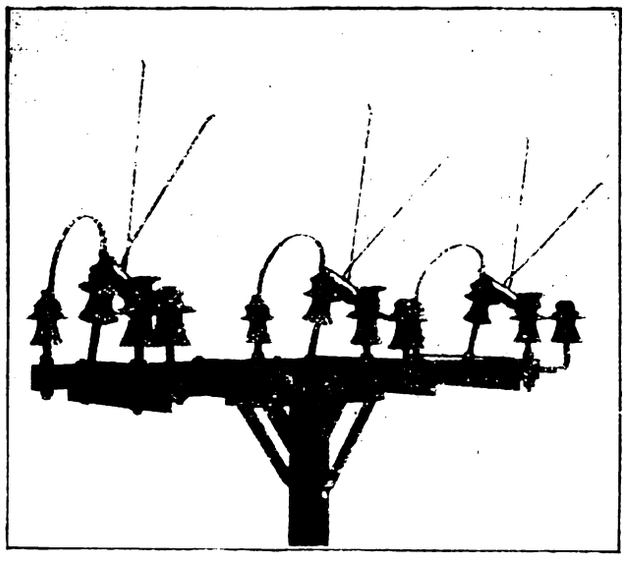

FIG. 1.—A 12 000 V HORN SECTIONING SWITCH.
(SPRECHER AND SCHUH Co.)

A horn type line sectioning switch (Fig. 1) exhibited has been designed for 200 A and a pressure of 12 000 V, and is capable of breaking this current at full voltage with perfect safety. There are also some oil switches with large breaking capacities. One of these switches is fitted with a direct high tension overload release, and the others are fitted with electrical remote control gear. There is also a high tension feeder panel equipped with instruments and control switches for the electrical remote control of the oil switches. Other exhibits consist of a collection of high tension apparatus such as horn type lightning arresters, choke coils, isolating switches, etc.

Testing Machines.

Rapidly rotating bodies, such as crankshafts, armatures, pulleys fans, etc., all require to be carefully balanced before they are put into use, and a useful machine for this purpose is being exhibited by W. AND T. AVERY, LTD. The object to be

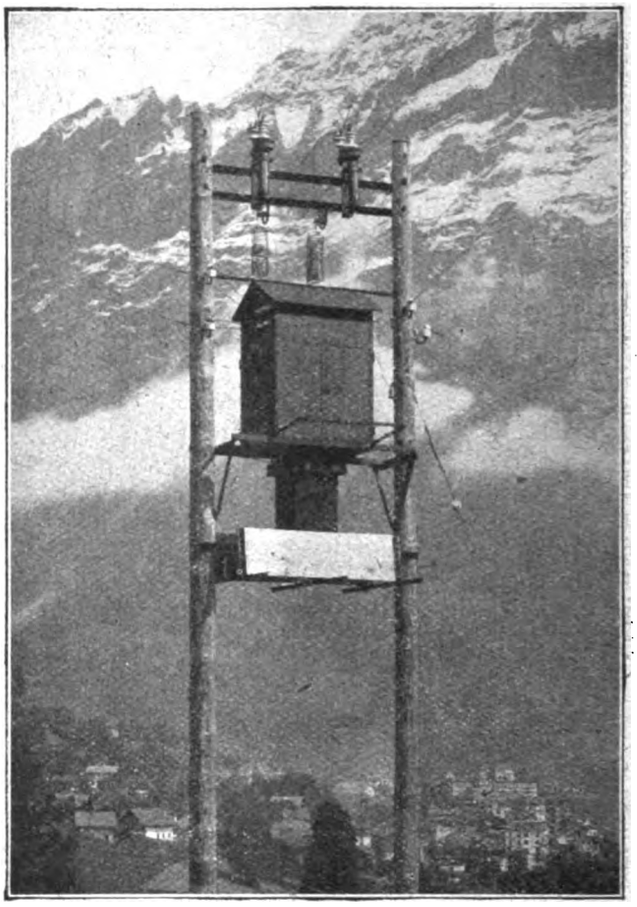

FIG. 2.—A MAST HEAD TRANSFORMER CABIN.
(SPRECHER AND SCHUH Co.)

balanced is supported in a cradle which is pivoted upon hardened steel edges and bearings, and the smallest amount of out of balance is immediately indicated in terms of inch-drams by an indicating pointer which moves over a graduated chart. The object under test may be turned through various angles in order to determine the error at any position. Machines of this type may be used for accurately balancing heavy rotors belonging to electrical machines and steam turbines. An india-rubber testing machine on the stand is designed for investigating the physical properties by means of a tensile test. As the machine is practically automatic in action, errors due to the operator are eliminated. The machine is connected to the district low pressure water supply and the load applied to the specimen is indicated by a weighted pendulum arm and a graduated scale. The maximum capacity of the machine is 100 kg.

A recorder fitted to the machine indicates the mechanical properties of the material, whilst an endless extension scale indicates the direct extension of the specimen under the wall and also the percentage of elongation throughout its extension. The specimen, which is of annular form, is caused to rotate, this ensuring a uniform application of the load. Besides these exhibits there is a very fine universal testing machine with a capacity of 50 tons which permits different forms of tests to be made without a change of tools. It is designed on the single lever principle, the load applied to the test piece being indicated by a poise weight which traverses a graduated scale upon the steelyard. There is also a hardness testing machine

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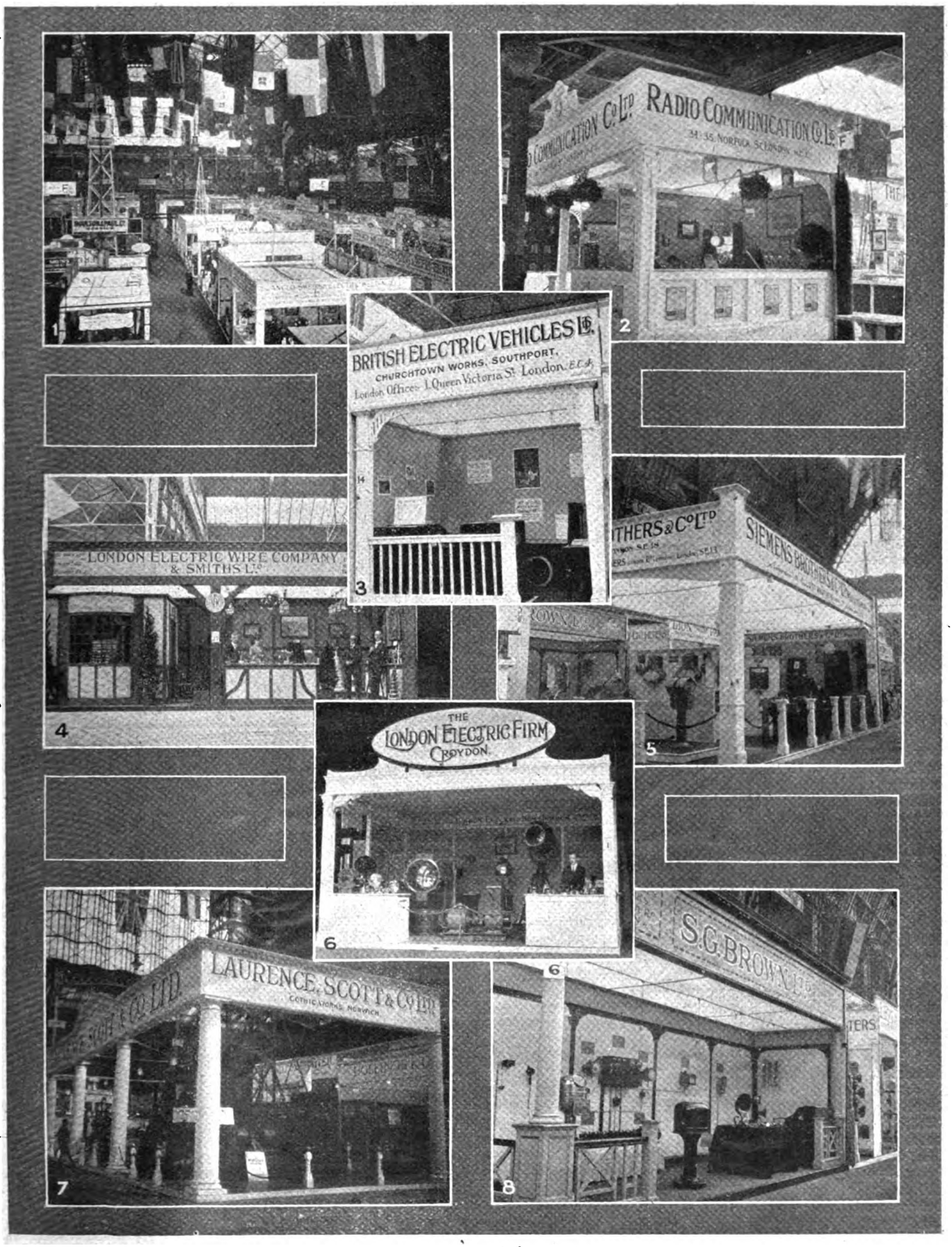
Some Electrical Stands at the Exhibition.



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for carrying out the "Brinell" test for hardness, and an automobile spring testing machine.

Presses of all Kinds.

Hydraulic presses for various classes of services are shown by HOLLINGS AND GUEST. There is a tyre press for removing and fixing the solid rubber tyres of commercial vehicle wheels. A special feature of the press is that it is provided with a slot in the head so that tyres can be fitted to or removed from Foden or similar wheels without removing the wheel from the axle. The complete wheel and axle are lifted on to the press by means of a runway. The table of the press has a 12-in. hole in the centre to receive the boss of the wheel. This press, which is the makers' latest type, is capable of dealing with the largest and heaviest tyres, and will give a pressure of 200 lb. per sq. in. Double hand pumps, which are usually supplied as part of the equipment, will work the press quite well; but in large garages, where a considerable number of

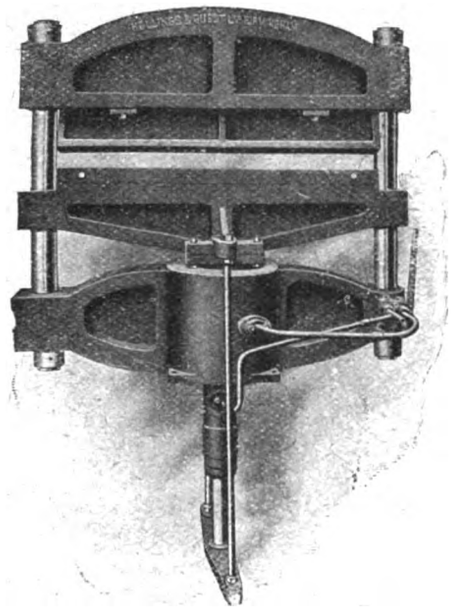

FIG. 3.—"A" TYRE PRESS FOR FIXING SOLID RUBBER TYRES.

tyres have to be dealt with, it is advisable to install power-driven pumps, which can either be operated from the line shaft or they may be directly coupled to an electric motor. A bending press on the stand is for bending plates cold up to 6 ft. in width, such as are used for safe bodies, conveyors, colliery tubs, and similar work. At one end the press has a swinging column, so that when a complete body or shape has been pressed the column can be swung out of place and the finished object can be slipped from the head of the press. Tools of various shapes can be fitted and easily changed. These presses are made to deal with plates varying from 2 ft. to 20 ft. wide.

Scrap Bundling.

Another machine is a hydraulic scrap metal bundling press, which consists of a rectangular cast-iron box 27 in. by 15 in. by 30 in. deep, with hinged covers. Underneath this box is the hydraulic ram, which fits closely inside the box. The whole apparatus is let into the ground, so that the top of the box is at a convenient height for throwing in the material, such as old tins, etc. When the box has been filled the lid is closed and the hydraulic pressure is applied by opening a valve. As soon as the pressure gauge indicates that the maximum pressure has been reached the operator releases the valve. He then swings off the cover and the ram ejects the bale from the press. The average size of bale produced in the standard press is 27 in. by 15 in. by 6 in., and weighs approximately 1¼ cwt., according to the class of material dealt with. The press is suitable for bundling old tins, scrap kettles, and general town refuse, also old wire, sheet iron clippings, etc. A hand pump may be used for operating the press, but it is better to install a set of small hydraulic power pumps, which can be driven by a belt or a direct-coupled electric motor, or the press may be connected directly to hydraulic mains. Any unskilled labourer can operate the press.

The hydraulic pumps supplied for operating these machines are of the two-throw vertical type. They are built up on a cast-iron bedplate and are driven directly by chain gears from an electric motor. This arrangement gives a quiet and efficient drive, and is considered to be superior to the ordinary spur gear drive. Moreover, as the pump is mounted on a cast-iron bedplate it forms a compact and self-contained unit. Pumps built in accordance with this design are supplied in a large number of sizes. All the machines exhibited are connected up to pumps and can be seen under ordinary working conditions. Another type of hydraulic pump shown is suitable for working larger hydraulic presses. This is a horizontal two-throw four-plunger pump with fast and loose pulleys, the former acting as a heavy flywheel.

Progress in Magneto Manufacture.

Visitors who are interested in magnetos and lighting sets for motor cars should not fail to visit the BRITISH THOMSON-HOUSTON Co.'s stand which is to be found in the new hall. "Polar inductor type" magnetos are shown for eight, nine, twelve and fourteen-cylinder engines. The windings of these machines are carried on a stationary iron core built into the main body, resulting in a very strong form of mechanical and electrical construction. Four sparks per revolution are produced by the flux reversals induced in the stationary windings by the magnetic inductor. With the exception of the nine-cylinder magnetos, these machines are supplied for base or spigot mounting, the nine-cylinder magneto being designed for spigot mounting only. The company's magnetos for single, twin, V-twin, three, four and six-cylinder engines are rotating armature machines. Laminated iron pole pieces are die cast integral with the main housing and distributor end plate, a form of construction which ensures extreme accuracy in machining and assembly.

To ensure accurate spacing and form the contact breaker cams are machined from a continuous ring. The distributor wheel carries a rotary safety spark gap in order to eliminate ionisation of the air gap, whilst in order to prevent tracking and to provide a spark amplifier, the distributor is of the jump spark type. These magnetos are supplied either for house or spigot mounting. A modified form of this magneto for four or six-cylinder engines has movable laminated sleeves which give a range of advance and retard of 45 degrees. Other exhibits are impulse starters, lighting generators and "Sparklight" combined lighting and ignition sets.

Insurance and Repairs.

Users of electrical and other machinery should endeavour to pay a visit to the BRITISH ENGINE, BOILER AND ELECTRICAL INSURANCE Co.'s stand, which is on the gallery. The company's representatives will be pleased to give visitors any information they may require relating to insurance. Briefly, the company reduces the risk of breakdown to a minimum by employing expert engineers who make periodical examinations of the plant insured. As far as possible breakdowns are avoided by timely recommendations and adjustments. If, however, a breakdown occurs the company pays the cost of the repairs and sees that the work is promptly and properly carried out. A time loss insurance also covers the loss of profits and the standing charges due to the breakdown of plant. Generally the repair work is done by BRITISH ELECTRICAL REPAIRS, LTD., although if a client particularly desires that the work shall be carried out by another firm no objection is raised. Works belonging to British Electrical Repairs, Ltd., have been established at London, Manchester, Birmingham and Glasgow. These works have been specially built or acquired solely for the purpose of carrying out repairs to electrical machinery, and elaborate precautions have been taken to ensure cleanliness so as to avoid damage to insulation. At each of the repair works there is a vacuum impregnating plant, and a model of one of these plants is to be seen on the British Engine, Boiler and Electrical Insurance Co.'s stand. There are also photographs showing motors, etc., that have been wrecked on account of excessive speed, and samples of impregnated armature and freed coils.

A Stand for Wireless Enthusiasts.

Wireless enthusiasts should not fail to inspect the IGRANIC ELECTRIC Co.'s stand. The main attraction is the Hazeltine Neutrodyne receiver made by Hazeltine Neutrodyne Radio Sets, Ltd. The set is the outcome of the investigations of Prof. Louis A. Hazeltine, who has devised a method of balancing out the valve capacities. In operation the set is very stable, and it is non-radiating. There are four valves—two high frequency detectors and two low frequency, the first high frequency valve also being used as a low frequency amplifier.

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The outfit is therefore practically equivalent to a five-valve set. The set presents a very handsome appearance, and in view of its special operating properties it will in all probability become popular in this country. Other exhibits are frame aerials, timing coils and coil holders, filament rheostats, potentiometers, variometers, etc.

Wireless Apparatus.

A wireless installation for ships' lifeboats is shown by the MARCONI INTERNATIONAL MARINE COMMUNICATION CO. (Fig. 4). The wireless compartment in which the apparatus is placed contains a ¼ kW transmitter and a small petrol engine and alternator. A single stout wire supported by light spars in sockets attached to the stem and stern post of the boat serves as the aerial, the whole arrangement being very light. The spars will stand without rigging and can easily be erected whilst the boat is in the water. On a wave length of 600 m. the range of communication that can be established with an ordinary ship is not less than 50 miles. As the receiver has direction-finding properties it is possible, in the event of the boat getting into communication with a rescuing ship, for the boat to be able to guide the ship towards her, even if the ship is not provided with a direction-finding instrument. A powerful electric light fitted on top of the wireless compartment is available during the short periods when the engine is running. This light enables other boats belonging to the same ship to keep near the wireless boat at night and also forms a leading mark for a rescuing ship. On the assumption that it would be desired to transmit for ten minutes in the course of every hour it is estimated that one gallon of petrol would serve for about 90 of these transmissions.

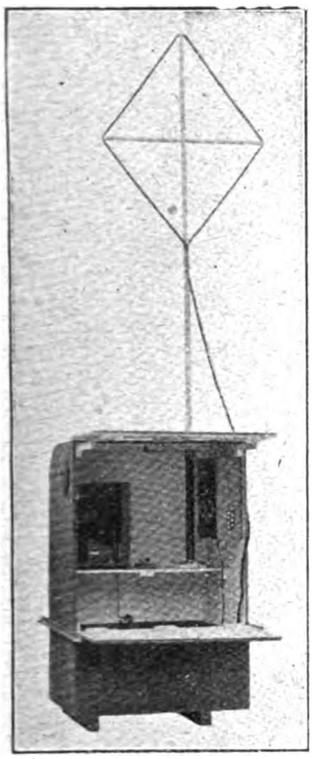

FIG. 4. MARCONI INSTALLATION FOR SHIPS' LIFEBOATS.

Besides this lifeboat wireless outfit, the Marconi International Marine Communication Co., is exhibiting a marine direction finder, a receiver for a rotating wireless beam, and a duplex telephone set.

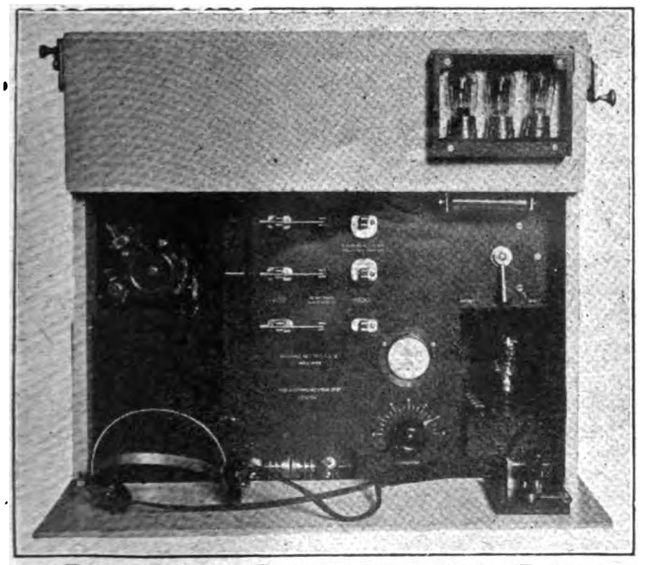

FIG. 5. ANOTHER LIFEBOAT INSTALLATION (RADIO COMMUNICATION CO.)

Another firm showing a wireless set suitable for use on lifeboats is the RADIO COMMUNICATION CO. (Fig. 5). This ¼ kW portable set is also designed to operate with an aerial suspended from two light masts, and the set can be tuned to suit aerials of widely different dimensions without loss of efficiency. The range obtainable will, however, be roughly proportional to the height of the aerial. The set is designed for transmission and reception on 600 and 300 m., the former wave-length being used to call up ships which are normally listening on 600 m., whilst the lower wave-length is employed when communicating with any particular ship, because the shorter wave-length then gives better results. The range of operation is fully 40 miles, and ranges of 60 miles can often be obtained. For securing these results an aerial about 30 ft. high and 20 ft. long is used. For operating the transmitter a ten-cell accumulator enclosed in a water-tight box is provided, and the battery has sufficient capacity to operate the set continuously for a period of six hours. Usually it is charged by means of a flexible lead connected to a water-tight socket fixed in a convenient position on the ship's deck. A canvas-covered box contains the receiver and transmitter. The front of the box is divided into two parts, one of which opens downwards and forms a support for the transmitting key and writing material, whilst the other opens upwards and serves to shelter the set from rain, spray, etc. The receiver has three stages of amplification, and the valves used are designed to operate at a low anode voltage, which is obtained from the transmitter battery.

(To be continued.)

The Electric Drive on Canals.

An Interesting New System.

The use of electricity for propelling canal boats has long been an ideal which nothing much has been done to realise, at any rate in this country. The reasons for this are not very far to seek. Canal transportation has fallen into a place of tertiary importance, so that the expense necessary to carry out the overhead and other equipment has not seemed worth while. Owing to the configuration of the canal it would not be possible to obtain a speed much greater than is usual with horse-drawn barges without danger to the banks, while the fouling of the propeller is likely to be an ever-present possibility. Nevertheless, the subject of the improvement of our inland waterways is a subject of great interest, especially in the Midlands, as will be evident when we say that the Shropshire, Worcestershire and Staffordshire Electric Power Co. carry over 100,000 tons of coal per annum by these means, and some research into the subject might well be repaid. This research the company has been conducting, and in conjunction with the Gill Propeller Co. have fitted a barge with an electrically driven hydraulic jet propulsion pump which gives good results both in speed and flexibility. No engine room is necessary, and the weight is only 24 cwt.

This equipment, which is now being tested on a length of canal near Kidderminster, consists of a 10 H.P. motor, which drives a jet-propelling unit. Apart from the necessary overhead lines for supplying the current, this equipment is self-contained and can easily be moved from one barge to another. Its essential features are that there is no propeller and no rudder, the jet which drives the barges acting instead according to its position. The operation is exceedingly simple, the motor being started or stopped by a foot pedal, and all the steering and manœuvring necessary is done from one position. If the barge goes aground it can easily be dislodged, the jet cutting the mud away, while as the jet drives astern under the boat there is no waste and no damage to the bank. The reversal of the jet acts as a brake. A cutter-bar is provided should the suction inlet become jammed.

All-Electric Houses.

Mr. A. F. Carter informs us that he and one or two other gentlemen, in conjunction with a well-known firm of builders, have been endeavouring to arrange for the building of an all-electric estate, and although Mr. Carter had been able to prove on paper that the actual cost of electrification covered the cost of chimneys, fireplaces, etc., and that financially the thing was quite sound, a letter, from which the following is an abstract, has been sent to him by a partner in the building firm referred to: "I am very sorry that both Building Societies refuse to do anything in the matter with regard to electrically equipped houses, although I included chimneys and fireplaces."

The streets of CORWEN (Lancs.) will be lit electrically for the first time to-morrow (Saturday). The local electric supply company offer to supply electricity for street lighting during the winter months for £70.

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A 10 000 A Oil Circuit Breaker.

Special Design for a Textile Mill.

What is claimed to be the largest oil immersed circuit breaker in the world was recently constructed by FERGUSON, PAILIN, and has been in successful operation in a textile factory in Scotland for the past seven months. It is capable of controlling 7 150 kVA at 525 V and a frequency of 50, and, therefore, has a current carrying capacity of 10 000 A at that periodicity or of 12 000 A at a frequency of 25. The genesis of this switch has been necessitated by the comparatively low working pressure which is convenient when a large number of small units are concentrated close to the generating station.

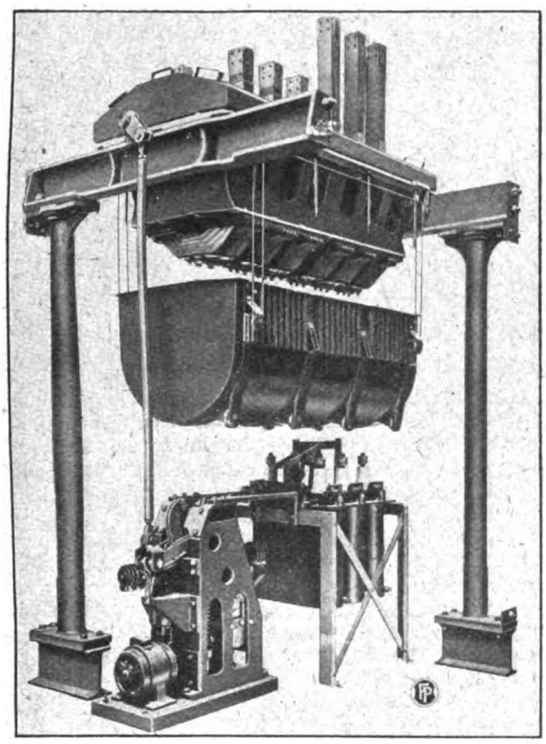

FIG. 1.—SWITCH AND OPERATING GEAR WITH TANK LOWERED.

It need hardly be said that the design of such a large circuit breaker has been a formidable problem on account of the heat developed due to self and mutual induction and the skin effect. As is well known with very heavy currents the strong magnetic field about the conductors sets up considerable heat if there are a large number of joints, while the distorting effects of such currents under short circuit conditions require that a mechanical design of proved rigidity be used.

In this particular switch these problems have been dealt with as follows:

Overcoming Difficulties in Design.

The current carrying parts have been split up into small sections not only to reduce the skin effect losses but to allow the oil to percolate through the mass of metal. In order to neutralise as far as possible the external magnetic fields the main breaker is divided into two sections, the three phases in each section being kept together. This virtually makes the unit into two 5 000 A three-phase sections operating together on one common shaft. The number of joints in the conductors have been cut down to a minimum. The connections leading in and out of the switch are brought right through to the copper blocks, which form the fixed contacts, and no screwed studs or nuts are relied upon for carrying current. In order to withstand the magnetic forces set up on short circuit the conductors are strongly braced and are held rigid from the main frame.

General Principle of Breaker.

As in other circuit breakers made by this firm, two circuit breakers operating in parallel are provided: a main breaker carries the current and a snap breaker performs the opening and closing operations. The necessity for this is at once apparent when the weight of the main moving element (more than half a ton) is mentioned. For it would be impossible to obtain sufficient acceleration of this heavy mass to give a safe and effective break on the main switch without the expenditure of a high operating power. The snap breaker is therefore arranged to make circuit first and break circuit last so that it is only necessary to provide a short break on the main breaker. The result is that in closing, the heavy mass is moved through a short distance whereas the light mass is moved through a long distance, thus reducing the operating power. The timing arrangement between the main breaker and snap breaker is quite definite, and there is no possibility of them operating in incorrect sequence. Fig. 1 shows the two breakers and the motor operating gear.

Details of Main Breaker.

Turning to details of design the complete breaker is supported from one main casting of non-magnetic material. This frame supports the fixed and moving elements, the operating mechanism, etc. The connections leading in and out of the breaker are of the laminated strip type, the individual laminations being 4 in. by $\frac{1}{8}$ in. section. These lead right through the breaker and are sweated and riveted into solid sectionalised copper blocks, which form the fixed contacts. The breaker contacts are mounted on the under-side of the main frame, and are insulated with bakelite. Arcing contacts are provided on both the fixed and moving elements, and the moving contacts are lifted by means of four cams and rollers, the cams moving through 180 deg. in order to get as small a gradient as possible, a bearing forming part of the main frame being placed near to each cam. The four cams are keyed to the main shaft on which there is also fixed at the driving end a segment gear wheel, which engages with a driving wheel keyed to the external operating shaft. The latter takes the remote operating lever and moves through 90 deg. only, the above gearing converting this motion into 180 deg. movement. The four cams operate on to rollers mounted on roller bearings, which are fixed to heavy cross bars; these carry the lifting rods for the moving contacts. The cam shaft and all the moving mechanism, with the exception of the external operating shaft runs under oil, ensuring very sweet working.

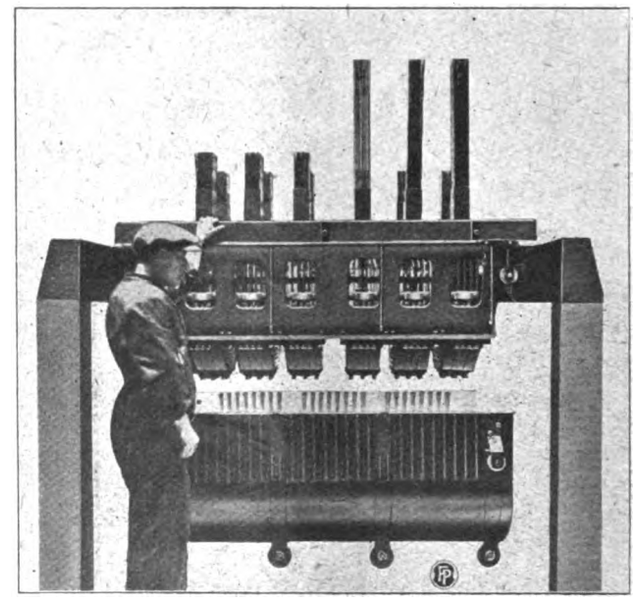

FIG. 2.—VIEW OF MAIN BREAKER.

The main tank is built of strong sheet brass plates. It is semi-cylindrical in shape, and is fitted with ventilating fins, and circumferential reinforcing pieces, which carry the wheels for transportation, a suitable worm and wheel being provided for lowering. The main breaker is shown in Fig. 2.

The Snap Breaker.

The snap breaker which works in parallel with the main breaker is a standard 1 200 A unit of high rupturing capacity. The connecting conductors between it and the main breaker

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are so arranged that any attractive or repulsive forces occurring on short circuit tend to bend the conductor on edge.

Motor Operating Gear.

Local conditions in this particular instance did not permit of direct current closing solenoids being used and motor operating gear was resorted to and is illustrated in Fig. 3. In this equipment the electric motor is connected through a reduction gear on to a worm and pinion. This rotary motion is translated into a vertical up and down movement by means of a crank, and it is this action that compresses the main closing springs. These springs are held in compression by means of a catch lever, and when it is required to close the switch a push button is operated on the control board, which

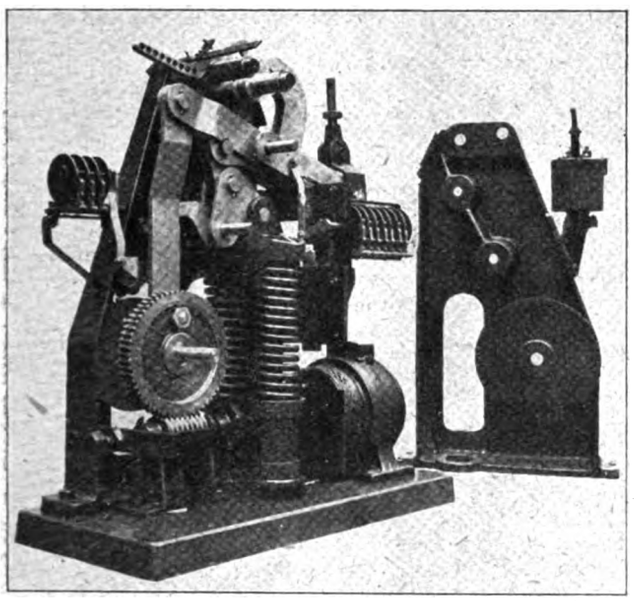


FIG. 3.—THE OPERATING MECHANISM.

makes the circuit through a solenoid device, which, in turn, trips the catch lever. Directly this is done the stored energy in the springs is thrown on to the main operating rod closing the breakers very rapidly and in correct sequence. When the breaker is closed a small contactor device restarts the closing motor, which again compresses the springs, these being held in that position by the catch lever. In the event of the switch being opened it is only necessary to operate the push button on the control panel, and the main springs will unload, reclosing the breakers. The decided operation given by this apparatus is absolutely necessary as the breaker is required for sychronising purposes. Provision has been made for hand operation in the event of failure of the motor or the supply.

Electrically Driven Ice Making Plant.

The ammonia ice-producing plant recently installed by the Aberdeen Steam Trawling and Fishing Co. presents many points of interest to those connected with this branch of engineering, and to electrical engineers as well, seeing that the compressors, the circulating pumps for brine, the ammonia and condenser cooling water, the overhead travelling crane, and the ram device which pushes the rows of cans from front to rear of the tank during the freezing process, are all electrically driven. We understand that this is the first plant in the north of Scotland to be so equipped; and that the machinery is the largest and fastest of the kind yet erected in Great Britain.

The complete installation was carried out according to the specifications and under the personal supervision of Mr. D. MacBride, Consulting Engineer, Glasgow, who specialises in this type of work, and to whom we are indebted for the following particulars:—

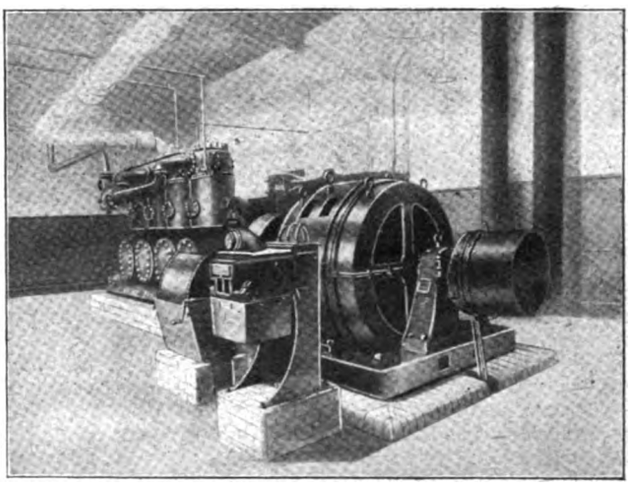
Details of the Equipment.

The ice-producing plant consists of two separate and independent units, each capable of producing seventy-five tons of ice per diem. The compressors, which are of the quick-revolution type, are single-acting, each machine having four cylinders, the compressor heads being water-jacketed. All valves are of the light ring-plate pattern, with safety devices to prevent the moving parts from falling into the cylinder. Both the valves and their seats may be easily removed without disturbing any motion-work or pipe-work. The gland is of the rotary type and owing to its being under low pressure and also subjected to a permanent positive oil-pressure due to its being incorporated in the forced lubrication system, it is practically immune from trouble. Scraper rings in the skirt of the trunk piston, combined with an ingenious design of oil separator, prevent the passage of oil into the ammonia system. The compressors are fitted with a byepass arrangement whereby they may be started up to all intents and purposes unloaded.

Motor Design.

Each of the two machines is direct-coupled to a Brush induction motor of the pedestal type, which is illustrated herewith. These motors have pedestal bearings lubricated by means of oil rings, and totally enclosed slip-rings. A short-circuiting and brush-lifting device is also fitted. The latter is simple and positive in action, only one movement being required for short-circuiting and brush-lifting. The arrangement is such that it is impossible to open the rotor circuit until the brushes are on the rings. Each motor is controlled by an oil circuit-breaker and a Brush liquid rotor starter, which is capable of starting the motor once in every four hours against two-thirds of full load torque. Running at 230 revs. per min. on a three-phase, 50 cycle, 400 V supply, each motor develops a normal output of 250 B.H.P. It was found necessary to adopt a special form of winding for these motors, as on account of the low running speed it was not easy to reconcile the requirement of a good power-factor and a high pull-out torque. Each motor is capable of withstanding 25 per cent. overload for two hours without stalling, injurious heating or mechanical damage. By the installation of these motors instead of the usual steam engine, a great economy of space has been effected, further, the flywheels of the compressors were greatly reduced in size owing to the large amount of kinetic energy developed by the massive rotors of the induction motors. The whole of the electrical equipment in connection with the compressors was supplied by the BRUSH ELECTRICAL ENGINEERING CO.

That this system of direct electrical drive, with its conservation of power which would otherwise be lost in shafts,



AN ELECTRICALLY DRIVEN COMPRESSOR FOR ICE MAKING.

belts, etc., together with the comparative cheapness of electric power, is appreciably economical in the matter of running costs is amply demonstrated by comparison with a steam-driven plant in the same district. Even under such favourable conditions as a steam consumption of 12 lb. per I.H.P., boiler evaporation of 8 to 1, with coal at 32s. per ton, the economy of the electrical drive of main compressors and all auxiliaries is most marked.

Mons. A. M. Loth's "ELECTRIC PILOT," consisting of a sunk cable which gives out impulses that enable a navigator to keep an accurate course, has been tried for some time at the Norwegian naval station at Horten, in the Christiania Fjord, by a number of naval experts, and the experiments have shown that the invention is most successful and will have far-reaching effects.

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Electricity and the Home Journals.

A Field Where More Might Be Done.

A feature of present-day domestic life (indeed some people would say the feature) is the difficulty of obtaining servants, added to which there is the difficulty of keeping them when obtained. This feature is for various reasons particularly evident in the "one servant" home, and a direct result is that the housewife has to do more of the domestic work herself than was formerly necessary. Not unnaturally she wishes to do this as effectively and quickly as possible, and an indirect result has been the creation of a number of journals containing hints and articles on how the daily toil may be alleviated and the beauty and comfort of the home increased. Most of these are well arranged and well edited publications, and in the words of the old *cliché*, doubtless fill a long felt want.

The Best Aid for the Housewife.

Believing as we do, however, that the best aid for the harrassed housewife is electricity, we are naturally interested to see how far these journals realise this, and how far they contain information about electrical equipment which, while extenuating nought and setting down nought in malice (especially on the question of price), will really be useful to their readers. A survey of the current issue of several of these magazines show that they are not doing so badly, though they might do more. If they are really to lead domestic policy and bring about improvements in housing conditions they must keep acquainted with the latest progress and realise that development will mean an entire change of method.

Keeping House with Electricity.

For these reasons we are glad to see that the current number of "Good Housekeeping" has an article by Mr. R. Hardie, of the Glasgow Electricity Department, on "Keeping House with Electricity." In this he shows that electricity in the home is not the prerogative of America, as some people seem to think, but that Glasgow is giving its citizens a chance of using the most modern of domestic aids at a very low cost. He describes the Glasgow all-electric houses and gives a useful list of electrical equipment that should be in every house. A balance sheet tells its own tale. "To-day's demand on the part of women for an alleviation of housework is topical," says Mr. Hardie. "Towards this elimination of drudgery electricity offers immediate aid."

Lighting and Decoration.

"House and Garden" contains no articles of direct electrical interest, but the illustrations to Prof. A. E. Richardson's contribution on "The Regency Interior and Decoration" show how chandeliers and candelabra of the period can be adapted for use with the electric light. Incidentally such decorations will be more lasting where modern methods of decoration are used. The same comment is applicable to the photographs of interiors which are to be found on pp. 89-91.

The Universal Lighting Factor.

"The Ideal Home" is quite an electrical issue. In the course of some eighty editorial pages it has several articles of direct electrical interest, while others contain hints, more or less broad, which may well be taken. "Lighting the Dinner Table," by Mrs. Robert Noble, and "Lighting by Electricity," by Miss Sybil Lane, both show how artistically and efficiently electricity can be used for these purposes. Mrs. Noble rightly stresses the importance of proper shading, while Miss Lane emphasises the flexibility and convenience of electricity as "the universal lighting factor." In "Heating by Electricity," Miss Edith Grey calls attention to its cleanliness, efficiency, economy and portability, and points her argument by many excellent illustrations. "From the woman's point of view," she says, "the claim which probably appeals most is the ease with which warmth can be produced and the certainty with which the consumption of current can be controlled." She effectively disposes of the cost bogey. In "Electric Cooking," by Mrs. Constance Creedy, some useful hints on the use of the equipment is given, and some typical modern apparatus is illustrated, and the same applies to "Self Contained Lighting Sets," by Mr. R. J. Pinnock and to Miss Gwynne Howell's "Good Housekeeping," and altogether an issue that should do useful work in the electrical cause.

"Homes and Gardens," on the other hand, illustrates the too prevalent neglect of electricity as a domestic aid. Both in the articles and in the hints on the budget its very existence seems to be ignored.

Transatlantic Communication—A New Link.

Shore End of World-Largest Cable Landed at Weston.

On Saturday last the COMMERCIAL CABLE CO. landed the shore end of what is described as the world-largest cable at Weston-super-Mare. The work should have been carried out some days earlier, but was delayed owing to heavy weather. On Saturday the conditions were ideal. On this page and on on the next, we give photographs of the operation which, besides being of electrical interest, indicate that the free show provided by the company was fully appreciated by the holidaymakers.

The actual landing of the cable was effected from a lighter which, conveying some miles of cable, was towed from the "John W. Mackay" to a point in Sand Bay opposite the company's offices in Richmond Street. A trench which uncovered the existing cables was dug down to low-water mark, and a hawser attached to a traction engine was attached to the new cable on the lighter. The shore end was then drawn in. All these operations are shown in our photographs. Finally the sea cable was connected to the land cable, flags were unfurled and congratulations passed between Commander F. H. Larnder, captain of the "John W. Mackay" and Mr. H. F. Russell, the British manager of the Commercial Cable Co.

We understand that the American end of this cable was successfully landed on Wednesday, August 29th at Far Rockaway, Long Island, from the "Faraday," which afterwards left for Nova Scotia to lay the Far Rockaway-Canso section, a length of about 1 000 miles. The "Colonia" is on her way

GENERAL VIEW OF THE LANDING OPERATION.

to Canso to lay the cable between that place and the Azores, a distance of 1 750 miles, whence connection will be made *via* Waterville to Weston. The "John W. Mackay" is now laying the Weston-Waterville cable.

The cable is capable of transmitting 600 letters per min. in each direction, and has, therefore a capacity nearly twice that of any existing cable of equal length. In its manufacture 4 000 000 lb. of copper, 1 800 000 lb. of gutta-percha and 80 000 miles of iron and steel wire have been used. The total cost of manufacture and laying will amount to some £2 000 000. The cable is entirely of British manufacture.

The Earthquake in Japan.

The Fire Danger and a Hint for Rebuilding.

While the earthquake started the havoc and distress in Japan, it is evident that much of the subsequent damage has been caused by fire. Airmen who have flown over the stricken cities of Tokyo and Yokohama report dense clouds of smoke, and as the usual type of building is of flimsy construction, it is evident that once a conflagration starts irreparable damage may be done. There appears no doubt that this damage has been much increased by the use of coal fires and gas for lighting, and it would be interesting to speculate how far the greater employment of electricity would have minimised the damage. Gas is a safe enough agent up to a point but, as railway accidents in this country and earthquakes elsewhere have shown, it can in certain cases do much to add to the horrors of wreckage and fire which are inseparable from such disasters. In rebuilding their cities, we hope our Japanese allies will bear this in mind and give a lead in electrical development that is badly needed.

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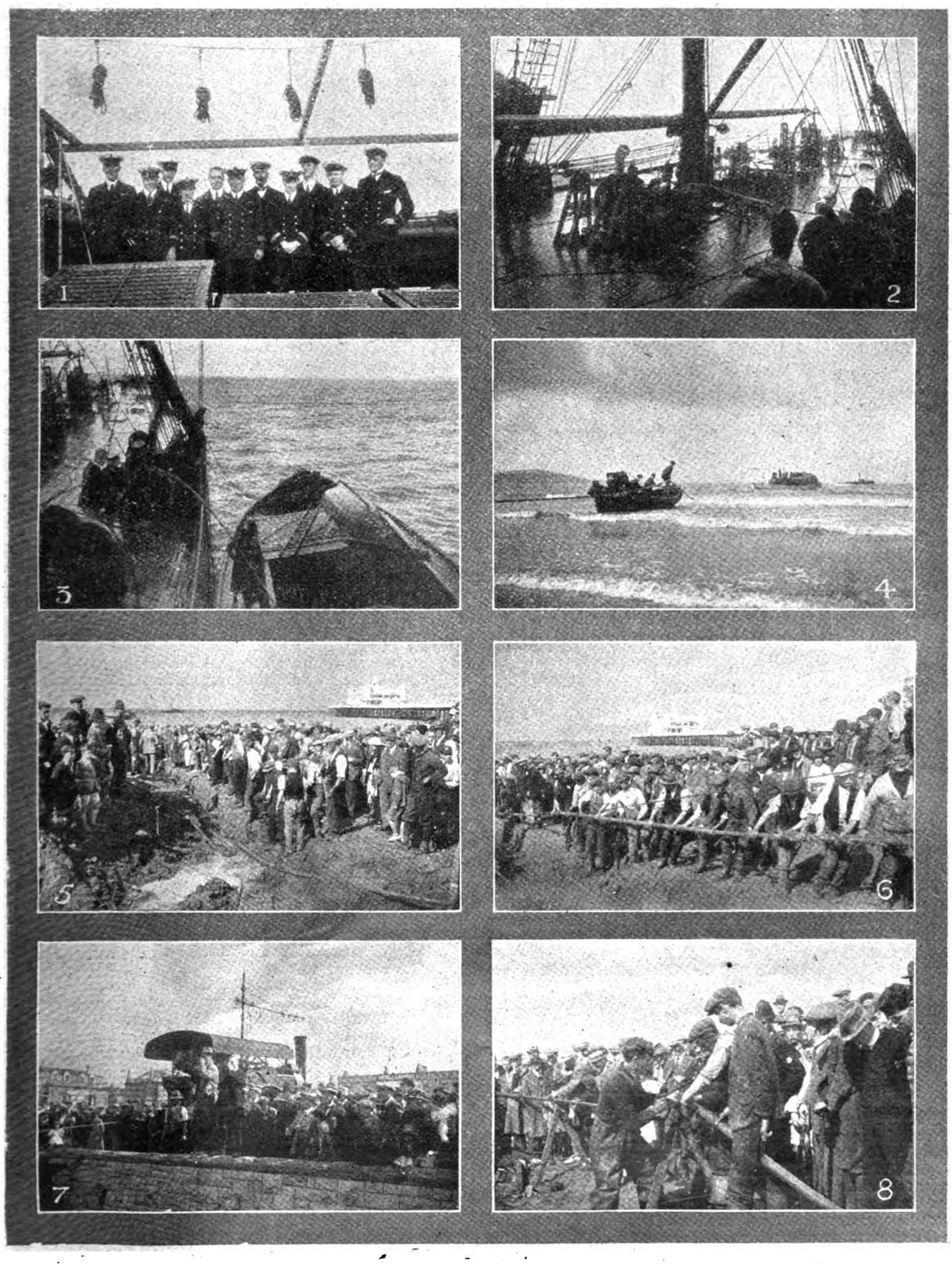
Transatlantic Communication.

Landing the Shore End of the New Long Island-Weston Cable.



1. *The Captain and Crew of c.s. "John W. Mackay," the laying vessel. On board the "John W. Mackay"; the Cable coming up from the Tanks.—3. The Cable going over the side into the Lighter.—4. The Cable being brought in.—5. The Crowd Waiting for the Cable to be Landed; two of the existing Cables are shown uncovered.—6. "All Together, Heave."—7. The Traction Engine and an Interested Crowd.—8. Preparing for the Splice.*

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Reviews.

Automatic Telephone Systems. Vol. II. By Wm. Aitken. (London: Ernest Benn, Ltd.) Pp. xiii.+227. 35s. net.

It is two years since the first volume of this work appeared and developments during this period have been such that the author has felt constrained to split his remaining material between two volumes, of which the first—Vol. ii.—is now to hand.

In attributing the delay partly to the fact that certain important systems are not yet sufficiently advanced for publication of their details, and partly to the intricate and exacting character of the diagrams, the author expresses the hope that Vol. iii. will follow shortly.

The present volume deals in detail with apparatus at subscriber's premises, including extensions, modifications necessary to manual P.B.X.'s when working in an automatic area, and private automatic installations. There are also sections dealing with Siemens Village Automatic System, the Automatic Telephone Manufacturing Co.'s Community Exchange, various types of branch and satellite exchange and the like. It will be noticed that the important subject of trunking and descriptions of systems suitable for the largest areas (such as the Ericsson, Director, and Panel systems) are left for Vol. iii.

A few sections at the end of the present volume are supplementary to Vol. i. Perhaps the most interesting of these is No. 62, describing the British Post Office Dial No. 8, also known as the Standard Dial. This represents the first step of any magnitude towards standardisation that has yet been made, at any rate in this country. The advantages of this course are briefly set forth in the book, but the remainder of the volume unconsciously emphasises, as did Vol. i., the need for further standardisation, and should be seen by every Telephone Administration in the world. The variety of facilities which are provided to meet the varying requirements of subscribers are well known, and when these have to be provided for some half-dozen systems, the resulting complication largely accounts for the size of the present volume. It can readily be imagined that, in the present state of the art, the amount of time, thought, and ingenuity spent in providing these and other facilities for so many systems might with advantage be used for the further improvement of one standard system.

Little need be said about the work in addition to what has been said regarding Vol. i. The outstanding feature is the treatment of diagrams, which are again very carefully and clearly prepared. In the preface the author refers to the fact that one firm uses a different form of diagrams from the ordinary, and that his conversion of these to the ordinary form has not found favour. Some diagrams have been reproduced in both forms to enable readers to judge for themselves. Apart from the fact that most engineers prefer the form which they learned, the choice of form depends on the object in view. For tracing connections easily (as, for instance, in dealing with a fault) there seems to be no doubt that the "unusual" or "detached contact" method is preferable (see Figs. 85 to 90 of the book). For learning circuits most people will probably prefer to have relays and contacts together, but the need for this is less when circuit descriptions are available.

As regards the text, it is noticed that in many places the descriptions are not so clear as could be wished. This makes reading rather difficult, though the information given will be found very complete when it has been digested.

The present is a useful companion to Vol. i. G. F. O'Dell.

Dictionary of Applied Physics. Edited by Sir Richard Glazebrook. Vol. III., Meteorology, Metrology, and Measuring Apparatus. (London: Macmillan and Co.) Pp. vii.+839. 63s. net.

For the mechanical engineer, including, of course, the electrical engineer, the most important article in this volume, of which it occupies just a hundred pages, is "Gauges," by F. H. Rolt. After describing some of the more common types of limit gauges employed in workshop practice and of the standard gauges used both for testing limit, and other workshop gauges, and as standards for comparison when making accurate measurements, the author describes the general methods of measuring the commoner types of limit gauges. He then passes to the measurement of standard gauges and the measuring machines employed. The measurement of plug screws and ring screws is dealt with very fully. Details are given of the more important types of screw threads. Optical methods of gauge testing are then described, followed by descriptions of the more important machines employed in testing standard gauges, and the manner of their use. Finally, the more commonly used workshop measuring instruments are described. Metrology (the accurate measurement of mass, length, time and their direct derivatives), sections VI. to VIII., Industrial Metrology, Screw Threads and Cylindrical Fits, may be taken as supplementing the section on gauges, while Metrology, section X., Drawing Office Conventions, together with the article, Draughting Devices, will appeal to the drawing office. Metrology, section V., Conditions of Observation may be taken with advantage by the research department as an introduction to the article, Observations, Combination of. The article, Instruments, Design of Scientific, by Sir Horace Darwin and C. C. Mason, although all too short, will be of value to the research department when special apparatus has to be devised, however rough and temporary, in insuring the consistency of its readings.

The article on Nomography, by S. Brodetsky, deserves special attention from research departments. Its aim is to introduce the reader to the main ideas and principles of alignment charts, with some applications and extensions. It will be seen that even in some cases where the relations of only two variables are to be graphically represented it may be found superior to the ordinary Cartesian method. The article Integration, Mechanical Methods of, should also be noted by research departments, and particularly the note on the superior accuracy of Gauss's rule to the better known Simpson's rule for the estimation of the area enclosed between the x axis and a given curve. They will also find much valuable information in the articles on Volume, Measurements of, Clocks and Time Keeping, Balances, and Barometers and Manometers.

In the article on Meters, the sections Speed Indicators and Steam Meters will appeal to mechanical engineers generally. In the article Weighing Machines a progressive cost department will find suggestive notes on recent developments in labour-saving and time-saving weighing devices. The Radio Electrical Engineer will find the articles Atmospheric Electricity and Atmosphere, Physics of the, of practical value.

Of the remaining more important articles, space limitations prevent more than an enumeration. With the exception of three, Calculating Machines, Alcoholometry and Saccharometry, which are of specialist appeal, they fall naturally into two groups:—

(1) Engineering Surveys.—Comparators; Line Standards of Length; Map Projection; Latitude, Longitude and Azimuth by Observation in the Field; Surveying Tapes and Wires; Trigonometrical Heights and Refraction.

(2) Physiography.—Air, Investigation of the Upper; Atmosphere, Thermodynamics of the; Earth, the Mean Density of; Earthquakes and Earthquake Waves; Seismometry; Gravity Survey; Oceanography, Physical; Tides and Tide Prediction; Humidity; Hydrometers; Meteorological Instruments; Meteorological Optics; Radiation (Meteorological).

G. W. de Tunzelman.

Special Steels. Chiefly Founded on the Researches of Sir Robert Hadfield. By T. H. Burnham. (London: Sir Isaac Pitman & Sons). Pp. 193. 5s. net.

Sir Isaac Pitman and Sons have added to their handy little series of "Technical Primers" a double volume dealing with special steels. The book has been compiled by Mr. T. H. Burnham from the researches of Sir Robert Hadfield, Bart., F.R.S. It will doubtless serve its purpose, although the attempt to deal with a subject like this within a compass of 165 pages (the rest of the book being bibliographical) is not an easy task, and much that is of value must necessarily be left out. Sir Robert Hadfield has been an indefatigable labourer in the metallurgical vineyard, and modern metallurgy owes him far more than it either knows or suspects. He has also the gift of investing even a difficult subject with lucidity and style. Some information of considerable value has in the present volume been skilfully condensed, and the principal alloy steels are concisely described. The list of Sir Robert's published papers at the end will enable those who want more readily to find it, for it may safely be said that the original papers contain nearly all that the worker needs to know as to the treatment and properties of the alloy materials described.

L. P. Sidney.

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The British Association.

Physical and Engineering Papers of Electrical Interest.

As already announced, the ninety-first meeting of the British Association will be held at Liverpool from September 12th to 19th. This is the fifth time the meeting has been held in that city. On the first occasion, 1837, Faraday was president of Section B (Chemistry), while on the third occasion, 1870, Clerk Maxwell presided over Section B (Physics). At the fourth meeting, 1896, Prof. (now Sir J. J.) Thomson was president of the same section, Sir Ernest Rutherford, this year's president, being joint author with him of one of the Papers read.

In the Section A (Physics) Programme there is not much of direct electrical interest, but Papers on "Series of Magnetic Disturbances," by the Rev. A. L. Cortie, S.J.; on "Some Effects of Alternating Current Magnetism," by Mr. W. M. Mordey; on "The Frenophone," by Mr. S. G. Brown; on "The Structure of Atoms and their Magnetic Properties," by Prof. P. Langevin; and on "The Effect of Weak Magnetic Fields on the Polarisation of Resonance Radiation," by Prof. R. W. Wood and Dr. A. Ellett, will be read.

In Section G (Engineering) the Presidential Address will be delivered by Sir Henry Fowler on "Transport and its Indebtedness to Science." Papers of electrical interest that will be read include the following: "The Future of Railway Transportation," by Col. H. E. O'Brien; "A Broad Outlook on the Future of Transport and its Past Obligations to Science," by Mr. A. T. Wall; "Recent Developments in the Application of Wireless Telegraphy to the Mercantile Marine," by Capt. J. A. Slee; "On a Method of Improving the Shape of the Voltage Wave of Alternators by External Means," by Prof. E. W. Marchant and Mr. T. H. Turney; "On the Currents Flowing between the Earth Neutral of an Alternator and the Earth Sheath of the Cable System," by Prof. E. W. Marchant; "Electric Ship Propulsion," by Mr. F. H. Clough; "Conversion from Alternating Current to Direct Current by Means of Mercury Arc Rectifiers," by Mr. R. L. Morrison; and "Squirrel Cage Induction Motor with High Starting Torque and Low Starting Current in the Line," by Mr. T. F. Wall.

"No-Mag" Non-Magnetic Cast Iron.

The steady march of progress in the design of electrical machinery and apparatus is occasionally accelerated by the discovery of some material permitting greater economy or efficiency than hitherto attained. The introduction of "No-Mag" gives designers another opportunity of improving the efficiency of their machines. As already announced by us, this material has been placed on the market by FERRANTI, LTD. It combines exceedingly low magnetic permeability with relatively high specific resistance, as shown by the following figures:—

	Magnetic Permeability. Maximum	Specific Resistance. Micro-ohms per cm. cube.
Ordinary Cast Iron ..	330·00 ..	95·0
"No-Mag"	1·03 ..	140·0
Brass	1·00 ..	7·5

Its temperature coefficient is low, being 0·0009 per deg. C., as compared with 0·0019 per deg. C. for cast iron.

No other metal yet discovered gives such freedom from hysteresis and eddy currents. In addition to its electrical advantages, "No-Mag" possesses greater toughness and malleability than cast iron and these qualities combined with its high resistance render it particularly suitable for resistance grids. "No-Mag" is cast and machined with the same facility as ordinary cast iron and costs 4½d. to 7d. per pound, according to the size and shape of the castings. It can also supplied in the form of pig iron.

British Standardised Steel Samples.

Some Sources of Supply.

In connection with the British standardised steel samples issued jointly by the Iron and Steel Institute and the National Physical Laboratory it is announced that the standards at present available are:—No. 1.—Sulphur (S.=0·027 per cent.); No. 2.—Sulphur (S.=0·071 per cent.); No. 3.—Phosphorus (P.=0·029 per cent.); No. 5.—Carbon (C.=0·65 per cent.) Acid O–H Steel; No. 6.—Carbon (C.=0·10 per cent.) Basic O–H Steel.

These samples are supplied post free, at 21s. per bottle containing 50 gm., together with a certificate of standardisation. They can be obtained, by sending order with remittance, direct from:—The National Physical Laboratory, (Metallurgy Dept.), Teddington, Middlesex, or by post or personal application from: Dr. C. H. Desch, Dept. of Applied Science, The University, Sheffield; Dr. C. A. Edwards, The University College, Swansea; Col. E. L. Johnson, Cleveland Technical Institute, Middlesbrough; Mr. D. A. MacCallum, West of Scotland Iron and Steel Institute, 93, Hope Street, Glasgow. These samples can also be obtained from all chemists dealing regularly in laboratory ware. Other samples are in preparation and will be issued when ready.

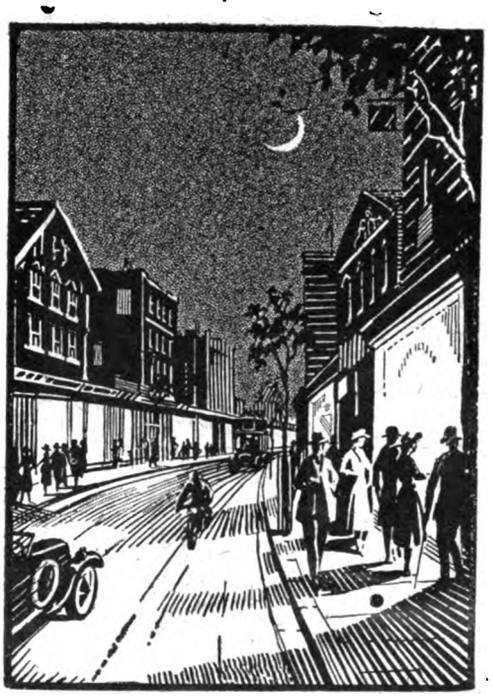
Reduced Price of Gasfilled Lamps.

In connection with the reduction in the price of gasfilled lamps mentioned in our Editorial Notes the BRITISH THOMSON-HOUSTON Co. are issuing a window bill to the trade. This consists of a clear and striking comparison of the old and new prices. As is well known, the company are pioneers in the art and practice of selling light. They propose to continue this pioneering by advertising what light is and does and how it can be employed artificially with the aid of the Mazda lamp—*bien entendu*. In the first advertisement of the series they have seized on the fact that on September 16th we shall return to winter time, and one hour's more darkness will have to be made visible somehow or other. The whole production is in fact the first of a series of short articles upon light, which is to make up the firm's advertising campaign for 1923. This is the right way to go about things and we hope the trade will show their appreciation by making full use of this interesting information.

Later Shop Window Lighting.

Some Attractive Advertisement Designs.

In our last issue we announced that the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION had prepared a number of advertising designs which will be used in connection with a campaign for later shop window lighting which is now being launched. An example of one of these designs is given herewith. The illustration will be flanked by some attractive letterpress with the title "Make Your Window Work Overtime," and suggesting that as the shop window



ONE OF THE DESIGNS WHICH B.E.D.A. WILL USE IN THIS SEASON'S LATER SHOP WINDOW LIGHTING CAMPAIGN.

is the best advertisement for the retailer it might be kept in action after the shop is closed. Two other designs emphasise the same idea. The lesson which contractors and supply authorities have to learn from this is that electricity is the cheapest light and the best advertisement. It should be their object to see that shopkeepers, for their own good, use it more and more.

Generation of Electricity in Great Britain.

The ELECTRICITY COMMISSIONERS have issued their analyses and summaries of the returns of fuel consumption and kilowatt hours generated made to them under the provisions of Section 27 of the Electricity Supply Act (1919) and of the returns furnished by railway and tramway authorities and by certain non-statutory undertakings. These analyses, which contain a number of figures and comparisons highly interesting to those connected with the electricity supply industry, are commented on in our leading article on p. 238. They are published by the Stationery Office, and can be obtained either direct or through any bookseller at a price of 1s. 6d. net.

An American dental company which uses three-phase ELECTRIC OVENS FOR JAPANNING the metal parts of its apparatus, reports, according to the "Engineer," that since electricity was substituted for gas in order to ensure a high finish the number of rejections due to imperfect baking has fallen from 20 per cent. with gas to less than 4 per cent. The cost of operation is about the same as with gas, but the temperature is automatically kept constant, and the baking time is less, resulting in increased output. Some of the ovens measure 7 ft. by 7 ft. by 7 ft., and can deal with two truckloads of material simultaneously.

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Merchandise to Sell and Profit By.

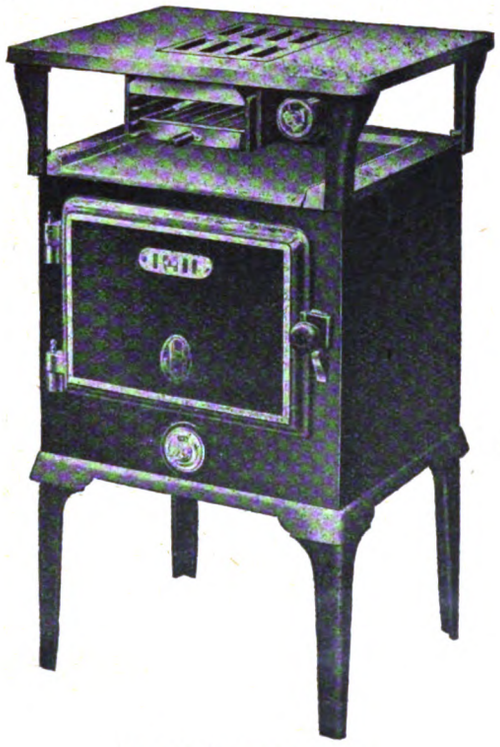
In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

The Progress of the Years.

It is but a short few years ago that supply engineers, contractors, retailers, and, in fact, all interested in the development of cooking by electricity, used to view and discuss with envy the active development of cookers in U.S.A. How attractive were the designs! How slow were the English manufacturers! It is recognised now, however, that English manufacturers are well to the fore, if not in front, and particularly is this so with the JACKSON ELECTRIC STOVE CO. Their latest No. 18 cooker is further proof of this, if further proof is necessary. The total loading of the complete cooker is 2·5 kW, and it is designed for houses and flats sheltering small families. This cooker is strongly constructed in



AN ALL-BRITISH COOKER.

cast iron and steel; the oven, which is loaded to 1 200 W, has three-heat regulation by means of a switch attached. The cooking space is 10 in. high by 13 in. wide by 13 in deep. The hob, constructed in cast iron with ground and polished top, is 20 in. wide by 14 in. deep, and contains one combined grill-boiling plate loaded to 1 300 W. This cooker, in conjunction with a 3 pint kettle, will meet the requirements of a family of three to six persons, depending, of course, on the class of cooking undertaken. It is constructed on the same substantial lines as other Jackson models, and is therefore suitable for hire purposes by supply authorities. The list price is £13, and, as usual with Jackson cookers, the hob or oven, being self-contained, can be supplied separately and mounted on a table.

Equiluxo Glassware.

Equiluxo glassware is so well known that it would seem unnecessary to refer to it in these columns, particularly as it has proved a line of profitable merchandise to many contractors and retailers. The desirability of providing efficient reflectors or bowls for the reduction of glare and for obtaining the most economical distribution of light is too well known and appreciated to call for further emphasis. A very definite problem arises, however, where decorative effect as well as satisfactory illumination is called for, as the ordinary plain opal shades and bowls, excellent as they may be for purely utilitarian schemes, are generally out of keeping with anything but the plainest decorations. Of late, however, prices for "open bowl" fittings have become so keen that there has been a tendency to use the plain opal bowl in almost every design of fitting and in almost every position.

Equiluxo is a milky white glass, the standard forms being considerably thicker than the usual opal glass shades and bowls. The glass has an appearance of robust and solid construction which, however, is not attained at the cost of undue absorption of the light. A full range of reflectors and shades with Doric flutings is obtainable, these being of both the concentrating and distributing type. Hemispheres are supplied with both Doric and Georgian flutings, while bowls and dishes of attractive shapes in many special

THE LATEST IN GLASSWARE.

designs are also listed. The most popular of all the Equiluxo series is the Doric glass lighting unit which we illustrate.

It is hardly necessary to state that the GENERAL ELECTRIC CO. are the sole suppliers of the Equiluxo glass. In their new leaflet (No. F. 3069) considerable reductions in prices are announced and a very favourable opportunity is thus presented to renew stocks in readiness for the coming lighting season.

Heat by Radiation.

There are very few men in the industry who are satisfied that we have reached the *ultima thule* in apparatus for heating by electricity. We still have much research work before us; many hopes have to be enjoyed and many fears suffered before finality is reached. Contractors and retailers must naturally follow the development and closely study the merchandising possibilities of any new device. It is for this reason that the radioelectric panels manufactured by GRIERSON, LTD., may be briefly referred to in this column. As is well known, heat may be distributed by three methods: (*a*) conduction, (*b*) convection, (*c*) radiation. It is the latter method that is principally employed in these patented radio-electric panels. We illustrate a tapestry screen which is but

AN ARTISTIC SCREEN HEATER.

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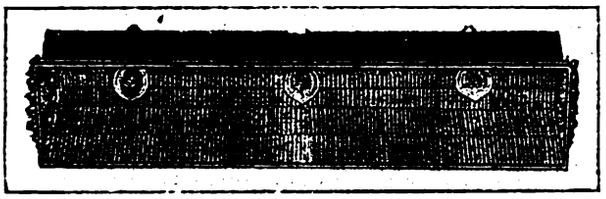
one of a comprehensive range. This particular screen is listed at £14 17s. 6d., and it proves that it is possible to make utilitarian electrical apparatus to a high artistic standard. A booklet published by Grierson, Ltd., merits the attention of all in the industry whose problem it is to study electrical heating. Particularly does it merit the attention of contractors and retailers.

A Shop Window Reflector for Gasfilled Lamps.

A. W. BEUTTELL, who are well known in the electrical industry as manufacturers of "Linolite" and "Tubolite" fittings, have recently produced a new reflector for shop window lighting, which takes 60 W or 100 W standard gasfilled lamps.

This fitting has a stout sheet metal frame in which is placed a silvered fluted glass reflector of special shape, accurately designed; whilst the frame obscures the source of light from the view of



THE BEUTTELL REFLECTOR.

persons standing on the pavement. Suspension from the ceiling is obtained by means of chains placed at each end. Although strongly made and efficient in operation, this reflector is of comparatively small size, the standard opening being 7 in. wide, and any desired length can be made to requirements. Ample ventilation is provided. This reflector comprises a combination of quality and price which should appeal to keen buyers.

Are you Ever Ready for Coming Season?

With the approach of the autumn and winter seasons it is necessary that all retailers should have their selling plans carefully laid out. Spasmodic and haphazard buying left until the season is well upon us will not make for success in turnover. The question—what are the best lines to sell—has been asked so many times that it has become a commonplace. But it is, however, not an easy question to answer, and its solution requires careful thought and judgment before the season commences. In a list of well-known manufacturers whose products will appeal to the public for their price and quality must be included the EVER READY CO. From the large range of merchandise which this company can offer, there are several outstanding items in utility devices which every retailer can afford to handle. A well displayed window and a judiciously selected stock will be the lodestone to secure business. In the new list just published by the Ever Ready Co. is a wealth of lines which will make turnover if they are marketed to the public with energy and judgment.

Outside Lanterns—Cheap and Good.

Weatherproof lanterns are common enough, and the conventional lines in design which all manufacturers follow have the effect of placing prices very much on the same level. It is possible, however, to select from the many manufacturers of this class of apparatus several who can offer the trade an attractive line both by way of quality and price. One manufacturing firm which falls under this heading is the GENERAL ELECTRIC CO., and we illustrate a

A GOOD SORT OF OUTSIDE LANTERN.

lantern known as the "Birmingham," This lantern is a favourite with a large number of contractors, and the fact that prices have been reduced will make it even more attractive for jobs where prices are, of necessity, keen. It is false economy to use "cheap" lanterns on any job, and in offering the "Birmingham" lantern at reduced prices the G.E.C. are offering a well-made lighting unit which will fill many requirements. It is made for gasfilled lamps up to 200 W, and is now listed at 31s. 6d. This price does not include lampholder, but includes the suspension loop and 15½-in. dia. reflector.

Siemens' Stock of Holophane.

Holophane glass is an established product. Experience has proved it to be one of the best lines in the lighting field, and now that the autumn and winter season is approaching it is time to go carefully over the complete range and select display samples for the showrooms, and nominal stocks of certain lines which it is easy to judge will be quick sellers. Holophane glass can be divided into two classes (*a*) types more suitable for industrial and commercial lighting, and (*b*) types more suitable for domestic lighting, and obviously the contractor or retailer will give attention to these types which are most suitable for the class of work specialised in, or, as it may happen, in both. As is well known, the manufacturers of Holophane glass follow the practice of distributing a large proportion of their output through certain well-established houses. One of these is SIEMENS AND ENGLISH ELECTRIC LAMP CO., who hold comprehensive stocks of almost every type and size. In fact they might be rightly called "the Holophane house." The recent catalogue which they published merits careful study.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

We have received the August number from MAVOR and COULSON of "M. and C. Machine Mining."

Price list No. 63 describing air break starters is the latest publication of WRIGHT MOTORS, LTD.

"Alabaster" is the introductory title of a profusely illustrated folder which the NEW ITALIAN ART ASSOCIATION has just published.

A useful booklet has been published by the CHLORIDE ELECTRICAL STORAGE CO., containing a list of "Exide" battery service depots.

Showroom buyers for supply companies, contractors and retailers, will be interested in the display of silk shades which is now being made by CHARLES SELZ.

We have to acknowledge from the WHOLESALE ELECTRICAL CO. (1922) a leaflet describing their "Pinnacle" quick make and break combined switch and fuse.

"Newalls insulations save heat and power." This is the claim of the NEWALLS INSULATION CO., in their new folder No. 2, which has just been published. It merits the attention of all engineers who have to deal with this problem.

FALK, STADELMANN AND CO. announce that they are now marketing a very complete range of domestic electric appliances, such as irons, toasters, etc. The range, which will be known as the "Ideal," is fully described in a catalogue recently issued.

The GENERAL ELECTRIC CO. continues to advise the trade of welcome reductions in prices. We refer to the latest prices on Equiluxo glass, and fittings buyers will be wise if they give close study to the leaflet No. F3069 which the company has recently issued.

"There are important changes in the catalogue; please look through carefully and order early to promote sales to our mutual benefit." This pertinent announcement is made by the EVER READY COMPANY (GREAT BRITAIN), LTD., in the 24th edition of their price list, which has recently been published.

Municipal Electricity Finance.

Bulk Supply Booming.

WILLESDEN Urban Council purchased from the North Metropolitan Electric Power Supply Company during the year ended March last 11 281 520 kWh, compared with 9 725 020 in the previous year, the cost being £41 276 (£46 676) or 0·878d. (1·152d.) per kWh. Sales of current reached 9 507 066 kWh (against 8 160 940). Revenue was £109 939 (against £102 764), working costs were £70 726 (£76 272), capital and loan charges £30 586 (£23 339) and profit £8 627 (£3 153). Works costs were 1·659d. (2·079d.) per kWh sold, and total costs 2·431d. (2·765d.). Consumers increased from 6 636 to 7 446 and total connections from 16 496 kW to 18 245 kW. A new 750 kW rotary converter was installed at the Salusbury Road sub-station during the year, and the aggregate capacity of the sub-stations was increased to 8 650 kW. The Ministry of Health and the Electricity Commissioners have sanctioned the conversion of all existing public gas lamps to electric lighting, and a considerable length of the mains necessary for this purpose was laid during the year. Many of the old arc lamps have been replaced by high candle-power gasfilled lamps, with improved results as regards illumination and lower labour costs. The Council's 14 house refuse-collecting vehicles worked 33 830 hours, and the total time lost by breakdowns, etc., was 32 hours. The total distance run was 56 208 miles, and the kW hours used in battery charging and maintenance were 107 514.

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Electricity Supply.

Extensions and Developments.

MACCLESFIELD Borough Education Committee has decided to substitute electric lighting for gas in the Athey Street Schools.

DUMFRIES Town Council has decided to light Dock Park electrically at a capital cost of £520 and an estimated annual cost of £90.

ACCRINGTON Corporation is having a report prepared by the borough electrical engineer as to the possibility of more fully utilising the river water from the weir for the purposes of the electricity undertaking.

MANCHESTER Corporation's new power station at Barton is to be opened by the Earl of Derby on October 11th. On that date the second generator will be started. Details of this station were given in our issues of June 8th and 15th last.

DARWEN Corporation have just entered into a contract with A. Carus and Sons, cotton manufacturers, for a supply of current for power purposes, and several power contracts with other large firms in the textile industries are being renewed.

The POWELL DUFFRYN Co.'s electric power station at ABERAMAN, one of the several power distributing centres which link up the company's colliery concerns in South Wales, is being extended, and it is expected that the new plant will be working within the next 12 months.

Exception was taken by Mr. Shergold at the last meeting of the NEWBURY Board of Guardians to the Board's action in accepting the tender of the Urban Electric Supply Co. for work in the Institution without calling publicly for tenders which, he said, would have saved something like £100. It was stated that the Ministry of Health had given its sanction, and it was decided to let the work proceed under the contract.

Tapping New Areas.

CREDITON Urban Council has asked the terms upon which Exeter Corporation can supply the town with electricity.

MORETON Parish Council has asked Wirral Rural District Council for permission to approach Birkenhead and Wallasey Corporations with a view to obtaining a supply of electricity.

LINLITHGOW Town Council has made a canvass to ascertain the number of prospective consumers of electricity. It is understood that the results are satisfactory and that the Council will take steps to secure a supply.

We learn that, despite reports to the contrary, the BANN ELECTRICITY SCHEME for North East Ulster has not been abandoned, and the Bill will come in due course before the Northern Ireland Parliament, although the opposition to it is very determined and may lead to some modifications in the Bill.

Alterations in Charges, etc.

DUBLIN Corporation is recommended to apply to the Ministry of Industry and Commerce for sanction to a maximum charge of 9d. per kWh for electricity instead of the maximum of 8d. allowed by its 1892 Order.

The Ministry of Transport has authorised the BARTON-ON-HUMBER ELECTRIC SUPPLY Co. to charge a maximum rate of 1s. per kWh for electricity supplied to private consumers instead of the present maximum of 10d.

The WHITSTABLE ELECTRIC Co. having applied for authority to continue to charge 9d. per kWh for lighting and 4½d. for power, the Urban Council has asked the Ministry of Transport to give the sanction only until the end of 1924.

SOUTH SHIELDS Corporation has adopted a new tariff which will come into operation at the end of the present month. For the first 91 kWh per quarter for lighting the charge will be 7d. per kWh, for the next 91 kWh 5d., and for all additional current 1½d. per kWh. An alternative system is offered of 6d. per kWh for 10 kWh per £ of rateable value per annum and 1d. for all further consumption. Of the 10 kWh per £ four are to be paid for in each of the winter quarters and one in each of the summer quarters.

Inquiries and Orders.

WELSHPOOL Gas Co. has informed the Town Council of its intention to apply for a Special Order to supply electricity in the district.

MAIDSTONE Corporation is applying for a Special Order authorising the supply of electricity in Loose, Linton, East and West Farleigh, Thurnham, Bearsted, Barming, Teston, Wateringbury, East and West Malling, Boxley, Aylesford, Boughton Monchelsea and Hollingbourne.

Miscellaneous Supply Items.

An electricity scheme is being promoted for SAUNDERSFOOT (Pembrokeshire). Considerable local support for the scheme has been enlisted.

Dundee Electricity Committee have agreed to allow £38 11s. 9d. discount to a large consumer whose account was paid a few days after the discount period had expired owing to its termination during the local holidays. There was some opposition to the creation of such a precedent.

THETFORD Corporation is considering a project to utilise the Little Ouse river for generating electricity. Mr. R. H. Lee, the engineer responsible for the scheme, suggests the construction of a dam across the river near Thetford and the installation of a turbo-generator and high voltage overhead transmission. The cost is estimated at about £40 000, and it is claimed that the scheme would be self-supporting at charges of 7d. per kWh for lighting and 3d. per kWh for power.

Personal Items.

Mr. S. CUMMINS SMITH is succeeding Mr. J. W. Swithinbank, retired, as manager of Post Office Telephones in the Sheffield district.

Mr. E. C. WILLIAMS has been appointed Professor in charge of the Ramsey Memorial Department of Chemical Engineering which will be opened at UNIVERSITY COLLEGE, London, in October.

Mr. WILLIAM FORREST, power signalling construction engineer of the Victorian Government Railways, has been appointed to succeed Mr. G. H. Crook as signal and telegraph maintenance engineer.

The ENGAGEMENT is announced of Lieut. E. Lyon Berthon, D.S.C., R.N., younger son of Mr. and Mrs. Claude T. Berthon, and Margaret Nancy, second daughter of Mr. and Mrs. Arthur Preece, and grand-daughter of the late Sir William Preece, K.C.B.

Mr. FRED COUTTS, lately manager of the Paisley and District Tramways Co., has been appointed manager and engineer of the Dearne Valley Light Railways. This system, which is expected to be completed by April next, will link up by tramway a number of important towns in Yorkshire.

Obituary.

Dr. E. K. Muspratt.

We regret to announce the death, on Saturday last, of Dr. E. K. MUSPRATT, in his 90th year. The deceased was chairman of British Insulated and Helsby Cables, Ltd., vice-chairman of the United Alkali Co., and a director of the Midland Electric Corporation for Power Distribution. He was the youngest son of James Muspratt, founder of the alkali industry in Lancashire.

Education in Electrical Engineering.

Prospectuses for the Session 1923-24.

The UNIVERSITY OF MANCHESTER has just issued its prospectus of university courses in the Municipal College of Technology for the session 1923-24. Over 200 pages are devoted to particulars of the various courses, including electrical engineering, extending over three years. Dr. Miles Walker is the Professor of ElectricalEngineering. Mr. J. L. Langton is the chief lecturer in this department.

At the UNIVERSITY COLLEGE OF SWANSEA, where Mr. R. G. Isaacs is lecturer in electrical engineering the course includes the final part in electrical engineering.

An illustrated brochure issued by the LEEDS TECHNICAL SCHOOL offers a number of facilities for training in electrical engineering. There is a senior course extending over two years, which is organised to combine technical and practical knowledge by dividing the time between workshop practice, electrical testing and a study of the principles governing application and design. The practical courses give instruction in the manufacture and repair of scientific instruments, armature winding, etc. Under the apprentice training scheme students receive instruction in alternate weeks, spending one week at the technical school, followed by one week at the employer's works.

Miscellaneous.

The Institute of Physics and the National Physical Laboratory have made arrangements for the regular publication of a new journal entitled the "JOURNAL OF SCIENTIFIC INSTRUMENTS." The journal will contain detailed descriptions and critical surveys of the behaviour of new instruments; and original papers, or laboratory and workshop notes dealing with the practical or theoretical aspects of scientific instruments, should be sent to the editor, Dr. John S. Sanderson, National Physical Laboratory, Teddington.

In rebuilding the foundations of a bridge in Nebraska, it was necessary TO FIND THE EXACT POSITION OF AN OLD CAISSON, which, according to "Electric Traction," had a taper and was 80 ft. to bed rock. A pile driver was set up close to the caisson and a 4 in. pipe was driven vertically. A wire was welded to one end of the pipe, and the other was connected to a 6 V storage battery which in turn was connected to the steel side of the old caisson through a 150 A d.c. ammeter. While the pipe was being driven the ammeter read from 8 to 10 A, but as soon as the pipe touched the steel caisson the ammeter showed 92 A. Then from the length of the pipe driven below ground and the horizontal distance from the pipe to the caisson at the surface of the ground, the exact slope of the caisson was found. A second pipe was then driven a short distance from the first, and the results checked within 2 in. or 3 in. In this way, it was found that the new bridge pier had to be set 2 ft. 3 in. farther away in order to clear the old caisson.

Electricity and the Boll Weevil.

Mr. A. M. Kennedy, of the Alabama Power Co., has been experimenting for some months in the research laboratory of the General Electric Co. at Schenectady, N.Y., on the electro-chemical manufacture of calcium arsenate. It is intended to use this product in the destruction of the boll weevil, an insect pest which it is reported destroys 400 million dollars' worth of cotton in the United States every year. About 30 million pounds of the calcium arsenate produced by the old purely chemical process are used for this purpose annually, but its price has precluded its general use. It is confidently predicted that Mr. Kennedy's work will result in the production of the 700 million pounds of calcium arsenate needed at a price low enough to admit of its use by every grower.

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Tenders Invited and Accepted.

GREAT BRITAIN.

BRISTOL GUARDIANS, September 11th.—Three or six months' supply of electrical fittings, etc. Forms of tender from the Clerk, St. Peter's Hospital, Bristol.

PONTYPRIDD GUARDIANS, September 12th.—Three months' supply of electrical materials, ironmongery, etc. Forms from the Clerk, Union Offices, Pontypridd.

LOCHGELLY TOWN COUNCIL, September 17th.—Electric wiring of houses included in the third development of the Newton Park site. Specifications from the Burgh Surveyor.

SALFORD CORPORATION, September 24th.—Cooling towers, pumping plant and pipework for Agecroft power station. Specification from Mr. J. A. Robertson, 20, Brazennose Street, Manchester.

WINDSOR GUARDIANS, September 24th.—Electric light installation, steam boiler heating, laundry equipment, etc., at the Poor Law Institution. Specifications from Mr. W. W. Nobbs, 50, Fairhazel Gardens, London, N.W.6.

AUSTRALASIA.

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, WELLINGTON, October 31st.*—30 000 dry telephone cells.

COMMONWEALTH OF AUSTRALIA, October 10th.—Testing and telegraph instruments (Q. 597); October 17th.—Galvanised tubular poles (W.A. 791); October 29th.—Telephone and telegraph apparatus (W.A. 793). Forms, etc., from the Supply Officer, Australia House, Strand, London, W.C.2.

SOUTH AUSTRALIA HARBOURS BOARD, October 31st.—Four 7-ton electric coal-handling cranes. Specification from the Agent-General for South Australia, Australia House, Strand, London, W.C.2.

VICTORIA ELECTRICITY COMMISSION, October 6th.*—22 000 V insulators.

BELGIUM.

MINISTRY OF RAILWAYS, MARINE, POSTS AND TELEGRAPHS, BRUSSELS, September 5th.*—Telephone wires, apparatus and accessories.

DIRECTION DU SERVICE DE L'OUTILLAGE DU PORT, ANTWERP, October 15th.*—Fifteen electric cranes, maximum load 3 tons.

IRELAND.

DUBLIN GUARDIANS, September 12th.—Six months' supply of electrical fittings, ironmongery, etc. Forms of tender from the Master of the Workhouse. A preference will be given to articles of Irish manufacture.

DUDLEY BOARD OF GUARDIANS has accepted the tender of G. T. Walker for electric light wiring at the Institution, at £1,255.

The tender of the English Electric Co. for a Diesel engine and 750 kW dynamo, at £11 368, has been accepted by WORTHING CORPORATION.

The tender of Johnson and Phillips for the construction of overhead mains to Airethwaite, at £490 11s. 6d., has been accepted by KENDAL CORPORATION.

The War Office has placed contracts with Truslove and Co. for complete electric lighting installations at Meeanee and Sobrano Barracks, COLCHESTER.

MAIDSTONE CORPORATION has accepted the following tenders:—Johnson and Phillips, transformer, £28 9s. 11d.; Craigpark Cable Co., cable, £189 12s.; Hadfields, Ltd., castings, rails, fishplates, etc., £171.

BLACKBURN BOARD OF GUARDIANS has purchased a Hobart electrical general purposes machine for the bakery at £219; an electric potato-peeling machine, £75; and a Crescent electric dish washer, £150.

A contract for lighting WIVENHOE URBAN COUNCIL'S street lamps electrically has been secured by Mr. Ellis. The amount of the successful tender was £209, compared with a tender for gas lighting at £215 11s.

The following tenders are recommended for acceptance by LEICESTER CORPORATION: English Electric Co., 10 000 kW turbo-alternator, £31 835, and condensing plant, £9 578; W. H. Allen, Son and Co., 500 kW auxiliary turbo-generator, £4 800.

The following tenders have been accepted by WOLVERHAMPTON CORPORATION: Denison, Ltd., automatic coal weighing machine, £695; British Thomson-Houston Co., two automatic Tirrill regulators, £354 4s.; A. Reyrolle and Co., transformers, £131 17s.

The following tenders have been recommended for acceptance by MARYLEBONE (LONDON) BOROUGH COUNCIL: Heenan and Froude, closed-circuit air coolers for two 8 000 kW turbo-alternator sets, £2 520; Babcock and Wilcox, variation of gantry in connection with new 60-ton per hour crane, £415.

BLACKBURN BOARD OF GUARDIANS has accepted the tender of C. T. Briscoe and Sons for electrical installation work at the Workhouse. Mr. Wheelwright, borough electrical engineer, has been asked to prepare a scheme for lighting and the application of electricity for power purposes throughout the institution.

LEEDS CORPORATION has accepted the tender of the British Thomson-Houston Co. for a steam turbine, a 10 000 kW three-phase alternator and exciter, condensing plant and accessories, at £31 470. There were four foreign and fifteen British tenders, the former being below the amount of the accepted tender.

* Particulars from the Department of Overseas Trade.

LEEDS CORPORATION has accepted the following tenders: British Electric Transformers Co., transformers; W. T. Henley's Telegraph Works Co., cable, £2 826; Enfield-Ediswan Cable Works, cable, £307 5s.; S. Dixon and Son, electric lighting of refreshment rooms (£159 16s.) and electric lighting of dairies, etc (£91 1s.) on Temple Newsam estate.

DARTFORD URBAN DISTRICT COUNCIL has accepted the following tenders: Johnson and Phillips, switchgear and cables, £729; cables to the West main sewerage works, £2 306; switchboard control panel, £312; and truck-type switchgear, £184. Seagers, Ltd., pipe work, £227. Brush Electrical Engineering Co., transformer, etc., £1 274; and gallery and air ducts, £280.

WALLASEY CORPORATION has accepted the following tenders: British Electric Transformer Co., six 35 kVA air-cooled transformers, £60 5s. each; Metropolitan-Vickers Electrical Co., four 50 kVA oil-cooled transformers, with tanks, £69 13s. each, and one 100 kVA oil-cooled transformer, with tank, £99 6s.; British Insulated and Helsby Cables, Ltd., six switch pillars, £75 each.

MARYLEBONE (LONDON) BOROUGH COUNCIL has received the following tenders for special cables for the 12 500 kW turbo-alternator and rotary converter plant: W. T. Henley's Telegraph Works Co., extra high pressure cables, £520, low-pressure cables £1 626; British Insulated and Helsby Cables, Ltd., £512 and £1 504; Enfield-Ediswan Cable Works, Ltd., £476 and (recommended for acceptance) £1 451.

BRADFORD ELECTRICITY COMMITTEE has decided to place contracts for a new 20 000 kW alternator and exciter with C. A. Parsons and Co., and for a turbine with the English Electric Co. The amount of the two contracts will be approximately £60 000. Originally 43 tenders were received, and Mr. Longley, deputy-chairman of the Electricity Committee, said there was a terrible difference between the British and foreign tenders. After capitalising the value of the difference in the guaranteed steam consumption, however, it was calculated that the disparity was only £9 000.

Amongst recent purchasers of travelling grate stokers from UNDERFEED STOKER COMPANY are the following:—Poplar Council (3 stokers), Stepney Council (3), Scottish Central Electric Power Co. (4), Marylebone Council (6), Carlisle Corporation (2), Stoke-on-Trent (8), Darlington (1), Swansea (4), Hull (2), Tunbridge Wells (2), Midland Electric Co. (3), Birmingham Corporation (6), London Midland and Scottish Railway (3), Kumamoto Electric Light Co., Japan (8), and Naigai Co., Japan (2). Hull Corporation has recently ordered air heaters; St. Pancras and Marylebone Borough Councils and West Bromwich Corporation, ash conveyors; and Birmingham Corporation a furnace arch. Numerous orders for the above-mentioned classes of goods and for underfeed stokers and coal conveyors have also been received from public authorities and companies outside the electrical industries.

MANCHESTER CORPORATION has accepted the following tenders:—Hall and Stinson for electric lighting installation at the Davyhulme Works; Vickers, Ltd., double sand-drying apparatus for Hyde Road Depot; Dod Bros., vacuum cleaner for cleaning tramcars; United States Steel Products Co., special trackwork (contract No. 23); Electro-Mechanical Brake Co., tramcar resistances; W. Spreadborough, wiring houses on Blackley Clayton and Catterick estates, and E. L. Bellhouse and Co. for similar work on Newton and Anson estates, respectively; Power and Lighting Supplies, Ltd., wiring Ross Place and Alfred Street schools; Hall and Stinson, wiring Varna Street schools; Ward and Booth, wiring Wheler Street schools; R. S. Miller, wiring Elysian Street schools; Maitland and Co., wiring Collyhurst schools; Manchester Electrical Maintenance Co., wiring Elmfield Hostel; Ferranti, Ltd., electric pressure testing equipment.

Forty Years Ago.

"The Electrician," September 8th, 1883.

WINDSOR CASTLE.—Considerable alterations and improvements are being carried out at Windsor Castle during the Queen's absence in Scotland. Amongst other things, chambers are being constructed in the North Terrace, which are intended for the reception of electric lighting machinery.

* * *

THE BRIGHTON ELECTRIC RAILWAY.—This railway, which was described in our last issue, was somewhat damaged by the heavy sea which prevailed on Sunday and Monday last. The shingle on which it is laid was partially removed by the force of the water, and the railway itself had a narrow escape of being washed away.

* * *

CONDUCTORS.—Mr. E. J. Cowling Welch, C.E., has published a small card, which will fit into any pocket book, on one side of which is printed a table giving the relative weights of copper conductors for conveying currents from 1 up to 5 000 A, in lbs. per mile. On the back of the card are a few remarks bearing upon the figures given on the front, in which Mr. Welch points out that for economy of working, as opposed to mere safety, larger conductors than those given in the table are required for currents up to 2 741 A.

The report of a recent collision between a L. and N.E. Railway express and a goods train at Retford mentions that all the passenger stock was electrically lighted and NO FIRE WAS STARTED in the wreckage caused by the collision. It is suggested in regard to the collision at Cardiff on the Great Western Railway that track circuiting with the usual locking might have prevented the mishap.

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Telegraph and Telephone Notes.

The GREAT NORTHERN TELEGRAPH Co. and the EASTERN TELEGRAPH Co. agreed to accept telegrams from the 3rd inst. for Denmark, Sweden, Finland, Russia, Latvia, Esthonia, and all places in the Far East (via Russia) at the tariffs charged by the Post Office.

In SASKATCHEWAN PROVINCE (Canada) it is stated that the number of RURAL TELEPHONES in use is one for every nine of the population, and numerous applications for new lines and installations continue to be made. In Alberta the demand is almost as great, telephones in use numbering 53 000.

The Postmaster-General announces that from to-morrow (Saturday) the rates for week-end letter telegrams to Australia and New Zealand via the Imperial and Pacific cables will be reduced from 9d. and 8d. a word to 7½d. and 7d. a word respectively. On the same date a new daily letter telegram service via the Imperial and Pacific cables will be inaugurated to these countries at one-quarter of the ordinary rates.

The Telegraph Construction and Maintenance Co.'s cable steamer "Stephan" arrived at Sydney recently with the two new submarine cables for DUPLICATING THE PACIFIC CABLE between Sydney and Southport and between Auckland and Fiji. The Pacific Cable Board intends to duplicate the whole Trans-Pacific cable system connecting Canada, New Zealand, and Australia. The duplication of the long sections north of Suva is held up pending experiments which are being conducted with a new design of submarine cable. The section between Suva and Fanning Island is 2 080 miles in length, and that between Fanning Island and Canada 3 458 miles. In the event of the experiments proving successful, it is expected that the new class of cable will have a carrying capacity of eight times the speed possible with the existing cable.

A communication from Capetown calls attention to one of the most serious difficulties encountered by those responsible for the maintenance of submarine cables. A BREAK IN THE EASTERN TELEGRAPH COMPANY'S CABLE in the Atlantic, between Capetown and St. Helena, was reported recently, and the company's repair ship, "Britannia," after a fortnight's search, discovered the break, the cable at this spot, 850 miles north of Capetown, in latitude 96.10, longitude 6.29, lying at a depth of only 700 fathoms, although the depth had previously been officially stated to be over 2 000 fathoms. A few miles north of the cable lies the Valdivia Bank shoal, only 512 fathoms below the surface. It is surmised that the southern end of this bank was raised by an upheaval of the sea bottom, extending about seven miles by 21 miles. It is suggested that the cable may have been broken by being swept by sea currents against the top of this new submarine execrescence. The cable was laid in November, 1899, and this is the first time it has been broken.

The Earthquakes in Japan and Submarine Telegraphy.

We are informed that the terrible earthquakes which have devasted part of Japan last week-end have not affected the submarine cables owned by the Great Northern Telegraph Co., which land at Nagasaki, in the South Island, nor the submarine cable, owned by the Japanese Government, from Nagasaki to Shanghai, while the land lines are working up to Osaka. The Eastern Telegraph Co.'s cables on the China coast are still working, but it is understood that the Japanese Government cable between Bonin and Tokio has broken down. The cable from Tokio to America is also affected, and messages for America now have to be sent by the Nagasaki-Shanghai route. It is, of course, difficult at present to obtain any definite information as to the extent to which the land lines are down around Tokio and Yokohama, and in the more northern districts. The Shanghai office of the Eastern Telegraph Co. notifies that communication is being maintained with Osaka and that telegrams for Tokio and Yokohama are being disposed of by the Osaka office by the best available means. There is, however, no guarantee that telegrams to the affected area can be delivered at present.

Leeds Corporation is organising a HEALTH AND MUNICIPAL SERVICES EXHIBITION, to be held from November 13th to December 1st, for the purpose of informing the inhabitants as to the extent and working of the various departments of municipal work. The executive duties are being carried out by the Medical Officer of Health, the Manager of the Gasworks, the Manager of the Electricity Department (Mr. C. Nelson Hefford), and the City Treasurer. The Exhibition is to be held in the Artillery Drill Hall, Fenton Street, Leeds. Amongst the exhibits the Corporation's electricity undertaking will figure prominently, but it is expected that some stands will be available for letting to electrical manufacturers and others.

An unusual accident was reported by "The Times" on Monday, with the comment that it contains a lesson for members of the public. A number of donkeys grazing on Ealing Common strayed into Gunnersbury Avenue. While they were being driven back to the common one of them BUMPED AGAINST AN ELECTRIC LAMP-POST and was killed by an electric shock. The lamp-post was found to be very much "alive." When the donkey fell, a man with a piece of iron rod in his hand touched the animal, and he, too, received a shock. Such accidents always "contain a lesson" for the electricity supply authorities, and we agree that the public should also take warning and prevent their donkeys from bumping against lamp-posts, whether electrified or not, and should also refrain from using pieces of iron rod to coax them (the donkeys) to rise.

Electric Traction.

Fares, Receipts and Passengers.

WEST HAM Corporation tramways show a deficit of £24 690 for the year ended March 31st last.

OLDHAM Corporation tramways took £921 between March 25th and July 31st for the carriage of parcels.

The annual report of the Southport tramways undertaking for he year ending March 31st last shows a gross profit of £26 872.

ABERDARE Urban Council has reintroduced penny fares on the municipal tramcars and omnibuses as an experiment for three months.

WALLASEY tramways gave £8 000 in aid of the rates last year, which, according to the accounts just published, makes a total of £141 398 applied to this purpose during the past 20 years.

DONCASTER Corporation Tramways Department sold, last week, 761 of the new special passes which enable people to use the trams any number of times in a week for certain low fixed rates.

WALTHAMSTOW municipal tramways show a deficit for the year of £11 716, due chiefly to motor 'bus competition. The District Council is calling upon residents to support their own trams, and not a rival undertaking.

The income from the ABERDEEN Corporation tramways for the ensuing year is estimated at £181 050, and from the motor omnibuses at £12 800. It has been decided to reduce 2d. fares to 1½d. and 3d. fares to 2½d. The minimum fare is ½d., paid by means of tokens.

Miscellaneous Traction News.

GLASGOW Tramways Committee has appointed a special subcommittee consisting of Bailies Izett, Laing, Dollan and George Smith, Treasurer Kelly, and Councillors Blackater, Higgins, M'Whirr, William Shaw and John Stewart to consider and report on all matters relating to the Subway Railway.

Foreign Notes.

Reduction of Italian Import Duties.

An Italian Royal Decree provides for certain modifications of the Italian Customs Tariff so far as goods supplied by countries enjoying most favoured nation treatment are concerned. In the following cases the co-efficients of increase on the rates of the Tariff of July, 1921, are lower than those fixed in the treaties with France and Switzerland. The actual duties, including the co-efficients fixed by the Decree, now include the following: 48 gold lire per 100 kg. on electric generators and motors, without commutators, over 3 000 kg. in weight, 56 lire between 1 000 and 3 000 kg., 72 lire between 250 and 1 000 kg, 96 lire between 50 and 250 kg., 127·5 lire between 10 and 50 kg. and 153 lire up to 10 kg. On electric generators and motors, with commutators, more than 3 000 kg. in weight 52·5 lire per 100 kg., between 1 000 and 3 000 kg. to lire, between 250 and 1 000 kg. 75 lire, between 50 and 250 kg. 112 lire, between 10 and 50 kg. 152 lire, up to 10 kg. 192 lire. On static transformers weighing over 100 kg. 56 lire per 100 kg., between 1 000 and 3 000 kg. 64 lire, between 250 and 1 000 kg, 80 lire, between 50 and 250 kg. 112 lire, between 10 and 50 kg 152 lire, up to 10 kg. 192 lire.

Electric Power and Traction in Austria.

In an article on "The Reconstruction of Austria," in the "Glasgow Herald," Mr. H. Quigley deals at considerable length with the railway electrification already carried out in Austria and the traction and power supply schemes projected and in progress. He refers to the fact that the electrified Innsbruck section of the railways, which was opened a few weeks ago, links up the Mittenwald line with the electric railways in Southern Bavaria. The electrified line between Italy and Switzerland, via the Brenner, Bozen, Innsbruck and Bludenz has now been opened, and the whole group of mountains and countries represented by the Alps is served exclusively by electric railways.

In addition to the traction power stations a considerable number of schemes have been prepared for utilising the water released from the high Alps in small streams debouching on mountain lakes. The water-power resources of Austria have been estimated at 2 455 000 H.P., of which only 80 000 H.P. has been utilised, while a further 98 000 H.P. is in course of utilisation. Herr F. Maass has evolved a plan for the construction of two dams at a height of about 6 800 ft., which would enable such a head of water to be obtained as would supply 10 000 H.P., and 50 per cent. could be added by means of a third dam. Herren Innerabner and Mayo propose the construction on the Inn of an 80 000 H.P. hydro-electric plant, and two plants of an aggregate capacity of 24 000 H.P. at Mayrhofen and at a point further up the Ziller. The Ackensee project to exploit the greatest lake in the Tyrol is calculated to give 134 000 H.P. to supply the whole of the Northern Tyrol with light and power and contribute to the further electrification of the railways.

Proposed Electrification of Vienna Railway.

A "Times" correspondent reports that Vienna municipality has offered to take over the City and Suburban Belt Railway, which has been closed for the last eight years, and to electrify and repair the system at an estimated expenditure of 170,000 million kronen (about £500,000), and run the railway as an extension of the city tramways. Thirty years' tenure is asked for.

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Wireless News.

Wireless Telegraphy in the Arctic Circle.

The Russian Soviet Government is erecting a large wireless station on the island of Nova Zembla which will be capable of communicating with Archangel and Siberia. The station will be specially fitted up for scientific and meteorological purposes.

Improvements in Broadcasting.

The British Broadcasting Co.'s London station is to be linked up by carrier circuits with the other broadcasting stations in the country, and there will be an interchange of the best items from each. This new feature was inaugurated last week, the time signal at seven o'clock and the news bulletins being relayed from London to the provincial stations and there broadcast. At an early date a performance of "Rob Roy" at the Glasgow station will be relayed to London and the other centres. The British Broadcasting Co. intend to broadcast from October onwards the whole of the Monday 2LO programmes to all stations. In the meantime items of general news will be broadcast to all stations at 7 and 9.15 each evening.

Projected Norwegian Station.

The Director of the Norwegian Telegraph Service has prepared the plans for the new WIRELESS STATION to be erected AT VARDOS. This station will have a transmission radius to enable messages to be sent to the station at Ingoe, near Hammerfest, and to the Meteorological Institute station at Tromsoe.

The Broadcasting Committee.

It is stated that the report of the Committee on Broadcasting will probably not be issued for a week or two. It is now being examined by the Post Office experts. Unless the proposals of the Committee appear to be practically uncontentious it is considered doubtful whether the Government will attempt to deal with the subject during the autumn session.

Wireless Stations in Bulgaria.

The BULGARIAN GOVERNMENT is considering a proposal to establish twelve WIRELESS STATIONS in the principal towns of the country.

Wireless Station at Zurich Aerodrome.

In connection with the extension of the Handley Page London-Paris air service to Zurich, a temporary wireless telephone station has been equipped at the Zurich aerodrome by Marconi's Wireless Telegraph Co. Within six days of the order being received the station was in operation. It consists of a Marconi Standard A.D., aircraft transmitter and receiver, with sub-control attachment. Marconi stations are now in operation at Croydon, Haren, Ostend, Cologne, Geneva and several places in Spain.

A Brave Japanese Operator.

A striking demonstration both of the value of wireless telegraphy and of the stolidity of the Japanese character (of which, by the way, the Japanese never had more need than at the present time) is given in a report in the "Daily Telegraph." The report states that Taki Yonemura, in charge of the wireless station at Tomioka, for three days since Saturday stuck to his post without relief, sending out the only messages received by the outside world regarding the disaster. While his station rocked with the earth tremors and the apparatus was repeatedly shattered, he repaired the damage and went on with his task, laboriously translating into English.

Outdoor Wireless with One Valve.

Tuning in all the broadcasting stations with the aid of only one valve and a frame aerial would have been regarded as impossible a few months ago. Yet the feat has been accomplished by a Nottinghamshire experimenter. The complete set is contained in a compact wooden box, and as the usual bulky accumulator and high-tension battery are replaced by two dry batteries, the outfit is easily portable. Constructional details of the set, which employs the Armstrong super principle, are given in a recent issue of the "Wireless World."

Pooling Wireless Patents Canadian Electrical Manufacturers' Agreement.

According to a Reuter message from Montreal, an agreement has been entered into by the Canadian General Electric Co., the Northern Electric Co., the Canadian Westinghouse Co., the Bell Telephone of Canada, and the International Western Electric Co., whereby the respective patents of each concern may be used by all for wireless purposes within their natural field of use. The Marconi Co. will have the use of patents, for wireless purposes, of the Bell Co. for telephone communication, and of the manufacturing companies, including Marconi, for the purposes of manufacture and sale. The same pooling of patents is already in operation between the various firms included in the British Broadcasting Co.

Wireless to Samoa.

Investigations are proceeding in connection with the modernisation of the radio-stations at Awanui and Apia, with a view to the promotion of a more efficient service between Samoa and the mainland. A close watch is being kept upon the development of high-power long-distance radio-telegraphy, and the possible adaptability of this means of communication to the requirements of the Dominion is being carefully studied.

Companies' Reports, Dividends, etc.

PINCHIN, JOHNSON AND CO.—An interim dividend of 6 per cent., actual, for the past half-year has been declared.

OXFORD ELECTRIC CO.—An interim dividend on the ordinary shares at the rate of 5 per cent. per annum is announced.

BRAZILIAN TRACTION, LIGHT AND POWER COMPANY.—Quarterly dividend of 1½ per cent. on the cumulative preference shares is announced.

HURST, NELSON AND CO.—The directors recommend a dividend on the ordinary shares of 2s. per share and a bonus of 1s. per share, both tax free, the same as for the previous year.

BARCELONA TRACTION, LIGHT AND POWER CO.—The report for 1922 shows revenue $2 575 466, compared with $2 065 537 in 1921. After meeting all costs and interest on bonds and debentures, there is a surplus of $23 085, compared with a deficit of $156 872.

SOUTH LONDON ELECTRIC SUPPLY CORPORATION.—An interim dividend on the ordinary shares for the half-year ended June 30th at the rate of 4 per cent. per annum has been declared. For the first half of last year the interim dividend was at the rate of 5 per cent., the final dividend making 10 per cent. for the year, plus a bonus of 1 per cent.

WALTER SCOTT, LTD.—At the meeting of Walter Scott, Ltd., last week, the chairman, Mr. W. S. Vaughan, said it was impossible for them to compete with the foreign steel at the present price of coal and coke, and therefore they had not attempted to make steel. They had a large output of coal, and this had enabled the preference interest to be paid off and a small dividend to be paid to the ordinary shareholders.

BROWN, BOVERI AND CO.—The report of Brown, Boveri and Co., of Baden, Switzerland, for the year ended March 31st, 1923, contains a review of the conditions which have affected trade in Switzerland as well as the company itself. The difficulty of reducing expenditure and salaries in the Government service has reacted on wages in industrial concerns. There has also of late been an increase in the price of certain foodstuffs, and this is used as a means of agitation. The Swiss Federal Railway authorities, encouraged by the satisfactory results of the electric lines, have decided to speed up the work of electrification. Switzerland is thus on the way to make general the use of electric traction to an extent unequalled in any other country. In addition to the unduly high prices of production in Switzerland, the possibility of exporting goods is seriously affected by Customs tariffs so high as to be practically prohibitive. In spite of the extension of the company's sales organisations in many overseas countries, it has not been possible to maintain the works at their normal capacity. The number of workpeople in the factories in Baden and Munchenstein has been reduced by about 1 200, and hours of labour have been shortened, with the result that the production is probably 40 per cent. below the normal, while general expenditure has remained approximately the same.

Institution Notes.

Mr. W. E. Highfield will deliver his Presidential address to the NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS, at St. Bride's Institute, Bride Lane, Ludgate Circus, London, E.C.4, on September 11. The chair will be taken at 7.30 p.m. by Mr. F. T. Alldread.

The WARRINGTON ELECTRICAL EXHIBITION ASSOCIATION has been formally wound up. The Association was formed for the carrying through of arrangements for a local exhibition, which, having been held with successful results, renders the continuation of the Association unnecessary.

A special meeting of the West of Scotland Branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS was held in Glasgow last week to consider the recommendations of the Department of Mines relative to the greater safety in the use of coal cutters and other electrical gear in mining work. Suggestions which were made for their modification and amplification will be considered by the council at a meeting to be held in Birmingham during September.

The president of the WHITWORTH SOCIETY, Dr. H. S. Hele-Shaw, has arranged with the management of the International Shipping Engineering and Machinery Exhibition, Olympia, London, the following programme for Tuesday next (September 11th):—4.30 p.m.—Reception by Dr. H. S. Hele-Shaw, chairman of the Committee of Experts; 4.45 p.m.—Tea; 7.30 p.m.—Dinner (morning dress). About 90 Whitworth scholars have promised to be present, and the hon. secretary, c/o Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1, will be pleased to hear from any scholars who have not already received notice.

A Ball is being arranged by the WOMEN'S ENGINEERING SOCIETY at the Hotel Cecil, London, on November 1st. The Duke and Duchess of York have given their patronage to the Ball and names on the Committee include: The Hon. Lady Parsons, J.P. (Chairman), Viscountess Falmouth, Viscountess Astor, M.P., Lord Invernairn, Lord Montagu of Beaulieu, the Hon. Lady Shelley-Rolls, the Hon. Sir C. A. Parsons, Sir Robert and Lady Hadfield, Sir Alfred and Lady Yarrow, Sir Charles Wakefield, Sir Wm. Mackenzie, Sir Ernest Benn, Dr. Hele-Shaw, Brig.-Gen. Mowat, Mrs. Thornycroft, Mr. H. G. Burford, Col. R. E. Crompton, Mr. T. C. Pulman, Mr. T. Clarkson, Mr. F. S. Button, and Mrs. Chaloner. Particulars from the secretary, Ball Committee, W.E.S., 26, George Street, Hanover Square, London, W.

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New Companies.

G. L. ADAMSON, LTD.—Private. Cap. £7 500 in £1 shares. Electrical engineers and contractors. Reg. office: Ohm Works, 116, Yorkshire Street, Rochdale.

MAGNETIC SIGNS AND CARRIERS, LTD.—Cap., £5 000 in £1 shares. Advertisers by means of electrical and other signs, etc. Reg. office: 22, and 22A, Regent Street, London, S.W.1.

ANGLO-AUSTRIAN ELECTRIC LAMP WORKS, LTD.—Private. Cap., £1 000 in £1 shares. Agents for the importation and exportation of electrical goods, etc. Solicitors: Gisborne, Woodhouse and Co., Temple Chambers, London, E.C.4.

PARKSIDE ENGINEERING CO., LTD.—Private. Cap., £1 550 in £1 shares (10 "A" and 1 540 "B"). Electrical engineers, manufacturers of wireless apparatus and accessories, etc. Reg. office: 29, Sheen Lane, East Sheen, London, S.W.14.

SPENCERS (ELECTRICAL), LTD.—Private. Cap. £1 000 in £1 shares. Import and export merchants and agents for importation and exportation of electrical goods, etc. Reg. office: 7, 8 and 9, White Cross Place, Wilson Street, London, E.C.2.

R. J. LLOYD AND CO., LTD.—Private. Cap., £300 in 5s. shares. Electrical and mechanical engineers, founders, manufacturers of parts incidental to receiving and broadcasting wireless telegraphy and telephony, etc. Reg. office: 332c, Goswell Road, London, E.C.1.

SURREY WHOLESALE ELECTRICAL CO., LTD.—Private. Cap., £1 000 in 500 ordinary "A" shares of £1 each and 10 000 ordinary "B" shares of 1s. each. To take over the business carried on at Church Path, North End, Croydon, Surrey, as the Surrey Wholesale Electrical Co., Ltd.

INDUSTRIAL PRODUCTS, LTD.—Private. Cap., £5 000 in £1 shares. To acquire business of manufacturers of electrical compounds and special paints carried on by G. Hollinshead, E. J. Aitken and M. H. Beattie at 17, Herschill Street, Glasgow. Reg. office: 17, Herschill Street, Anniesland, Glasgow.

BROWN PISTOL SPARKING PLUG, LTD.—Private. Cap., £2 000 in £1 shares. To adopt an agreement with A. G. Brown for acquisition of British and foreign patents relating to his sparking plug inventions, to carry on the business of electrical engineers, manufacturers of and dealers in sparking plugs, etc. Reg. office: 116, Putney Bridge Road, Putney, London, S.W.15.

WIRELESS CONSTRUCTION CO., LTD.—Cap., £1 000 in £1 shares (500 preference and 500 ordinary). Manufacturers of and dealers in drawn wire, electric cabling and electric lamps and all articles made from tungsten, molybdenum and other metal, and all parts, accessories and articles used in the manufacture of electrical instruments, etc. Reg. office: Suffolk House, Laurence Pountney Hill, London, E.C.

RADIONS, LTD.—Private. Cap., £6 000 in 3 000 10 per cent. cumulative participating preference shares of £1 each and 12 000 ordinary shares of 5s. each. To manufacture, repair, remake, let on hire and deal in thermonic valves and all kinds of apparatus connected with radio telegraphic or telephonic, wireless or broadcasting apparatus, electric lamps, etc. Reg. office: 2, Marsden Street, Manchester.

KARTRET SWITCHGEAR CO., LTD.—Private. Cap., £3 500 in £1 shares. To acquire the sole right of selling and marketing the electrical switchgear and any other electrical gear formerly manufactured by the Kartret Engineering Co., Ltd., and now manufactured by the New Switchgear Construction Co., Ltd., and to enter into an agreement with the last named company. Reg office: 7, Carteret Street, London, S.W.

AUTOMATIC CO. (BRISTOL), LTD.—Private. Cap. £3 000 in £1 shares, (1 000 preference and 2 000 ordinary). To adopt agreement with G. H. Keat trading as Automatic Alarm Co., 7 and 9, Nicholas Street, Bristol, and to carry on business of manufacturers and maintainers of electrical or other appliances for advertising, burglar and other alarms, publicity, electrical and advertising agents, dealers in wireless appliances, etc.

ELECTRICAL IMPORTERS (HULL), LTD.—Private. Cap., £205 in £1 shares. Manufacturers, repairers and importers of, agents for and dealers in electrical goods and accessories, fittings, switch boards, recorders, clocks, time switches, ventilaing fans, vacuum cleaners, transformers, balancers, rectifiers, batteries, motors dynamos, accumulators, scientific, magnetic, telegraphic and mathematical instruments, wireless apparatus and accessories, etc. Reg. office: 11, Portland Place, Hull.

Customs duty is levied on catalogues entering Canada. Stamps for the payment of duty can be obtained from the High Commission r for Canada, Kinnaird House, Pall Mall East, London, S.W.1.

The British Consul-General at Mexico wishes to draw the attention of British traders SENDING CATALOGUES TO MEXICO to the necessity for arranging for the payment of the recently-imposed duty on such literature.

We have received the 1923–4 edition of the handsome calendar issued by the BRITISH ALUMINIUM CO. The design of the front cover is the same as it was last year, and the back contains a good deal of useful information regarding aluminium sections and sheets. Anyone who is interested in this metal, as most electrical engineers are, should take steps to obtain a copy.

Business Items.

The INTERNAL COMBUSTION ENGINEERING CORPORATION of New York is reported to be negotiating with VICKERS, LTD., with a view to the formation of a new English corporation, in which the two companies would jointly be interested.

R. H. JACKSON, LTD., the well-known Manchester advertising agents, have removed to more commodious premises at 1, Princess Street, Manchester. Telegraphic Address: "Adroit, Manchester," and Telephone No.: Central 1041, remain unaltered.

As the lease of the premises of FRANCIS POLDEN AND CO., at 17, Wells Street, London, W., has expired, more extensive premises have been obtained adjoining the head offices, 56, Cannon Street, E.C., and a showroom for the display of electrical fittings, domestic appliances and accessories has been opened. Telephone No.: City 5538–9.

Fuller's United Electric Works, Ltd., of Chadwell Heath, have opened a London depot at 58, High Street, W.C.2 (close to Tottenham Court Road Tube Station), where stocks of "Sparta" and wireless batteries, wireless accessories, cables, etc., will be held, and facilities for battery repair and charging will be provided. Telephone: Gerrard 5070.

H.M. Trade Commissioner in Canada advises that British firms who wish their names to be given to suitable enquirers in CANADA should forward copies of their catalogues to H.M. Trade Commissioners, 285, Beaver Hall Hill, Montreal, 24, Adelaide Street West, Toronto; 210, Winch Building, Vancouver, and/or 703, Union Bank Buildings, Winnipeg.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Bathroom Furnishings"; "Made by Machinery"; "Woodworking Machinery at the Shipping and Engineering Exhibition."

THE CHEMICAL AGE.—"Chemical Plant at the Shipping, Engineering and Machinery Exhibition"; "The Late Dr. E. K. Muspratt: A Great Chemical Leader."

THE FRUIT GROWER.—Annual Planting No.: "Supplies for the Season" (illustrated); "Protection Belts for Plantations," by Jos. Cheal; "U.S. Fruit and Vegetable Quarantine."

GARDENING ILLUSTRATED.—"Roses from Cuttings"; "Gladiolus le Marechal Foch" (illustrated); "Allotment Work in September.

THE GAS WORLD.—"The Lighting Load": Discussion by North British Association of Gas Managers; Shipping, Engineering, and Machinery Exhibition: Some Exhibits; "Concentration of Ammoniacal Liquor," by A. Nisbet.

THE HARDWARE TRADE JOURNAL.—"Opening of the Lamp Season"; "Chats on Silver and Plate"; "A Manchester Firm's Jubilee."

Prices of Metals, Chemicals, etc.

TUESDAY, September 4.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£65 15 0	—	15s.
Electro Wirebars	„	£69 0 0	—	£1 0 0
H.C. Wire, basis	per lb.	9⅝d.	—	⅛d.
Sheet	„	10⅛d.	—	⅛d.
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 1⅛d.	—	¼d.
Brass 60/40—				
Rod, basis	„	7½d.	—	—
Sheet, basis	„	10d.	—	—
Wire, basis	„	10½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 7 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
Lead Pig—				
English	„	£26 5 0	10s.	—
Foreign or Colonial	„	£25 2 6	12s. 6d.	—
Tin—				
Ingot	„	£194 17 6	£4 2 6	—
Wire, basis	per lb.	2s. 7d.	½d.	—
Aluminium Ingots	per ton	£120 0 0	£5 0 0	—
Spelter	„	£33 0 0	7s. 6d.	—
Mercury	per bottle	£8 15 0	—	2s. 6d.

Sulphur (Flowers)—Ton £8 10s. *Sodium Chlorate*—Per lb. 2½d.
„ (Roll-Brimstone)—„ £8 10s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. „ £26 per ton, £7 10s.
Boric Acid (Crystals). „ £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2⅛d.; plantation 1st latex, 1s. 4d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Company.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

ALLCHURCH AND CO., 45, Ashsted Row, Birmingham, electricians. £20 15s. 10d. June 8th.

BROWN, George, 54, Brittain Hill, Handsworth, Sheffield, electrical engineer. £47 11s. 3d. July 21st.

FOSTER AND FOSTER, 71, Temple Row, Birmingham, electricians, £29 19s. 4d., July 12th, and £39 8s. 6d., July 31st.

GARNER AND THREADGOLD, Plough Inn, Spon Street, Coventry, electricians. £19 4s. 8d. July 19th.

HUDSON'S ELECTRICAL ENGINEERING CO., 7 and 8 Prudential Buildings, Park Row, Leeds, electrical engineers. £31 6s. 0d. August 20th.

JONES, D. E. AND CO., 29, Carne Street, Pentre, Rhondda, electricians. £16 18s. 11d. August 26th.

KNOWLES, Mr. C. (trading as PREMIER ELECTRICAL CO.), 11, Paley Terrace, Wakefield Road, Bradford, electrical engineer. £13 4s. 3d. July 18th.

LOUTH AND SMITH, LTD., 3, Hanging Ditch, Manchester. wholesale electrical dealers. £10 1s. 11d. July 20th.

MITCHELLS ELECTRICAL AND WIRELESS, LTD., 188, Rye Lane, Peckham, electricians. £91 5s. 1d. July 13th.

PARLETT, Mr. F., Faxfield House, Watling Street, E.C., electrical engineer. £41 13s. 2d. July 5th.

PEWCO ELECTRIC CO., 36, Broadway Parade, Crouch End, engineers. £15 16s. 6d. July 20th.

SCOTT (JAMES) AND CO., LTD., Knowsley Electrical Works, electrical engineers, Bootle. £25 15s. 9d. July 14th.

STOODLEY, Mr. P. W., 60, London Road, Camberley, electrical engineer. £12 2s. 8d. July 13th.

TURNER BROS., 63, Manor Road, Stoke Newington, electrical engineers. £11 13s. 9d. June 12th.

Receivership.

TRIUMPH ELECTRIC MANUFACTURING CO., LTD. A. H. Warriner, of 47, Temple Row, Birmingham, was appointed receiver on August 20th, under powers contained in debenture dated February 19th, 1923.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

BROOKING AND CO., electrical engineers, 44, High Street, Exeter 73, Thomas Street, Weymouth; and The Parade, Exmouth.: At a meeting of creditors last week at 50, Gresham Street, E.C., when Mr. Robinson, of Messrs. Robinson, Hand and Co., the largest trade creditors, presided, Mr. W. F. Kightly, of Judson, Mills and Co., I.A., 110, Cheapside, E.C. (the trustee of the estate), submitted a statement of affairs which showed liabilities £4 235 (sundry creditors £3 842 and bank overdraft £393), and total assets of £4 498, or an excess of assets over liabilities (subject to realisation) of £263. Mr. Mills said there were two partners in the firm, Mr. William Bird and Mr. George Ewings. Since the year 1920 the losses on trading had been as follows: £165, £112 and £529. The recent drawings of the debtors had been £10 each per week. Mr. Mills added that one of the causes that had led to the present difficulty was that a branch of the business had been opened in Dorchester. Soon afterwards, however, the Government forced them to close down this business owing to the war. On this venture they lost £700. They opened another branch at Teignmouth, mainly with a view to a contract for installing electric light in the town. The scheme, however, fell through and they lost between £400 and £500; this was during 1917. Another branch, called the Southern Trading Co., was started principally for the purpose of buying surplus Government stocks. A further £1 500 was lost here. Considerable discussion took place with regard to the deed of assignment already registered (see THE ELECTRICIAN, 31/8/23, p. 235), but eventually this was approved, and a committee of six creditors appointed. The following are creditors:—Ever-Ready Co., £133; Callender's Cables, £205; B.P. Battery Co., Ltd., £200; Emanuel, A., & Son, Ltd., £68; Edison Swan Electric Co., Ltd., £322; General Electric Co., Ltd., £225; General Cable Co., £46; Hoover, Ltd., £84; Morgan Electric Motor Co., £83; Robinson, Hand Electric Co., Ltd., £996; Simplex Conduits, Ltd., £95; Vandervell Co., Ltd., £102.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-Up Voluntarily.

PREMIER ELECTRICAL SUPPLIES, LTD. C. T. Payne, 80, Lancaster Road, West Norwood, appointed liquidator.

PREMIER ELECTRICAL ENGINEERING CO., LTD. C. H. Mellor, 1, Melbourne Street, Stalybridge, accountant, appointed liquidator.

Bankruptcy Information.

METCALF, Charles Frederick Mason, trading as C. F. METCALF, 8, Cow Green, Halifax, in the county of York, electrical engineer. First meeting, September 10th, 10.15 a.m. Public examination, October 12th, 10.30 a.m. County Court House, Prescott Street, Halifax.

Bankruptcy Proceedings.

ALEXANDRA, George William Arthur Charles, electrical engineer, late of Iddesleigh House, Caxton Street, Westminster, S.W. The statutory first meeting of creditors under a receiving order made in this case on August 20th on the petition of the Omega Lamp Works, Ltd., Wimbledon, was held on September 3rd at Bankruptcy Buildings, Carey Street, W.C. The Official Receiver said that according to statements that the debtor had made he began business as an electrical agent at 86, Pilgrim Street, Newcastle-on-Tyne, in September, 1920, under the style of A. C. Alexandra and Co. He traded with success, and in January of last year, in consequence of the slump in the engineering world and of the necessity of further capital for the business, he converted the business into a limited company called A. C. Alexandra and Co., Ltd., with a nominal capital of £10 000 in shares of £1 each, of which he received 6 000 as sale consideration. He was appointed managing director of the company at a remuneration of £600 per annum, but in the following July he resigned in consequence of a dispute with his fellow director, and he sold his shareholding for a cash consideration of £400. The name of the company was changed to the Northumberland Engineering Agencies, Ltd., and he then came to London and began business at Iddesleigh House as an electrical and mechanical engineer under the style of A. C. Alexandra and Company, with his capital of £400. He built up a good connection with some thousands of clients, and in June last a company was also formed to acquire this business under the style of A. C. Alexandra and Company, Ltd., with a nominal capital of £20 000 in shares of £1 each. Part of the sale consideration was the issue to him of 4 000 shares and to his nominees of 5 000 shares as fully paid, while as residue of the consideration the company undertook to pay all his debts, liabilities and engagements and to indemnify him against proceedings, claims and demands. He became the managing director of the company, which took over from him liabilities amounting to £4 026 and assets of the value of £13 026, of which £10 000 was in respect of goodwill. The debtor had added that he considered that theoretically he had no creditors with the exception of three accounts which totalled less than £100, while his assets consisted of the 4 000 shares which he had received from the sale of his business to the company. He attributed his present position to his having been called upon to pay liabilities which he had transferred to the company together with all his assets, and to the inability of the company to meet all the liabilities for the time being. On behalf of the debtor, Mr. Percy Haseldine asked for an adjournment of the meeting for a fortnight to enable the debtor to bring in a scheme for the payment of his creditors, but the meeting passed a resolution for bankruptcy, and appointed Mr. E. H. Hawkins, Incorporated Accountant, 4, Charterhouse Square, E.C., as trustee of the estate, together with a committee of inspection

ASSOCIATED ELECTRIC TRADERS (LTD.), 2, Percy Street, Tottenham Court Road, W.C. The following are scheduled as creditors in the compulsory liquidation of the company:—Anglo Commercial Italian Agency, £98; Cole Bros., £32; Fontein, S. G., £72; Galliers, H. G., Brighton, £60; Gilner, G., London, £116; Hall, J. and Co., Birmingham, £491; Joseph Henry and Co., £47; Kremenezoky, J., Vienna, £107; Lee Albert and Co., Ltd., £95; London Commercial Electrical Stores, Ltd., £176; Shrimpton, G. and Sons, Birmingham £105; Stellar Conduit Co., Ltd., Bilston, £53; Soper Lamp Co., London, £50; Wilkins and Wright, Birmingham, £29; Russell, P. D., Horsham, £330.

CORONA LAMP WORKS, LTD., 10, Ascham Street, Kentish Town, N.W. Under the compulsory winding up order made against this company in June, 1922, a statement of affairs has been lodged, showing gross liabilities, £110 655, of which £82 265 is unsecured and no available assets. The total deficiency in the case of both creditors and shareholders is stated at £84 265. Creditors include: Bell and Co., Leicester, £876; Ogilvie, G. N., London, £14 163, £3 621, £6 666 and £1 666; Westminster Bank, £3 059; Aeronautical Instrument Co., Ltd., £9 204; Smart, H. W., Stourbridge, £1 591; British Thomson-Houston Co., Ltd., £5 390; Vactitic Wire Co. (1919), Ltd., £59; Sutherland and Partners, £4 180.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

201 055 E. C. R. MARKS (LEICH ELECTRIC CO.). Rotary electric ignition current distributors or timers. (14/8/22.)
201 063 A. H. STEVENS (C. E. F. AHLM). Electro-magnetic transmission mechanisms. (22/8/22.)
201 067 B. J. VAN DER STIGCHEL. Electric lighter. (31/8/22.)
186 333 WESTERN ELECTRIC CO. Telephone systems. (20/9/21.)
186 623 A. BÓNIG. Suspension for electric lamps. (30/9/21.)
186 632 A. RENAUDIN. Insulators for suspended high-tension wires. (3/10/21.)
200 049 T. KLOTZLI. Electric plugs. (3/7/22.)
198 322 PHILIPS' GLOEILAMPENFABRIEKEN. Devices for hermetically sealing-in glass leading-in wires for heavy electric currents. (27/5/22.)
201 085 F. H. ROYCE and ROLLS-ROYCE, LTD. Electromagnetic cut-outs. (27/10/22.)
201 088 C. V. MORRIS. Thermionic valves. (20/11/22.) (Cognate Application 34 082/22.)
201 089 G. A. H. WOOTTON. Electric battery lamps or batteries. (23/11/22.)
201 092 H. BARON (F. ALDENDORFF). Method of manufacturing contact banks for electro-mechanical telephone systems and the like. (17/7/22.) (Divided Application on 19 595/22.)
201 099 F. H. MADSEN. Clamping device for use on electrical switchboards. (8/12/22.)
201 104 BRITISH-THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Control systems for electric furnaces. (2/1/23.)
201 110 W. G. MOORE. Electrodes for electric arc lamps for medical and other purposes. (12/2/23.)
201 115 J. F. GILL and J. N. CHAVIARA. Monopolar electric current generators or motors. (9/12/22.) (Divided Application on 197 406.)
201 189 F. CHIANTORE. Machines for coating current-conducting wires, cords, and cables with asbestos, cotton, etc. (26/1/22.)
201 192 E. SCHATTNER. Electric heating devices. (23/2/22.)
201 218 SIEMENS BROS. AND CO., C. L. PETERS and J. BERRY. Circuit arrangements for operating automatic or semi-automatic telephone systems. (22/4/22.)
178 860 GES. FUR DRAHTLOSE TELEGRAPHIE. Telephone systems. (23/4/21.)
201 220 NOBEL'S EXPLOSIVES CO. and W. O. LITTLEBURY. Fuseheads for electrical firing. (22/4/22.)
201 233 P. F. E. MAJOR, G. H. MILES and C. C. SMITH. Coin-released gas and electricity meters. (26/4/22.) (Cognate Application 18419/22.)
201 250 C. HOLT. Vacuum tubes of the thermionic type. (1/5/22.)
180 653 A. SCHERBIUS. Electric cyphering apparatus. (23/5/21.)
201 254 C. W. MOSS. Electrical advertising cash change plate. (2/5/22.)
201 256 WESTERN ELECTRIC CO. and G. DEAKIN. Automatic telephone switches. (2/5/22.)
180 992 A. MONARD. Electro-mechanical apparatus for working and controlling points for railways, etc. (30/5/21.)
201 264 E. Y. ROBINSON. Antenna systems for wireless communications. (5/5/22.) (Cognate application. 28324/22.)
201 267 MATHER AND PLATT, S. F. BARCLAY and H. E. MELLOR. Bi-polar electrode electrolysers. (5/5/22.)
201 272 M. D. HART. Conversion of electric currents. (6/5/22.)
201 276 N. F. S. HECHT. Wireless systems. (9/5/22.)
201 277 R. BROOKS, and W. T. GRAY. Controllers for electric traction and other electric systems or apparatus. (9/5/22.)
201 279 R. GREAVES. Magnetic separators. (10/5/22.)
201 288 A. L. DAVIS. Electric switches. (12/5/22.)
181 692 SCHNEIDER ET CIE. Electric signalling apparatus utilising the principle of the Wheatstone bridge. (15/6/21.)
201 299 J. B. BOLITHO. Electrical contacts. (16/5/22.) Cognate Application, 4586/23.)
201 308 BRITISH THOMSON-HOUSTON CO., A. P. YOUNG and E. G. PARROTT. Terminals or connections for electric conductors. (17/5/22.)
201 313 A. M. KEAYS and F. PATON-MOORE. Method of and means for utilising the sound conveying and amplifying parts of a gramophone or the like, as a loud sounding or speaking delivery agent for wireless or other telephony or telegraphy. (19/5/22.)
182 097 BENJAMIN ELECTRIC, LTD. Connecting and supporting devices for electric fixtures. (23/6/21.)
180 673 GES. FUR DRAHTLOSE TELEGRAPHIE. Transmitting antenna systems for wireless telegraphy and telephony. (27/5/21.)
201 327 W. T. HENLEY'S TELEGRAPH WORKS CO., E. E. JUDGE and E. MOOR. Electrical distribution apparatus. (1/6/22.)
201 331 M. J. RAILING and C. W. SAUNDERS. Multi-light electric lamp fittings. (6/6/22.)
201 352 WAYGOOD-OTIS, LTD. (OTIS ELEVATOR CO.) Multi-voltage system of control for elevators. (19/6/22.)
201 356 J. W. FLOWER. Electrically driven rotary pump with reducing gear. (21/6/22.)
201 360 T. H. MARTIN-HARVEY. Surface wiring for electricity distributing systems. (23/6/22.) (Cognate Application, 29501/22.)
185 396 A. COLLEVE. Recording apparatus for radio-communication. (30/8/21.)
201 368 W. D. DALE, R. A. HOPKINSON and J. HOPKINSON AND CO. Electro-magnetic remote-control apparatus. (28/6/22.)
182 793 LANDIS AND GYR AKT.-GES. Arrangement for making connection to electricity meters. (5/7/21.)
201 380 R. H. BARBOUR and J. R. WALTON. Electrical control gear. (11/7/22.)
184 456 F.I.A.T. SOC. ANON. System for the distant control of a direct current electric motor. (9/8/21.)
201 403 E. W. PATTISON (DICTOGRAPH PRODUCTS CORPORATION.) Telephone and like head instruments. (27/7/22.)
187 206 SOC. FRANCAISE RADIO-ELECTRIQUE. Reception of wireless signals. (11/10/21.)
185 412 H. WADE (PHILIPS' GLOEILAMPENFABRIEKEN.) Electric lamps with enclosed arc discharge. (28/8/22.) (Convention date not granted.)
200 785 C. BRANDES, INC. Tools for the manufacture of telephone receivers and the like. (11/7/22.)
201 433 MAYOR AND COULSON and W. LAWRENCE. Junction-boxes for electric cables. (2/9/22.)
201 441 Z. TAKAHASHI. Aluminium electrolytic rectifier. (11/9/22.)
201 447 W. MATHESIUS, and H. MATHESIUS. Electrolytic process and apparatus for making an alloy of lead with the metals calcium, strontium, barium. (21/9/22.)
201 456 CABLE ACCESSORIES CO., F. H. REEVES and P. W. DAVIS. Electric bells. (13/10/22.)
201 460 BRITISH THOMSON-HOUSTON CO. and A. S. FITZGERALD. Protective devices for electric circuits. (23/1/22.) (Divided Application on 188 001.) (Addition to 188 001.)
201 462 S. PERCIVAL, C. E. WELLS and H. F. LLEWELLYN. Electric bulb holders. (24/10/22.)
201 470 W. RAUSCG. Electric alarm clock. (1/11/22.)
201 471 J. H. ST. H. MAWDSLEY. Current-collecting devices for dynamo-electric machines. (2/11/22.)
201 476 BRITISH THOMSON-HOUSTON CO., E. B. TUPPEN and G. O. WATSON. Electric motor control apparatus. (8/11/22.)
201 505 G. A. H. WOOTTON. Accumulator charging boards. (19/4/23.)
195 962 MACHINENFABRIK OERLIKON. Device for automatic operation of electric circuit-breaker, controlled by pressure of a liquid or gaseous medium. (4/4/22.)

APPLICATIONS FOR PATENTS.

August 20th.

21 032 J. T. E. SLOAN. Indirect lighting.
21 034 T. F. WALL. Squirrel cage induction motors.
21 037 A. M. TAYLOR. Joints for electric cables.
21 047 A. A. SANDBROOK. Electric lamps.
21 049 F. H. BLAXLEY. Variable electric condensers.
21 054 WESTERN ELECTRIC CO. Signalling systems. (19/8/22 U.S.)
21 064 G. W. EDGECUMBE. Spotlight brackets.
21 076 BRITISH THOMSON-HOUSTON CO. (GENERAL ELEC. CO., N.Y.). Methods of joining metals.
21 094 A. F. BERRY. Electric heating apparatus.
21 105, 21 106, 21 107 and 21 108 METROPOLITAN-VICKERS ELECTRICAL CO. Elastic fluid turbines.
21 117 and 21 118 A. COMPARE. Wireless telegraph apparatus, etc.

August 21st.

21 123 F. H. PHILPOTT. Adjusting variable electric condensers, etc.
21 146 T. J. MARCHANT and E. J. LORD. Multiple telephone terminals, etc.
21 164 H. MACFARLANE. Electric couplings.
21 174 L. LÉVY. Wireless telegraph apparatus. (24/8/22 France.)
21 176 E. BERTRON. Distribution and Reception of electrically transmitted signals. (28/8/22 Belgium.)
21 183 BRITISH THOMSON-HOUSTON CO. Electron discharge devices. (3/10/22 U.S.)
21 187 A. W. STAPLETON. Diaphragms for telephones, etc.
21 194 U. CANTUTTI. Production of sparkless commutation in collector machines.
21 195 AKT. GES. BROWN, BOVERI ET CIE. Apparatus for striking the arc in electric welding. (28/8/22 Germany.)
21 198 C. A. POOLEY. Reception of wireless signals, etc.

August 22nd.

21 236 A. E. HANDFORD. Crystal detector.
21 237 G. H. MOODY. Variable and fixed condensers.
21 245 C. R. GARRARD. Means for transmission of power.
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21 275 METROPOLITAN-VICKERS ELECTRICAL CO. Electric meters. (2/9/22 U.S.)
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August 23rd.

21 312 H. G. A. SCOTT. Electromagnetic firing mechanism for guns.
21 317 H. A. YOWARD. Device for holding and connecting dry batteries.
21 318 H. A. YOWARD. Device for controlling currents for radio-telegraphy, etc.
21 325 W. C. LINFOOT. Electric clocks.
21 330 W. BINNEY. Emergency brake for electric trams.
21 337 H. R. A. FENNER and H. J. ORBELL. Crystal holders.
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21 380 BRITISH THOMSON-HOUSTON CO. Automatic switching equipments. (15/9/22 U.S.)
21 383 A. H. M. J. WARD. Coil carriers.
21 404 C. R. COOK. Vibratory systems for telephony, etc.
21 405 W. F. HIGGS. Dynamo-electric machines.
21 413 SOC. FRANCAISE RADIO-ELECTRIQUE. Wireless telegraph systems, etc. (24/8/22 France.)
21 415 A. PREEN. Electric condensers.
21 417 J. S. MULOCK. Rheostats for dimming head-lamps, etc.

August 24th.

21 443 G. WILKINSON. Apparatus for thermostatic control of electric heaters, etc.
21 460 F. H. SCHROEDER. Electric vehicles.
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21 498 IGRANIC ELECTRIC CO. (CUTLER-HAMMER MFG. CO.). Resistance control apparatus.
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August 25th.

21 530 KITSON ENGINEERING CO. (LONDON) and W. A. MCNUTT. Thermostatic electric controls.
21 546 ELECTRICAL IMPROVEMENTS, LTD., L. C. GRANT and R. W. GREGORY. Electric protective arrangements.
21 551 T. THORNE-BAKER and W. J. PALMER. Telephone receivers.
21 557 L. LANQUETIN. Electric generator and engine starting device.
21 558 H. J. GARNETT and W. S. SMITH. Magnetic alloys for telegraph cables, etc.
21 561 GAS METER CO. and W. E. KING. Electric time switches.
21 569 SIGNAL GESELLSCHAFT. Telephones. (26/8/22 Germany.)

Arrangements for the Week.

INSTITUTE OF METALS (AUTUMN MEETING, SEPTEMBER 10th to 13th).

10th, 8 *p.m.* In the Lecture Hall of the College of Technology, Manchester. Lecture on "The Use of Non-Ferrous Metals in Engineering," by Sir H. Fowler.
11th, 10 *a.m.* At the Municipal College of Technology, Manchester. General Meeting of the Members. Papers to be presented and discussed.
8 *p.m.* At the University, Oxford Road, Manchester. Formal opening of the new building of the Department of Metallurgy.
12th, 10 *a.m.* At the Municipal College of Technology. General Meeting of the Members.

TUESDAY, SEPTEMBER 11th.

NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS.
7.30 *p.m.* At St. Bride's Institute, Bride Lane, Ludgate Circus, London, E.C.4. Presidential Address by Mr. W. E. Highfield.

WEDNESDAY, SEPTEMBER 12th, to WEDNESDAY, SEPTEMBER 19th.

British Association. Liverpool Meeting.

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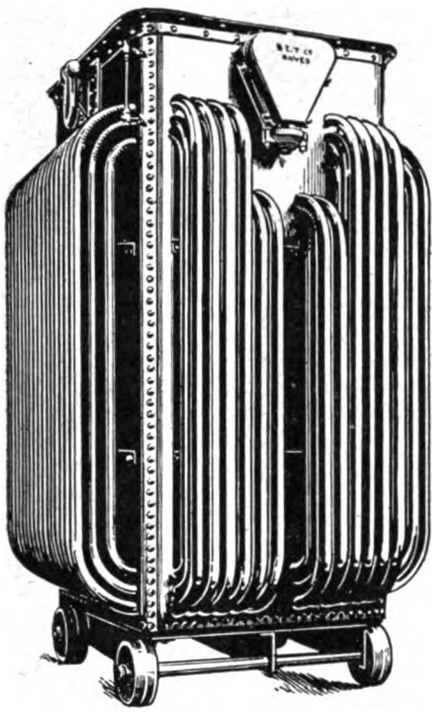

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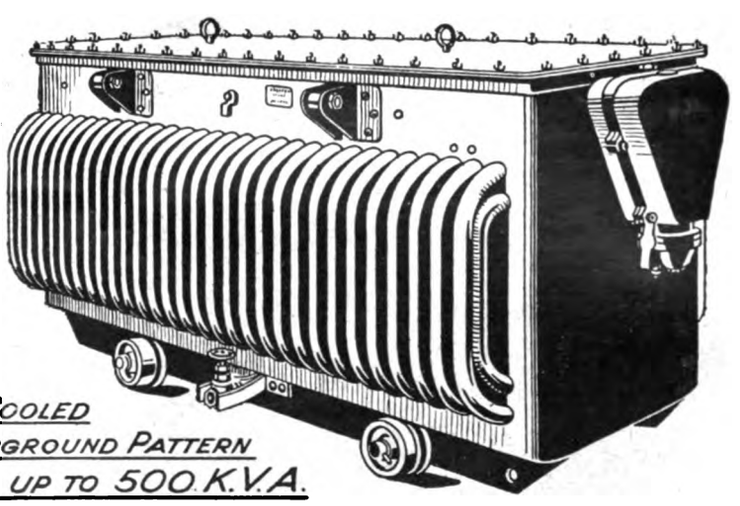

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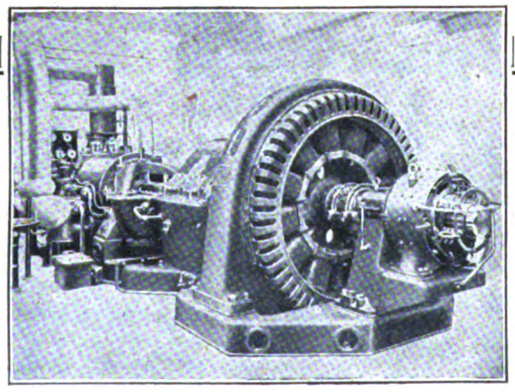

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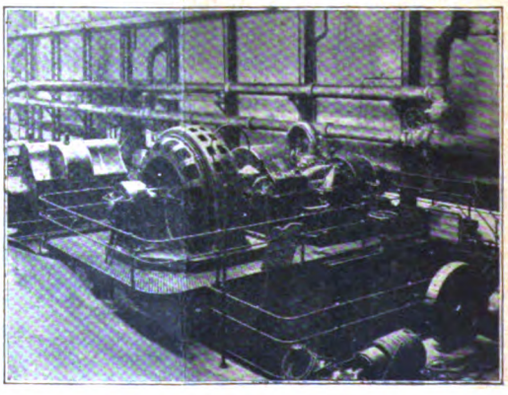

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THE ELECTRICIAN

ESTABLISHED 1861.

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Notes of the Week.

The British Association Meeting.

The subjects which are to be discussed at the ninety-first meeting of the British Association which opened at Liverpool on Wednesday are extraordinarily diverse in character and large in number. Though several joint meetings will be held, for the most part the sections will work in watertight compartments, and as the meetings take place simultaneously, the intelligent amateur will have to make a selection which will be strictly controlled by considerations of time and space. We are not altogether sure that this is a good thing. If the Association is to have a popular appeal it will certainly detract from its force; and the same applies if it is intended to allow workers in one branch of science to become acquainted with what is going on in other fields. Unless a visitor neglects his own subject the attention he can give to the proceedings in the other sections is infinitesimal. The programmes of the sections are very long and the time allowed for the discussion of the Papers almost absurdly short. In most of them little more can be done than make a few congratulatory remarks. For instance, forty minutes to deal with such an important subject as electric ship propulsion gives no time for any real arguments for or against to be presented.

A Quarter of a Century's Progress.

It is a fortuitous, but none the less interesting, coincidence that the last meeting of the British Association held in Liverpool, in 1896, should have marked the dawn of a new era, the heroic age, in electrical physics. As Sir Ernest Rutherford pointed out in his Presidential Address, with which we deal elsewhere in this issue, X-rays and the radio-activity of uranium had then just been discovered by Röntgen and Becquerel respectively. Mr. Marconi had succeeded in successfully transmitting signals a few hundred yards, a success which has rapidly developed into international wireless communication and its subsidiary developments. But, as Sir Ernest rightly points out, these later advances have largely depended on the application of the results of fundamental researches on the properties of electrons, as illustrated in the use of the thermionic tube. That what has been done in this direction may be clearly understood by all who care to read, Sir Ernest devoted his address to the main features of recent advances in the knowledge of the nature of electricity and matter. None, or only one other, is more qualified to do so. The result is most interesting. It is history written by one of the principal actors. No electrical engineer at least should fail to study it closely; a study it deserves.

England's Opportunity.

While every sympathy will be felt for the Japanese in the disaster that has overtaken them the present and future effects of what has occurred on British trade must not be lost sight of. As the lists that have been published in the newspapers show, we are already well represented in the country, and, in fact, our commercial relations with Japan were good and were getting better. The situation that has arisen may be regarded from two points of view. At present Japan's credit has fallen almost to nothing, and British creditors must therefore be content to wait with what equanimity they can summon for any amounts that may be owing. That these will eventually be paid there is little reason to doubt. On September 1st Japan's financial position was perfectly sound, she still possesses the same qualities of courage and enterprise which raised her to the height from which she has been so suddenly cast down, and, before long, we feel certain that she will be setting to work on the very difficult task of reconstruction. Without in the least wishing to be cynical we may say that here lies England's opportunity. Politically,

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this country has been Japan's closest friend. Commercially our relations have been equally satisfactory. It is to be hoped that our trading community, both individually and by associations, will see to it that the whole of their organisations and activities are directed to establishing anew our trade supremacy in Japan, and in assisting a friendly country in the difficult and dangerous work of reconstruction.

Our Trade Relations with Japan.

OUR best markets with Japan have been in wool and cycles, though India has supplied large quantities of pig-iron and cotton; and other more or less satisfactory markets have been fertilizers, chemicals and drugs, paper and rubber. From Japan the British Empire has taken such products as cotton yarns and hosiery, glassware and canned salmon. In the electrical industry, a close connection was being established between the two countries. A great deal of cheap Japanese electrical material has been imported into India, while, on the other hand, we had established a good market in the heavier machinery and switchgear in Japan. As we mention above, a The best chances for British enterprise probably lie in power station construction and railway electrification, though the market in smaller goods, especially those with which Japan has been supplying herself, must not be neglected. As regards railway electrification, an extensive programme, which was not to be completed before 1933, was approved in the last session of the Imperial Diet. We have no doubt that this programme will now be extended and that the work will be speeded up. In expressing our sympathy with the Japanese, among whom we number many friends, we would urge them to look upon the bright side of things. Though they are faced with a most arduous task, they have a heaven-sent opportunity for reconstructing their domestic and industrial life on the most modern scale. It is to be hoped that they will seize the opportunity and use electricity to the greatest possible extent. Considering their resources and their knowledge, it would be both economically and technically justified.

Foreign Contracts and British Trade.

GENERALLY we can be content to allow the ethics of buying in the cheapest market to be argued by the economists to their own if to nobody else's satisfaction. But in these abnormal times, with unemployment increasing, the question becomes a severely practical one which may be stated in the terms that every contract which is given to a foreign firm means increasing distress and expense at home. The problem is more industrial than political. Nevertheless, we view with surprise the indifferent attitude of the Labour party to the matter, an attitude which can only be explained by the supposition that they consider it an excellent chance to harm the hated capitalist, even if in so doing they do twice as much damage to their own members. Of this we feel sure, that, if the Trades Unions took this matter up as heatedly as they do some other question, no Government department or municipality and few private firms would dare to buy other than British goods.

Examples to be Followed.

WE can only ascribe to this indifference the fact that certain important contracts for electrical equipment in a mining area have been allowed to go abroad. As we know to our cost all is not well with the mining industry or with the miners. The iron and steel trade is suffering from the high price of coal and the high price of iron and steel is felt throughout the country, especially by the electrical industry. If the price of coal were reduced, or the demand for electrical machinery increased, this vicious link in the chain of unemployment might be broken. Perhaps it is felt that to import cheap foreign machinery will help to lower the price of coal. We think that a better way would have been to buy British plant. We are glad to see that this solution, though not without some searchings of heart, has been adopted by the Bradford and Leeds corporations. In both cases tenders were invited for turbo-generators and auxiliary plant, and in both cases a number of prices were submitted both by British and foreign firms. Of the original tenders at Leeds those of four foreign firms were considerably lower in prices than any of the British, but, after consultation, the British firms were able to reduce their prices by 15 per cent and the contract was awarded to the British Thomson-Houston Co. At Bradford there was also a "terrible difference" between the British and foreign prices, but this was reduced by capitalising the steam consumption guarantees and the contract was awarded to the English Electric Co. and C. A. Parsons and Co. The method by which this decision was reached is worth attention. Before the war we remember witnessing the jubilation of a station engineer who had purchased a foreign turbine cheaply. We also remember that before many months had passed his joy had turned to wailing because the machine could only be got to run with difficulty and, when running, had a gargantuan appetite for steam that had not been allowed for in the paper figures.

Cooking: Coal and Electricity Compared.

SOME useful tests on the comparative costs of electric, coal and combined cooking have been undertaken in a Swiss sanatorium catering for 180 persons. Details are given in a recent issue of the "Bulletin de l'Association Suisse des Electriciens." The kitchen was equipped with up-to-date heating devices and a large coal range; and the test of each piece of apparatus lasted a week. During the winter the kitchen was heated by the range even when the cooking was done electrically. The results of these tests showed that cooking by coal cost 19·30 fr. per day, as against 18·46 fr. when cooking by coal and electricity and 14·51 fr. when cooking with electricity alone. In winter the cost was 15·41 fr. when using electricity for cooking and coal for heating. These costs are based on a tariff of 0·1 fr. per kWh for cooking and 0·04 fr. per kWh for water heating during the night. The cost of coal is not stated, but the saving by using electricity is said to be 1 584 fr. per annum; 1·35 kWh of electricity doing the same work as 1 kg. of coal. Having in view the different conditions in the two countries, these figures are put forward merely as an indication of what can be done rather than as a direct comparison. They indicate, at least, that electricity can successfully do this class of work, a fact which some people find some difficulty in believing.

Building Societies and Electric Houses.

LAST week we published a communication from a correspondent in which he recounted his experiences with Building Societies and electrically equipped houses. These bodies, it appeared, refused to have anything to do with such dangerous places. Our wonderment is profound. Building Societies are doing very useful work (and getting rich in the process) lending money to people who have not the capital to buy or build their own houses, but must live somewhere. It is not a philanthropic but a business transaction and the Building Societies properly insist that the houses on which they lend money shall be strongly constructed, have modern sanitary arrangements and adequate protection against fire. On which of these scores is electricity objected to? When it is used it does not affect the construction of the houses and it rather improves the sanitation than otherwise. We must therefore suppose that some Building Society king has heard that fires are caused by the fusing of electric wires. On the other hand we believe that electric lighting is not objected to but rather encouraged and an extension of uses of electricity can therefore affect no principle. We

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must therefore place ourselves in the position of Rosa Dartle with regard to this question, but in no more hope of obtaining a satisfactory answer than she usually did.

This idiosyncracy, or whatever else our taste and fancy may call it, emphasises, however, the need for a new branch of propaganda. We suppose there is an Association of Building Societies somewhere. It would do its Secretary good to have a talk with Mr. BEAUCHAMP.

Electro-Chemical Progress.

It may be stated without fear of argument that developments in electro-chemistry are seldom spectacular. Progress is no doubt being made year by year, but as a rule it is not of the type that attracts widespread attention. Moreover, electro-chemical processes are often regarded as trade secrets, particularly in the older branches, and details are generally kept carefully in the background. Yet it happens at times that special demands arise and that there is then greater inducement than usual to find a solution to a particular problem. The great war was not without its effect in this respect.

Electro-Chemical Repairs.

In this connection reference may be made to the building up of worn parts of machinery. During those years of national emergency old plant was as important as new, and if such plant could be put into serviceable repair in a comparatively simple manner the gain was important. This was effected by depositing iron on the worn parts so as to bring them up to size once more. By heating a treated worn part at a suitable temperature for, say, half an hour, the old and the new iron are rendered indistinguishable.

A kindred process is the use of copper in the construction of parts for aeronautical engines. In this connection electro-deposition is utilised in various ways. For example, it is necessary that certain parts, such as camshafts, should be case-hardened, and this is effected by increasing the carbon content of the steel superficially, so that a hardened surface is obtained on quenching. It may be that adjoining parts should not be carbonised. In that case, if such parts cannot be machined to remove the carbonised layer, they must be protected in some way. A simple and effective method, and we believe the only one that has proved effective, is to deposit copper on these parts. Deposition to a thickness of only 0·004 in. is sufficient to prevent the carbon from passing into the steel during the process of case-hardening.

Copper Deposition and Engine Construction.

Another application is the deposition of copper on the fins of engine cylinders so as to improve the thermal conductivity, but the advantage of so doing requires, possibly, rather more adequate demonstration. Yet another application is the building up of a water jacket round a cylinder, as in the Beardmore engines. For this purpose an alloy of low melting point, such as Wood's alloy, is cast round the cylinder, the outside of this casting being shaped to correspond with the inside of the desired water jacket. Copper is then deposited upon the alloy, and when a sufficiently thick deposit has been obtained, the whole is heated and the molten alloy is run out, leaving a copper water jacket in position.

During the war the adequate supply of zinc presented difficulties, and therefore the problem of the electrolytic extraction of zinc from its ores was worked out, at least in some directions, to a successful conclusion. Success depends entirely on the adequate purification of the electrolyte, certain impurities that are liable to be present being particularly harmful.

We need scarcely remind our readers that the fixation of nitrogen received an enormous impetus from the war. This industry, however, was already well established, and from the electro-chemical point of view no very important modifications are to be recorded as the result of this abnormal expansion.

The Increasing Use of Cobalt.

Another advance in electro-deposition, but probably not due to the war, is the increasing use of cobalt. In some physical respects cobalt may not be quite the equal of nickel, but in many ways it is quite as good, if not preferable. From the point of view of the electro-plater it has many points in its favour. By using suitable solutions cobalt may be deposited at least fifteen times as fast as nickel. This is due to the much greater solubility of the cobalt salt, and the greater speed leads, of course, to a valuable saving in time; this, in turn, means that the investment is smaller, even when the higher cost of the cobalt salt is taken into account.

Electrical Precipitation.

The most notable advance of importance in electro-chemistry during the last few years has undoubtedly been that of electric precipitation. The work began in this country with the historic experiments of Sir OLIVER LODGE on dispelling fog. Such an undertaking, however, was too stupendous for any commercial success to be expected. Attention was also given to the deposition of fumes, but not very much progress was made. Non-success appears to have been due to minor causes, for the general principle was sound enough. The fact is that the process required to be thoroughly worked out in detail, and this was finally done by the Research Corporation in the United States, where it was felt that the problems were beyond the resources of a private individual, or even of a university laboratory. It must also be remembered that materials and methods are available now which were not available in the early days. The result of the researches, largely carried out under the direction of Cottrell, has been the development of thoroughly commercial plants, and electric precipitation has now become well established, being applied to the precipitation of dust, smoke and fume. The application of the process so far has been largely in the direction of avoiding nuisance on the one hand and recovering valuable ingredients in fume on the other. The former includes such bodies as sulphuric acid fume, in the treatment of which a good deal of difficulty might be expected; and the latter refers more particularly to metallic fumes in metallurgical operations. It appears now, however, that the method may be applied in some cases to deal with the whole of the metallurgical products instead of merely with a small but valuable part thereof, seeing that the volatilisation of chlorides is finding favour as a metallurgical process of separation.

Electric Furnace Developments.

The demand for ferrous alloys and all kinds of steel during the War gave an enormous impetus to the electric furnace. Even so-called "synthetic cast iron," made from steel borings and similar scrap, was in demand. Present-day conditions, however, are very different, and we are back in the days when methods have to be considered purely on their commercial merits and not at all by the standard of expediency. There has necessarily been a check in the rate of development here, but, even so, the electric arc furnace has marked advantages in the production of alloys, and will certainly hold its own in this particular field.

Many electric furnaces have also been devised to suit the special conditions necessary in the melting of brass, and also furnaces for particular purposes. The most interesting development in this direction is Northrup's high frequency furnace. The great advantage of this type of furnace is that an arc, with its attendant difficulties, is avoided; equally the difficulties of resistors and induction furnaces are eliminated. So long as the charge is conductive, or the crucible containing it is conductive, high frequency eddy currents will be generated and will cause the desired heating. There is little doubt that this type of furnace will find some important uses, and we venture to think that this is not the only direction in which high frequency currents will find an application in electro-chemistry.

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Notes on Wireless Matters.

By Prof. G. W. O. HOWE, D.Sc.

The Radiation from an Aerial.

In a letter published in THE ELECTRICIAN of April 27th, 1923, Mr. L. B. Turner pointed out that my treatment of the subject of the nature of the electromagnetic field in the neighbourhood of the transmitting aerial took the actual radiation from the aerial as a matter of course, but offered no explanation of it. He stated, moreover, that a simple explanation of the phenomenon was badly needed. In the issue of June 8th, I endeavoured to remove this reproach by giving a simple and yet numerically accurate explanation involving a minimum of mathematics. It appears, however, that this explanation does not meet with universal approval, for in the issue of August 3rd, a letter is published from my old friend and colleague, Mr. A. Press, in which several objections are raised. In the first place he objects to my assumption that electromagnetic waves travel through space with the velocity of light; he even calls this a very violent assumption and says that "the relativists do not assume that wave motion exceeding the speed of light cannot exist." In reply to this I can only assure him that this assumption is a very common form of violence among those who would not dare to call themselves relativists; the somewhat vague and negative statement as to what the relativists do not assume, prompts one to ask the more definite question: have the relativists proved that wave motion exceeding the speed of light does exist, and if so, by how much does it exceed it? Failing a definite answer to this question, I think that we shall be justified in going on making the violent assumption.

Electronic Revolutions.

The second point to which Mr. Press objects is that I deduce the radiation from the acceleration of the electrons; he says: "has it not lately been forced upon physicists that revolving electrons cannot radiate despite the accelerations?" This raises very complicated issues. When two or more electrons revolve around a positive nucleus in such a way that there is no resultant moment, there may be no radiation; even if a large number of atoms consisted of positive nuclei with single electrons revolving around them, there would presumably be no external radiation unless all the electrons could be forced to revolve in unison; in the latter case it would be surprising if there were no radiation, but, of course, surprising things do happen sometimes. In the case of the aerial, however, there is no doubt that radiation does occur, but only when there is a rapidly changing current in the aerial, that is to say, only when the electrons are being rapidly accelerated or decelerated. In my opinion, in giving a simple explanation of the phenomenon of radiation, or in establishing for non-mathematical readers, the relation between the radiated field and the current in the aerial, it is preferable to do so directly from the electron, without any reference to the capacity constants, or self-induction constants or waves of exciting potential travelling with hypervelocity and such things to which Mr. Press refers.

Multiple Earthing Systems.

In no branch of radio-telegraphy has greater progress been made during the last two or three years than in the design of the earthing systems of large transmitting stations. For many years the effectiveness of a station was judged by its so-called power in kilowatts, which sometimes was supposed to represent the power actually supplied to the aerial, but more often represented the power supplied by the dynamo or alternator to the transmitter. The power actually radiated from the aerial was rarely considered, though this, after all, was the only thing that mattered. It is now fully realised, however, that the only true measure of the effectiveness of a station is the radiated power, and since, for a given frequency, this depends on the product of the effective height and the current, this product is now specified instead of a meaningless number of kilowatts. To obtain the maximum radiated power for a given total power delivered to the aerial, every effort is now made to reduce the various losses. These consist of the losses in the aerial wires, tuning inductances, etc., and in the towers, stays, etc., losses in the insulators themselves and over their surfaces, losses due to brush discharge from the wires, and last, but by no means least, losses in the earth under the aerial.

Experience of Power Transmission.

High tension transmission lines are now being operated at 220 000 V and the experience gained can be applied to the design of aerials, but the losses in the insulators will be much greater at the higher frequency, and 150 000 V should probably be regarded as the limit for aerial design. The losses in the towers raise the questions of wooden *versus* steel towers and insulated *versus* earthed steel towers Apart from the shorter life of a wooden tower as compared with a steel one, it must be remembered that wood is a poor dielectric and the losses in the towers may be very considerable, so that increased effective height may be more than set off by reduced efficiency. On the other hand, most attempts to carry steel towers on insulators have proved unsuccessful and such stations are usually found to be working with the tower connected to earth. It is possible that with a better design of insulated base and with precautions to avoid losses in the earth below and around the insulator, this problem may yet be solved.

A serious problem is the reduction of the losses in the tuning inductance in series with the aerial. Not only must the conductors be designed to give a low resistance at high frequency, but the coil must be supported in such a way as to minimise the losses in the frame on which it is supported and in the surrounding earth and buildings. This is best done by supporting it at as great a distance as possible from the earth and any neighbouring walls and ceiling and by conducting screens such as copper sheets or short circuited turns between the coil and these imperfect dielectrics.

The Most Important Loss.

We have left to the last the most important of the various losses—viz., those in the earth, and it is here that the greatest improvements have been made. The old method of burying a number of radial wires in the earth led to very serious losses in the soil between the surface and the network of wires, however extensive the latter might be. Three methods have been introduced with a view to minimising the loss, the multiple antenna of Alexanderson, employed at the Long Island station of the Radio Corporation of America; the earth screen installed at several of the Marconi stations; and the multiple earth system in use at Sainte-Assise and being installed at Nauen. The first-named is applicable to very long aerials at a medium height, and especially to those of the T or inverted L type. It really reduces it to a number of smaller aerials connected in parallel and the paths of the earth currents are greatly reduced. The earth system of each one of the multiple aerials has still to be properly designed and may involve either of the other methods.

Earth Screen or Multiple Earth?

The earth screen is a development of the insulated counterpoise, the wires being so spaced and arranged that they practically screen the earth from the electric field of the aerial. The introduction of an earth screen has reduced the earth resistance of the stations where it has

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been installed to a fraction of the previous value, with a corresponding increase in the efficiency.

The Multiple Earth System.

The multiple earth system consists in distributing under the aerial a large number of earth plates or pins, the currents from which are brought back to the transmitting station by means of overhead wires. The French engineers at Sainte-Assise have fitted up both types, so as to compare the relative merits of the earth screen and the multiple earth system, and it appears from a recent paper by M. Bouvier that they have decided in favour of the latter, the reasons given being that the earth screen is expensive and that the large number of wires with their supports and insulators make it difficult to carry out work on the aerial. They consider that equally good results can be obtained by the multiple earth system. As applied to the large aerial at Sainte-Assise the system is as follows: The aerial is a T with a total length of 2·8 km., carried on 16 steel lattice masts (uninsulated); 42 earth plates have been installed, 16 being at the feet of the masts and 26 suitably distributed under the aerial. These are connected to the transmitting station by 12 collecting wires running the whole length of the aerial at a height of 16 ft. These wires will also act to some extent as an earth screen.

The system is more complicated, however, than we have indicated, for, in order to ensure that each earth plate collects its proper quota of current, the impedances of the various return paths must be equalised by inserting large inductances in series with the earth connections which have a short return path and smaller inductances in those which have a longer return path. With this arrangement potentials up to 8 000 V would occur at the station ends of the collecting wires. To avoid this and to reduce the size of the inductances required in the earth leads, the collecting wires are interrupted at various points and series condensers inserted so as to neutralise to some extent the inductance of these collecting wires. No attempt at perfect neutralisation is made, as this would make the adjustment too critical for variations of wave length.

The total effective resistance of the Sainte-Assise aerial is 0·54 O at a wave length of 14 300 m. This is made up as follows:—

Radiation resistance	0·19
Tuning inductance	0·10
Aerial wires	0·05
Earthing system	0·20
	0·54 O

This corresponds to an aerial efficiency of $\frac{0\cdot19}{0\cdot54}=0\cdot35$.

This station is the most powerful in the world.

Auto-Transformer Limitations.

In a recent issue "The Electric Journal" discusses the properties of the auto-transformer to show that though it has some advantages over one with two windings, its application is not universal. The auto-transformer, it is pointed out, can only be used where it is unnecessary to insulate the secondary winding from the primary. In certain cases it may be permissible to use an auto-transformer from the viewpoint of voltage alone; but there are undesirable conditions which often prevent such use. The main advantage of the auto-transformer, where it can be used, is that it is cheaper than the two-winding transformer. Since the amount of material used is less, the losses are lower and, therefore, the efficiencies are higher. The efficiencies of an auto-transformer, when based upon the amount of energy transformed, are at times almost unbelievably high. The reactance of the auto-transformer is also low, and in some applications this may become somewhat embarrasing when, for example, it is desired to have the impedance sufficiently high to withstand short-circuit conditions. The degree of lower cost, higher efficiency and lower reactance of the auto-transformer depends on the ratio of transformation, and this indicates the restricted nature of its field of usefulness.

The Design of Inductances for High-Frequency Circuits.*

By Prof. C. L. FORTESCUE.

This paper is an investigation of the proportions and the arrangement of the winding of high-frequency inductances in order to obtain the minimum ratio of R/L.

The Losses in a Stranded Wire Inductance.

Assuming that the strands are properly arranged and that each carries its proper share of current, the losses in the metallic circuit only are:

(1) The conductor losses, assumed to be in this case the same as for steady currents.
(2) Eddy current losses in the conductor, due to the main field of the inductance.

These losses may be calculated and added.† Dealing with n strands in parallel and letting d_1 be the diameter of the strand in cms., n the number of strands, λ the wave-length in metres, and p the specific resistance. Thus for 1 cm. length of the strand the resistance $= 1\cdot27\ p/d_1^2$ O, and for n strands in parallel the resistance per cm. is $1\cdot27\ p/nd_1^2$. The average loss in watts per cm. length of strand throughout the whole coil can be shown to be

$$17\cdot4\left(\frac{d_1^4}{p\lambda^2}\right)\left(\frac{K^2N^2}{D^2}\right)I^2 \quad . \quad . \quad . \quad . \quad (1)$$

where I is the r.m.s. current in conductor, N the number of turns, D the diameter overall in cms., and K the constant depending on form of coil.

That is, the average contribution of each cm. length of strand to total resistance is

$$=17\cdot4\left(\frac{d_1^4}{p\lambda^2}\right)\left(\frac{K^2N^2}{D^2}\right)\text{O} \quad . \quad . \quad . \quad . \quad (2)$$

Therefore, the total resistance for 1 cm. length of stranded inductance at λ

$$=1\cdot27\ p/nd_1^2+17\cdot4\left(\frac{nd_1^4}{p\lambda^2}\right)\left(\frac{K^2N^2}{D^2}\right)\text{O} \quad . \quad . \quad (3)$$

Regarding n as variable, this is a minimum when

$$n=\cdot27\left(\frac{p\lambda}{d_1^3}\right)\left(\frac{D}{KN}\right) \quad . \quad . \quad . \quad . \quad (4)$$

and total number of strands in section

$$Nn=\cdot27\left(\frac{p\lambda}{d_1^3}\right)\left(\frac{D}{K}\right) \quad . \quad . \quad . \quad . \quad (5)$$

and the minimum resistance corresponding to this number of strands per cm.

$$=9\cdot4\left(\frac{d_1}{\lambda}\right)\left(\frac{KN}{D}\right)\text{O} \quad . \quad . \quad . \quad . \quad . \quad (6)$$

Similarly, *the resistance of a coil having a solid conductor* may be regarded as having losses, due to

(1) Conductor losses due to the distribution of main current over the skin.
(2) Losses due to the surface distribution of eddy currents set up by main flux.

The resistance of 1 cm. of a cylindrical conductor of diameter d_2 cm.

$$=\frac{1\cdot1}{d_2}\sqrt{\frac{p}{\lambda}}\text{O}$$

To determine the losses arising from currents induced by the main flux, it is known that if the current down the outside of the cylindrical conductor is distributed over the surface according to a sinusoidal law, the flux density inside the cylinder is constant. Then, eddy currents, if of the correct magnitude will balance, the main external flux and prevent it penetrating the conductor. This leads to the expression for the losses per cm. length.

$$13\cdot7\ d_2\sqrt{\frac{p}{\lambda}}B^2\text{W} \quad . \quad . \quad . \quad . \quad . \quad (7)$$

and the contribution per cm. towards the total resistance

$$13\cdot7\ d^2\sqrt{\frac{p}{\lambda}}\frac{K^2N^2}{D^2}\text{O} \quad . \quad . \quad . \quad . \quad (8)$$

Therefore the total resistance per cm. length of an inductance consisting of a solid conductor is:

* Abstract of a Paper read before the Wireless Section of the Institution of Electrical Engineers.

† Proceedings of the Royal Society, 1917, vol. 93 (A), p. 468. Howe.

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$$=\frac{1\cdot094}{d_2}\sqrt{\frac{\bar{p}}{\lambda}}+13\cdot7\,d_2\sqrt{\frac{\bar{p}}{\lambda}}\frac{K^2N^2}{D^2}\,\Omega \quad . \quad . \quad (9)$$

If d_2 is regarded as a variable the resistance is a minimum when

$$d_2=0\cdot286\left(\frac{D}{KN}\right)$$

and with this value of d_2 the resistance in ohms per cm. length of conductor is

$$=7\cdot7\,\frac{KN}{D}\sqrt{\frac{\bar{p}}{\lambda}} \quad . \quad . \quad . \quad . \quad . \quad (10)$$

The Determination of the Form Factor K.

The form factor is calculated, and explained, in an appendix.

TABLE I.

THE FORM COEFFICIENT, K.

b=axial length of coil.
t=winding depth of coil.

$\frac{b}{D}=$	0·5	0·75	1·0	1·25	1·5
$\frac{t}{D}=0\cdot0$	0·99	0·68	0·52	0·43	0·37
0·1	0·77	0·55	0·44	0·37	0·31
0·2	0·65	0·48	0·38	0·32	0·27
0·3	0·57	0·42	0·33	0·28	0·24
0·4	0·52	0·37	0·29	0·24	0·21

The Minimum Ratio R/L for an Inductance.

The length of wire on an inductance of N turns is

$$l=\pi N\,(D-t),$$

and, therefore, for a stranded wire having the best number of strands the ratio R/L from equation (6) is

$$\frac{29\cdot6}{D}\cdot\frac{d_1}{\lambda}\cdot\frac{K}{L_0}\left(1-\frac{t}{D}\right)\Omega \text{ per } \mu \text{ henry} \quad . \quad (11)$$

where $L=L_0N^2D$, and
L_0=constant.

For a large solid conductor having the best diameter R/L from equation (10)

$$=\frac{24\cdot3}{D}\sqrt{\frac{\bar{p}}{\lambda}\frac{K}{L_0}}\left(1-\frac{t}{D}\right)\Omega \text{ per } \mu \text{ henry} \quad . \quad (12)$$

This factor

$$\frac{K}{L_0}\left(1-\frac{t}{D}\right)$$

will be noted in both cases, and is given in tabular form in the original paper.

The Space Factor.

The space factor for stranded wire is defined as area of cross-section of copper to area of whole of winding space and is

$$nN\frac{\pi d_1^2}{4}\Big/bt$$

which becomes

$$\frac{0\cdot21}{D}\cdot\frac{p\lambda}{d_1}\cdot\frac{1}{K}\Big/\left(\frac{b}{d}\cdot\frac{t}{d}\right) \quad . \quad . \quad . \quad . \quad (13)$$

For the single layer solid conductor the more important ratio is the length of winding space occupied by conductor, to total length of winding space which

$$=\frac{0\cdot29}{K}\Big/\frac{b}{d}$$

The Limitations Arising from the Space Factor for Transmitting Inductances

The spacing, to avoid sparking between turns or losses in the insulating material make a space factor greater than ·2 difficult to realise. Then from

$$\frac{0\cdot21}{D}\frac{p\lambda}{d_1}\frac{1}{K}\Big/\left(\frac{b}{D}\frac{t}{D}\right)>\cdot2 \quad . \quad . \quad . \quad . \quad (14)$$

and

$$\frac{\lambda}{D}>\frac{Kd_1}{p}\frac{b}{D}\cdot\frac{t}{D} \quad . \quad . \quad . \quad . \quad . \quad (15)$$

Solid Conductors.

With the same space factor we have

$$0\cdot064\,\frac{I}{NK^2}\Big/\frac{b}{D}\cdot\frac{t}{D}>\cdot2 \quad . \quad . \quad . \quad . \quad (16)$$

and substituting

$$N=\sqrt{\frac{L}{L_0D}}$$

then

$$\frac{L}{D}<\cdot1\,\frac{L_0}{K^4}\Big/\left(\frac{b}{D}\cdot\frac{t}{D}\right)^2 \quad . \quad . \quad . \quad . \quad (17)$$

Usually single layer solid conductor coils are employed and allowing a space between conductors equal to half their diameter, then

$$K\frac{b}{D}<0\cdot43$$

The Resistance for Coils in which the conditions for maximum efficiency cannot be complied with.

The author shows that if a stranded coil of n_1 strands be used instead of the best value n then the resistance all through must be multiplied by a factor $\frac{1}{2}\left(\frac{n_1}{n}+\frac{n}{n_1}\right)$.

In the case of a solid conductor coil of d^1_2 instead of d_2 all the resistances will be multiplied by a factor $\frac{1}{2}\left(\frac{d^1_2}{d_2}+\frac{d_2}{d^1_2}\right)$.

General Conclusions.

For both types of conductors the minimum value R/L varies inversely with the diameter of the coil.

The value of $\frac{K}{L_0}\left(1-\frac{t}{D}\right)$ has but a small variation between $\frac{b}{D}=1$ to 1·5 and $\frac{t}{D}=0$ to ·2, giving much choice in the shape of a coil. If $b=D$ there is little to chose between a simple or multi-layer coil. Taking as a figure

$$\frac{K}{L_0}\left(1-\frac{t}{D}\right)=80$$

$\frac{R}{L}$ in ohms per μ henry becomes for the stranded the ratio

$$\frac{2\,400}{D}\frac{d_1}{\lambda}$$

and for the solid

$$\frac{2\,000}{D}\sqrt{\frac{\bar{p}}{\lambda}}$$

That is for given values of d_1 and p there is a λ for which these values are equal, and at that λ the solid and stranded give equally good coils. If manufacturing reasons impose a limit to wire smaller than No. 38 S.W.G. and $p=1\cdot8\times10^6$, then at $\lambda=186$ metres the two inductances of stranded and solid conductors are equally effective. These conclusions are independent of the accuracy of form factor K.

Penang Electricity Supply and Tramways.

The report of the electric supply department of the municipality of GEORGE TOWN, PENANG, for 1922, shows improvement in consumption of current per head of population, and in profit in spite of reductions of prices. The following figures are in dollars, one dollar being equal, at the present rate of exchange, to about 2s. 4d. The revenue of the electric supply department was $631 231, compared with $649,497, a decrease of $18 266, although the kilowatt-hours sold showed an increase of 557 250 (the total being 2 832 000), the decrease in revenue being, of course, due to reduction of prices of current. Total costs, other than capital charges, were £344,843, showing the remarkable decrease of $108 963, equivalent to 12.10 cents per kWh sold. Out of the gross profit of $631 231, $25 000 has been placed to renewals fund reserve, and $98 419 to depreciation, and, after provision for interest and sinking fund, $20 000 has been contributed to the Municipal Fund, leaving net profit $15 112. We note that since Mr. N. J. Williams took up his appointment as manager of the undertaking in January, 1921, the output has been doubled, and the load factor increased from 21·5 to 45 per cent. The municipality is erecting a large power station at Prai, on the mainland, and Penang will be connected to the mainland by 4½ miles of submarine cables transmitting current at 11 000 V. Some electric cookers have been installed, and a large increase in the demand for cookers is expected. There are distinct signs of a more general adoption of electricity for domestic and industrial purposes. The tramways and motor omnibus department earned $225 225, compared with $259 014 in the previous year, and operating costs were $181 698 against $207 850. After providing for interest and sinking fund, and placing $25 000 to renewals reserve and $17 385 to depreciation, there was a deficit of $34 876.

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The Wave Antenna.*

A New Type of Highly Directive Antenna.

By H. H. BEVERAGE, C. W. RICE and E. W. KELLOG.

Historical.

The wave antenna consists essentially of a single insulated overhead line similar to an ordinary transmission or telephone line, pointing towards the transmitting station, the length of the line being of the order of one wave length of the waves it is desired to receive. (See Fig. 1.)

The possibilities of such a line from the point of reception were discovered by Beverage in studying the properties of long earth antennæ of the order of half a wave length or more in length. He discovered that under certain circumstances they showed marked unidirectional properties. Rice and Kellog, before learning of the results of Beverage's work, had concluded on purely theoretical grounds that a long horizontal antenna, pointing in the direction of a sending station, would constitute a unidirectional receiver, provided the receiver were placed at the end of the antenna remote from the sending

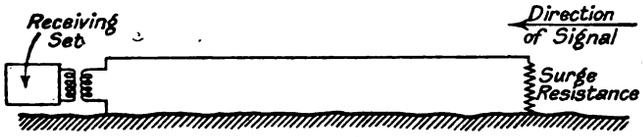

FIG. 1.—A SIMPLE FORM OF WAVE ANTENNA.

station, while the end nearest the sending station was earthed through a non-inductive resistance equal to the surge impedance of the antenna. The theory of the subject indicated that the full realisation of the possibilities of the wave antenna called for a line of high velocity and low attenuation and free from points of reflection. Such a line was accordingly constructed by the Radio Corporation.

The Experimental Line.

A flexible type of line construction was adopted suitable for experimental work. Two cross arms were provided, one 18 ft. and the other 30 ft. above ground. The upper arm carried two No. 10 B. and S. copper wires and the lower arm four similar wires. All lines were broken every ten poles and down

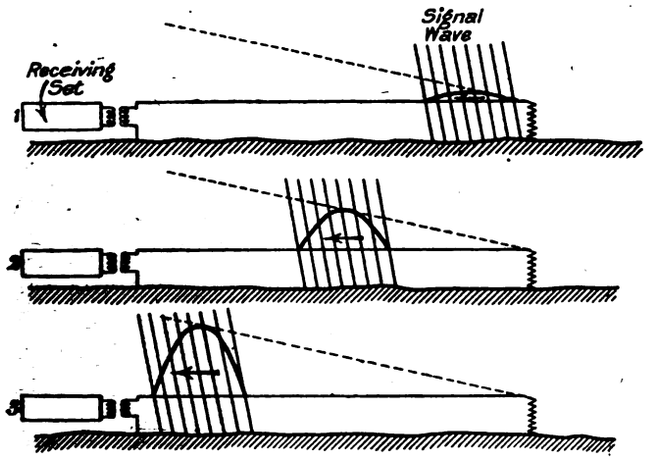

FIG. 2.—THE BUILDING UP OF WAVE ON WIRE AS SPACE WAVE PROGRESSES.

leads were provided that connections might be readily changed. The line ran seven miles, approximately, south-west from Riverhead, and thence to Terrell River, a total length of nine miles. The line was as straight as it was feasible to build it, and its direction substantially in line with the principal European long wave stations.

The first tests on the new line showed that the hoped-for results had been realised. Oscillator tests indicated that the velocity was high and the attenuation low compared with the rubber covered ground lines of the original experiments. It was also found to have no serious reflection points.

Explanation of the Action of the Wave Antenna.

Referring to Fig. 1, when the signal reaches the right hand end an e.m.f. is induced in the horizontal antenna wire due to the fact that the wave front is not perpendicular to the ground, but has a tilt forward of from one to ten degrees, depending on the wave length and on the character of the ground. Thus a little wave starts to run down the line towards the receiving station, and if it travels with the same velocity as the radio-wave in space, the space wave follows right along

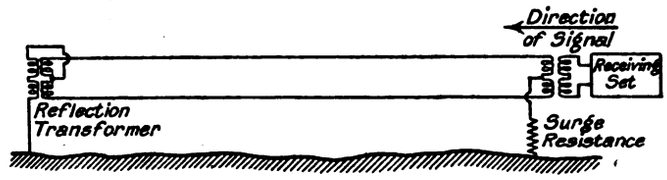

FIG. 3.—ARRANGEMENT FOR LOCATING RECEIVING AT THE SAME END AS SURGE RESISTANCE.

with it, supplying energy to it as it goes and building it up, until at the far end it has reached a magnitude many times that which it had at first. This is illustrated in Fig. 2, which shows a single wave at successive time intervals. If the velocity of the wave on the wire is not equal to that of the space wave, interference effects develop, the wave on the wire building up for a certain distance and then decreasing in amplitude. The velocities on actual antennæ are, however, nearly enough

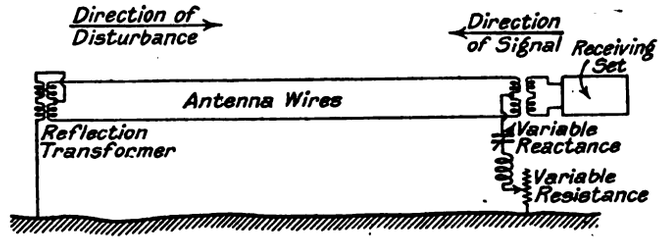

FIG. 4.—METHOD OF BALANCING BACK-END CURRENTS BY REFLECTIONS FROM DAMPED END.

equal to that of light, so that for considerable lengths the wave on the wire builds up as it would on a light velocity line.

A signal coming from the opposite end to that which has been considered will build up a wave on the wire in a similar way, from a small value at one end to a large value at the other. If, now, the line were open or earthed, a sound would be reflected back over the antenna to the receiver end and would be heard. On the other hand, if one end is damped in such a manner as to prevent reflection, the antenna becomes unidirectional. A non-indicative resistance having the value $R=L/C$ ohms, where L and C are the inductance and the capacity of the antenna per unit length, constitutes a practically perfect damper.

Reduction to Practical Form.

After the construction of the Riverhead antenna, considerable time was devoted to experimental work.

In order that the receiving set might be located at the same end of the line as the surge impedance, thereby facilitating adjustment, the arrangement shown in Fig. 3 was proposed by Kellog. The two wires work in multiple as an antenna, but act as a balanced transmission line to bring the signal currents back from the south-west end. This scheme obviates the use of extra wires for the return transmission line and thus avoids the problem of preventing detrimental effects from nearby conductors.

Compensation for Back Wave.

Beverage showed that, while the resistance could be adjusted to give a minimum for static while listening to European signals, still better stray ratios were obtained by combining with the signal currents brought in over the transmission line, a small amount of the currents flowing to earth at the north-east end of the antenna. Kellog showed that this was due to the fact that since the antenna was not an exact number of half wave-lengths long there would be a reflected wave which would prevent the antenna from being unidirectional,

* Abstract of a paper read before the American Institute of Electrical Engineers.

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even though the true surge impedance had been used for damping the end.

A method proposed by Kellog of supplying this necessary compensation is illustrated in Fig. 4. It consists of inserting in the neutral at the end nearest the transmitting station a circuit of inductance resistance and capacity in series. By adjusting the resistance, and varying the capacity through the point where it just tuned out the capacity reactance of the coil, a wave of any desired intensity and phase could be reflected down the antenna to compensate exactly for the back-wave effect and thus render the antenna uni-directional.

Multiplex Reception.

If only one station is to be received the circuit described above is quite satisfactory. One of the objects of the research, however, was the establishment of a system suitable for the simultaneous reception of a number of stations. A system was wanted in which all the adjustments for each station to

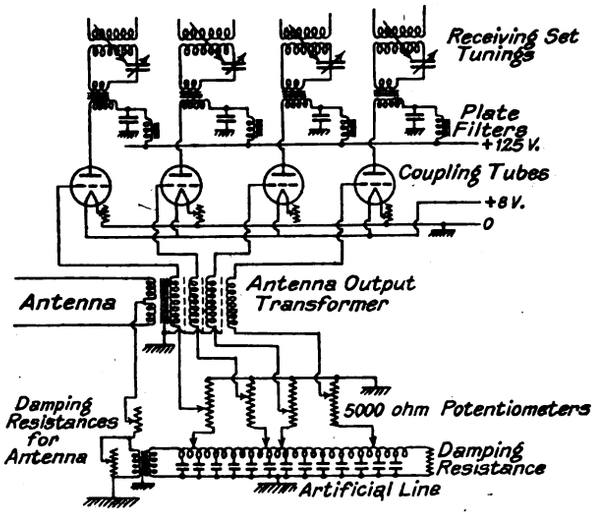

FIG. 5.—MULTIPLEX RECEIVING SYSTEM.

be received could be made without reacting on the adjustments for the others.

For this purpose the arrangement shown in Fig. 5 proved entirely satisfactory. Each coupling tube feeds a receiving set, and the antenna output transformer and artificial line with its sliding contacts and potentiometers serve to impress the deisired potentials on the grids of the tubes. Since the load is negligible, there is no reaction between the different sets. Earthed shields between the secondaries of the antenna output transformer prevent electro-static reactions. The desired component of the currents or potentials in the earth circuit can be obtained in any desired phase by moving the sliding contact along the artificial line, and in the needed intensity by adjusting the potentiometer. The artificial line has a characteristic impedance of about 400 O, and reflections are prevented by a resistance of about this value. 5 000 O potentiometers are used, and these constitute so small a load on the artificial line that the adjustment of any one does not

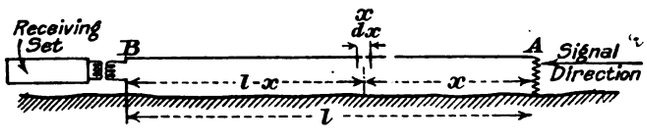

FIG. 6.—MEASUREMENTS REFERRED TO IN DERIVATION OF EQUATIONS.

appreciably alter the potential distribution on the line. The artificial line, damped as it is at the far end, acts as a practically pure resistance in the antenna surge impedance circuit, By adjustment of the series and shunt-resistance boxes the antenna damping resistance may be set at the best average value, leaving only a small difference to be dealt with by the artificial line adjustments.

New Riverhead Station.

In the new Riverhead station a capacity of nine receiving sets was planned for. Of these six are now in daily operation. Mutual reactions are minimised by careful screening of the various component elements, and by the astatic winding of coupling coils. In addition a two-stage filter is introduced in each circuit between the detector and the audio-frequency amplifier. These precautions have made it possible to operate the several sets with the same filament and high-tension batteries, without trouble from back coupling.

Theory.

The mathematical theory of the wave antenna can be stated in very simple terms. Referring to Fig. 6, if e_x be the instantaneous value of the intensity of the electric field at the point x on the antenna, the e.m.f. induced in a small element of the line dx in length will be $e_x \cos\theta dx$, θ being the angle between the direction of the wave and that of the antenna. If λ be the wave-length the apparent wave-length in the direction of the antenna will be $\frac{\lambda}{\cos\theta}$. There fore, if

$$e_0 = \hat{E}_0 \cos \omega t$$

be the instantaneous value of the intensity at the end A,

$$e_x = \hat{E}_0 \cos\left(\omega t - \frac{2\pi . \cos\theta . x}{\lambda}\right)$$

and the e.m.f. induced in the element dx is

$$\hat{E}_0 \cos\theta \cos\left(\omega t - \frac{2\pi \cos\theta\, x}{\lambda}\right) dx$$

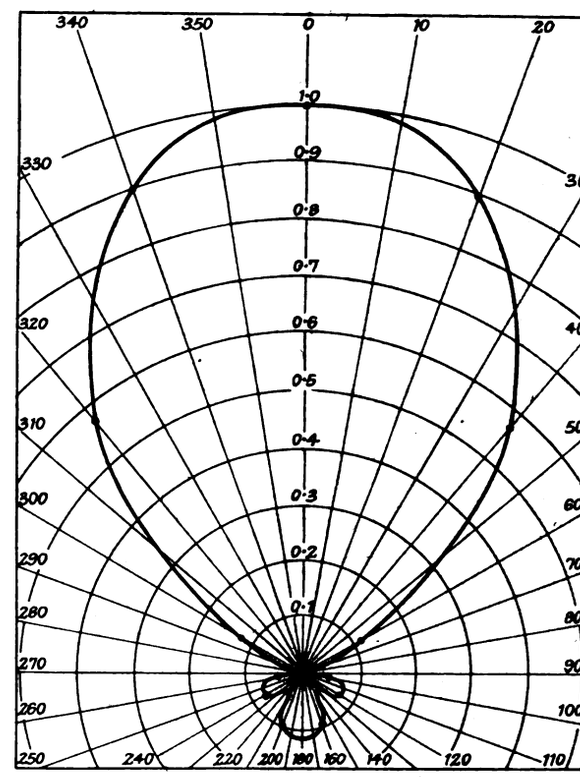

FIG. 7.—DIRECTIVE CURVE OF WAVE ANTENNA.

If this is transformed into vector form and $\dot{E}_0$ be the vector representing e_0, the vector representing the elementary e.m.f. is

$$\varepsilon^{-j\beta_s \cos\theta . x} \dot{E}_0 \cos\theta\, dx.$$

where $\beta_s = 2\pi/\lambda$—i.e., β_s can be described as the wave-length constant of the space wave. This e.m.f. can be considered as supplying current to two transmission lines in series, one running to A and the other to B. Each of these lines can be treated as a line of infinite length, since the surge impedance at the end A, and the compensation currents sent down the line from the end A to cancel the reflections from B, prevent reflection from either end.

The appropriate transmission line formula will therefore be the comparatively simple one which applies to lines of infinite length. This will give for the elementary current dI_B at the end B due to the element dx.

$$dI_B = \frac{I}{2Z_c} \varepsilon^{-(\alpha+j\beta)(l-x)} \varepsilon^{-j\beta_s \cos\theta x} \dot{E}_0 \cos\theta\, dx$$

where α and β are the attenuation factor and the wave-length constants of the line, and where z_c is the vector characteristic

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impedance of the line. The total current at the end B will be the integral of this expression between the limits $x=0$ and $x=1$—i.e.,

$$I_B=\frac{1}{2Z_c}\frac{\varepsilon^{-(\alpha+j\beta)l}\{\varepsilon^{(\alpha+j\beta-j\beta_s\cos\theta)l}-1\}}{(\alpha+j\beta-j\beta_s\cos\theta)}\dot{E}_0\cos\theta$$

The value of the current at the end A can be found in a precisely similar manner, and will be found to be

$$I_A=-\frac{1}{2Z_c}\frac{\{\varepsilon^{-(\alpha+j\beta+j\beta_s\cos\theta)l}-1\}}{(\alpha+j\beta+j\beta_s\cos\theta)}\dot{E}_0\cos\theta$$

It will in general be a very close approximation to take α as negligible and $\beta=\beta_s$. In this case the expressions take the much simpler forms.

$$I_B=\frac{1}{2\sqrt{L/c}}\frac{\{\varepsilon^{-j\beta_s\cos\theta l}-1\}}{j\beta_s(1-\cos\theta)}\dot{E}_0\cos\theta$$

$$I_A=-\frac{1}{2\sqrt{L/C}}\frac{\{\varepsilon^{-j\beta_s(1+\cos\theta)l}-1\}}{j\beta_s(1+\cos\theta)}\dot{E}_0\cos\theta$$

where L and c are the inductance and capacity per unit length.

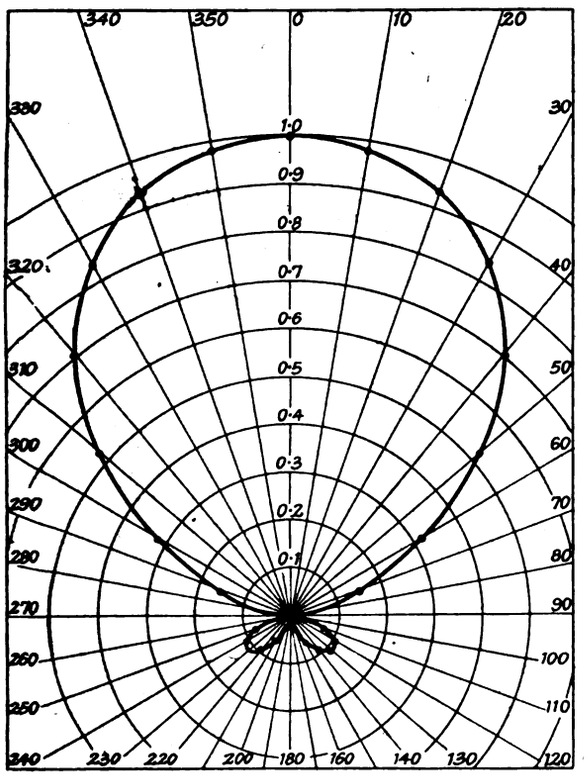

FIG. 8.—DIRECTIVE CURRENT OF IDEAL WAVE ANTENNA.

The type of directive curve given by the above expressions in two typical cases is illustrated in Figs. 7 and 8. An actual experimental determination of the directive curve gave results substantially in agreement with those calculated.

The Possibilities of Shorter Antennæ.

The question of the possibility of obtaining in less space directive properties approaching those of a full wave-length antenna is one of considerable practical interest.

It is obvious that as long as there is considerable inequality between the sizes of the two lobes of the figure eight directive curve a back end zero can be obtained by compensation without entirely sacrificing the signal. Another alternative is, however, available. This consists of the reduction of the velocity of the antenna by loading in the usual way. An antenna for which

$$\frac{v}{u}=\frac{\lambda}{l}-1,$$

where l is the length of the antenna, v the velocity of light, u the antenna velocity and λ the wave-length, will give zero reception at the back end without compensation, and a directive curve very similar to that of the normal velocity compensated line. Compared with the latter, the loaded antenna has a better directive curve for its own wave-length but a smaller range of satisfactory multiplex reception since, though it can be compensated for wave-lengths longer than that for which its velocity is adjusted, compensation for shorter wave-lengths leads to not very favourable conditions.

On the whole, the writers have concluded that wherever possible full wave-length, or at least half wave-length antennæ should be used for commercial reception in preference to shorter loaded lines.

Electrical Supply Developments in Styria.

Austria, as is well known, is faced by considerable financial and industrial difficulties and an increase in productive power and export trade is an imperative necessity. At the present time it is of special importance to economise its insignificant coal reserves and to produce energy on a hydro-electric basis. Austria possesses about 3 million h.p. of workable water-power. The actual supply of the whole State, including railways, would demand an output of about 1·5 million h.p. and a potential power considerably higher, about 2·3 million h.p. The costs of a complete long-distance network and transformers would be about 2 000 gold crowns, to be raised in a period of 20 to 30 years.

The basis for such an electrification is to be found in existing companies, though the stations they operate are at present small. Special importance attaches to the work being undertaken by the Styrian Water-Power and Electricity Co., whose operations are to be extended throughout the country. The plans outlined would take about 15 years. The maximum load of the whole of Styria, put down as about 100 000 kW, is at present met by steam plants only and in an unsatisfactory manner. Within 50 years an increase of quite 50 per cent. is probable. If the demands of Lower Austria and the electrification of the Styrian railways (requiring about 90 000 kW) are included the total would be at least 265 000 kW. It is proposed to follow the method hitherto adopted on railways in Central European States of using single-phase supply for the railways; but for the benefit of industries three-phase will also be generated. An important element will be the meeting of the variable load, high in the daytime but insignificant at night, by the aid of hydraulic storage.

Power Works Contemplated.

The various power works will comprise :—

(*a*) The Enns power station, planned to supply 136 000 kW; the hydro-electric Erzbach-Radmer group, rated at 10 000 kW; and the storage works on the Thalbach and Solkbach with a total capacity of 54 000 kW.

(*b*) In the Mur district, the low pressure Judenburg-Zeltweg works (10 000 kW), Bruck-Mixnitz (18 000 kW), Peggau-Weinzödl (24 000 kW) and Puntigam-Werndorf (23 000 kW).

(*c*) The Teigitsch storage works in Western Styria (42 000 kW).

(*d*) The Teich-Alpe storage works near Mixnitz (18 000 kW).

Five supply centres are projected, covering respectively Central, Eastern and Upper Styria, the Upper Mur valley and the Upper Enns and Traun district. About 25 000 kW are reserved for ultimate supply to Lower Austria. Long-distance transmission at 60 000 V in Central and Eastern Styria and 100 000 V in Upper Styria is proposed. Railway feeders will be kept separate from the three-phase network.

Cost of Enterprise.

The cost would have to be raised within a building period of 15 years, the average annual expenditure being thus 17 million gold crowns. In view of the favourable conditions for hydro-electric power and storage, an annual construction of about 1 200 million kW should be available for the chief centres of consumption and the railways. The enterprise will be carried through by partial constructions in the first place, utilising existing power stations as far as possible.

The organisation of the whole enterprise will be in the hands of the Styrian Water-Power and Electricity Co., the town of Graz and the agricultural corporations participating. The company will supply in bulk and retail distribution will be effected by subsidiary concerns.

Financial Details.

A detailed financial scheme involving the issue of preference bonds, preferred shares and stock has been prepared and it is hoped to receive the aid of foreign capital. The total expenses are assessed at about 6 per cent. of the invested capital of 250 million gold crowns—*i.e.*, about 21 millions. Total proceeds should be 41 millions, leaving a surplus of 20 millions, which would equal an interest of 8 per cent. on the capital, assuming complete amortization of two-thirds of the same within 15 years.

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The Electrical Structure of Matter.*

By Prof. Sir ERNEST RUTHERFORD, D.Sc., LL.D., Ph.D., F.R.S.

It was in 1896 that this Association last met in Liverpool, under the presidency of the late Lord Lister. The year was a memorable one, for it marked the beginning of what has been aptly termed the heroic age of physical science—a period of intense activity when discoveries of fundamental importance followed one another with bewildering rapidity. The discovery of X-rays by Röntgen was published in 1895, and of the radioactivity of uranium by Becquerel in 1896. The address of Prof. J. J. Thomson, President of Section A, was devoted mainly to a discussion of the nature of the X-rays, and the remarkable properties induced in gases by the passage of X-rays through them—the beginning of a new and fruitful branch of study.

The Genesis of Wireless.

In applied physics, too, this year marked the beginning of another advance. In the discussion of a paper which I read, on a new magnetic detector of electrical waves, the late Sir William Preece told the meeting of the successful transmission of signals for a few hundred yards by electric waves which had been made in England by a young Italian, Mr. G. Marconi. The first public demonstration of signalling for short distances by electric waves had been given by Sir Oliver Lodge at the Oxford Meeting of this Association in 1894. It is startling to recall the rapidity of the development from such small beginnings of the new method of wireless inter-communication over the greatest terrestrial distances. Later advances in radiotelegraphy and radiotelephony have largely depended on the application of the results of fundamental researches on the properties of electrons, as illustrated in the use of the thermionic valve or electron tube. The important reaction between pure and applied science can be illustrated in many branches of knowledge. In this age no one can draw any sharp line of distinction between the importance of so-called pure and applied research. Both are equally essential to progress, and without flourishing schools of research on fundamental matters in our universities and scientific institutions technical research must tend to wither.

Atomic Theory—the Beginning of Scepticism.

It is my intention to refer briefly to some of the main features of recent advances in our knowledge of the nature of electricity and matter. Let us first review the state of knowledge of the constitution of matter in 1896. The atom then formed the philosophic basis for the explanation of the facts of chemical combination. In the early stages of investigation it was unnecessary to have detailed knowledge of the dimensions or structure of the atom. It was only necessary to assume that the atoms acted as individual units. The kinetic theory of gases explained the main properties of gases by supposing that the atoms acted as minute perfectly elastic spheres. During this period Lord Kelvin and others obtained rough estimates of the absolute dimensions and mass of the atoms. Nevertheless there was a general belief among the more philosophically minded that the atoms of the elements could not be regarded as simple unconnected units. The periodic variations of the properties of the elements brought out by Mendeléef were only explicable if atoms were similar structures in some way constructed of similar material. At the same time the idea was gaining ground that the results of Faraday's experiments on electrolysis could only be explained on the assumption that electricity, like matter, was atomic in nature. The name " electron " had even been given to this fundamental unit by Johnstone Stoney.

The proof in 1897 of the independent existence of the electron as a mobile electrified unit, of mass minute compared with that of the lightest atom, was of extraordinary importance. It was seen that the electron must be a constituent of all the atoms of matter, and that optical spectra had their origin in their vibrations. The discovery strengthened the view that the electron was probably the common unit in the structure of atoms which the periodic variation of the chemical properties had indicated. In the development of this subject science owes much to the work of Sir J. J. Thomson, who early took the view that the atom must be an electrical structure, held together by electrical forces.

The Influence of Radioactivity.

In the meantime our conception of the atom was revolutionised by the study of radioactivity. It was soon shown that the atoms of radioactive matter were undergoing spontaneous transformation, and that the characteristic radiations emitted, viz., the α, β, and γ rays, were an accompaniment of these atomic explosions. The wonderful succession of changes that occur in uranium, more than thirty in number, was soon disclosed and simply interpreted on the transformation theory. The proof that the α particle is a charged helium atom for the first time disclosed the importance of helium as one of the units in the structure of the radioactive atoms, and probably also in that of the atoms of most of the ordinary elements. The use of α particles as projectiles with which to explore the interior of the atom has definitely exhibited its nuclear structure, has led to artificial disintegration of certain light atoms, and promises to yield more information yet as to the actual structure of the nucleus itself.

The influence of radioactivity has also extended to yet another field of study of fascinating interest. The energy associated with a single α particle is so great that it can readily be detected by a variety of methods—e.g., by the flash of light easily visible in a dark room when it falls on a screen coated with crystals of zinc sulphide, and by the most beautiful of all methods perfected by Mr. C. T. R. Wilson for observing the track through a gas of any type of penetrating radiation which produces ions or electrified particles along its path. The method is simple, depending on the fact that if a gas saturated with moisture is suddenly cooled each of the ions becomes the nucleus of a visible drop of water. Hence the track of the α particle is clearly visible to the eye, and can be recorded photographically.

Fixing the Atomic Mass.

In the meantime new methods had been devised to fix the mass of the individual atom and the number in any given quantity of matter. The surmise that electricity is atomic in nature has been confirmed and extended by a study of the charges carried by electrons, α particles, and the ions produced in gases by X-rays and the rays from radioactive matter. It was first shown by Townsend that the positive or negative charge carried by an ion in gases was invariably equal to the charge carried by the hydrogen ion in the electrolysis of water. Millikan, by comparing the pull of an electric field on a charged droplet of oil or mercury with the weight of the drop, measured this with an accuracy of about one in a thousand. Knowing this value, we can by the aid of electrochemical data easily deduce the mass of the individual atoms and the number of molecules in a cubic centimetre of any gas.

The idea of the atomic nature of electricity is closely connected with the problem of the structure of the atom. One of the main difficulties has been the uncertainty as to the relative part played by positive and negative electricity. The electron has a negative charge of one fundamental unit, while the charged hydrogen atom has a charge of one positive unit. But the mass of the electron is only 1/1840 of the mass of the hydrogen atom, and no evidence of the existence of a positive electron of small mass like the negative has been found. In no case has a positive charge been found associated with a mass less than that of the charged atom of hydrogen. It is natural to inquire what explanation can be given of this striking difference in mass of the two units. The small mass of the negative electron appears to be associated with the energy of its electrical structure, so that the electron may be regarded as a disembodied atom of negative electricity. An electron in motion, besides possessing an electric field, also generates a magnetic field around it, and energy in the electromagnetic form is stored in the medium and moves with it.

Atoms Built up of Electrical Units.

This gives the electron an apparent or electrical mass, which, while nearly constant for slow speeds, increases rapidly as its velocity approaches that of light. This increase of mass is in good accord with calculation. The hydrogen atom is the lightest of all atoms, and is presumably the simplest in structure, and the charged hydrogen atom, regarded as the hydrogen nucleus, carries a unit positive charge. It is thus natural to suppose that the hydrogen nucleus is the atom of positive electricity, or positive electron, analogous to the negative electron, but differing from it in mass. The hydrogen nucleus must be of minute size, of radius less than the electron (supposed to be about 10^{-13} cm.). Experimental evidence is not inconsistent with the view that the hydrogen nucleus may actually be much smaller than the electron. We

* Abstract of the Presidential Address to the British Association delivered at Liverpool on Wednesday, September 12th.

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are, however, still left with the enigma why the two units of electricity should differ so markedly in this respect. There is the strongest evidence that the atoms of matter are built up of those two electrical units, viz., the electron and the hydrogen nucleus or "proton." It is probable that these two are the fundamental and indivisible units which build up our universe.

New light has been thrown on this subject by examining the deviation of α particles in their passage through the atoms of matter. Beautiful photographs illustrating the accuracy of the laws of collision between an α particle and an atom have been obtained by Messrs. Wilson, Blackett, and others. Remembering the great kinetic energy of the α particle, its deflection through a large angle in a single atomic encounter shows clearly that intense deflecting forces exist inside the atom. Hence the conception of the "nuclear atom," in which the heart consists of a minute but massive nucleus, carrying a positive charge of electricity, and surrounded at a distance by the requisite electrons to form a neutral atom.

Data obtained from the scattering of α particles and of X-rays indicate that the nuclear charge of an element is equal to about half the atomic weight in terms of hydrogen. It is fairly clear that the hydrogen nucleus has a charge one, and the helium nucleus (the α particle) a charge two. Researches on the diffraction of X-rays by crystals have shown definitely that X-rays are electromagnetic waves of much shorter wavelength than light, and the experiments of Sir William Bragg and W. L. Bragg have provided simple methods for studying the spectra of a beam of X-rays. H. G. J. Moseley, following the analysis of X-ray spectra emitted by a number of elements, formed the conclusion that the atomic number of an element is a measure of its nuclear charge. The correctness of this deduction has been recently verified by Chadwick by direct experiments on the scattering of α particles. Moseley's discovery is of fundamental importance, for it not only fixes the number of electrons in all the atoms, but shows conclusively that the properties of an atom are determined not by its atomic weight but by its nuclear charge. The great power of Moseley's law in fixing the atomic number of an element is well illustrated by the recent discovery by Coster and Hevesy in Copenhagen of the missing element of atomic number 72, which they have named "hafnium."

The Structure of the Atom Considered.

The further study of the structure of the atom falls naturally into two great divisions—the arrangement of the outer electrons which controls the main physical and chemical properties of an element, and the other the structure of the nucleus on which the mass and radioactivity of the atom depends. The hydrogen atom is of extreme simplicity, consisting of a singly-charged positive nucleus with only one attendant electron. The position and motions of the single electron must account for the complicated optical spectrum, and whatever physical and chemical properties are to be attributed to the hydrogen atom. The first definite attack on the problem of the electronic structure of the atom was made by Niels Bohr, by the aid of the Quantum Theory. He showed that it is possible not only to account for the series relations between the bright lines of the hydrogen spectrum, but also to explain the fine structure of the lines and the complicated changes observed when the radiating atoms are exposed in a strong magnetic or electric field. Under ordinary conditions the electron in the hydrogen atom rotates in a circular orbit close to the nucleus, but if the atoms are excited by an electric discharge or other suitable method, the electron may be displaced and occupy any one of the stable positions specified by the theory. This conception of the origin of spectra has been instrumental in throwing a flood of light on the relations and origin of the spectra of elements, both X-ray and optical. It has been possible to fix the quantum numbers that characterise the motion of each electron, and to form a rough idea of the character of the orbit. Take, for instance, the heaviest atom, *uranium*. At the centre of the atom is a minute nucleus surrounded by a swirling group of 92 electrons, all in motion in definite orbits, and occupying but by no means filling a volume very large compared with that of the nucleus. Some electrons describe nearly circular orbits round the nucleus; others, orbits of a more elliptical shape whose axes rotate rapidly round the nucleus.

The Nucleus of the Atom.

The study of radioactive bodies has provided very valuable information on the structure of the nucleus. We know that the α and β particles must be expelled from it, and there is strong evidence that the very penetrating γ rays represent modes of vibration of the electrons contained in its structure. In the long series of transformations which occur in the uranium atom, it seems clear that the nucleus of a heavy atom is built up, in part at least, of helium nuclei and electrons. It is natural to suppose that many of the ordinary stable atoms are constituted in a similar way. It is possible that the hydrogen nuclei are not built into the main nucleus but exist as satellites in motion round a central core.

The experiments suggest that the hydrogen nucleus or proton must be one of the fundamental units which build up a nucleus, and it seems highly probable that the helium nucleus is a secondary building unit composed of the very close union of four protons and two electrons. The view that the nuclei of all atoms are ultimately built up of protons of mass nearly one and of electrons has been strongly supported and extended by the study of *isotopes—i.e.*, radioactive elements which showed distinct radioactive properties were chemically so alike that it was impossible to effect their separation when mixed together. The nuclear theory of the atom offers a simple interpretation of the relation between isotopic elements. Since the chemical properties of an element are controlled by its nuclear charge and little influenced by its mass, isotopes must correspond to atoms with the same nuclear charge but of different nuclear mass. Such a view also offers a simple explanation why the radioactive isotopes show different radioactive properties, for it is to be anticipated that the stability of a nucleus will be much influenced by its mass and arrangement.

Research on Isotopes.

Our knowledge of isotopes has been widely extended in the last few years by Aston, who has devised an accurate direct method for showing the presence of isotopes in the ordinary elements. He has found that some of the elements are "pure"—i.e., consist of atoms of identical mass—while other contain a mixture of two or more isotopes. The atomic masses of the isotopes of most of the elements examined have been found, to an accuracy of about one in a thousand, to be whole numbers in terms of oxygen, 16. This indicates that the nuclei are ultimately built up of protons of mass very nearly one and of electrons.

Energy Relations and Atomic Nuclei.

Before leaving this subject it is desirable to say a few words on the energy relations involved in the formation and disintegration of atomic nuclei, first opened up by the study of radioactivity. It is well known that the total evolution of energy during the complete disintegration of one gramme of radium is many millions of times greater than in the complete combustion of an equal weight of coal. Since it is believed that the radioactive elements were analogous in structure to the ordinary inactive elements the idea naturally arose that the atoms of all the elements contained a similar concentration of energy, which would be available for use if only some simple method could be discovered of promoting and controlling their disintegration. This possibility of obtaining new and cheap sources of energy for practical purposes was naturally an alluring prospect to the lay and scientific man alike. It is quite true that if we were able to hasten the radioactive processes in uranium and thorium so that the whole cycle of their disintegration could be confined to a few days instead of being spread over thousands of millions of years, these elements would provide very convenient sources of energy on a sufficient scale to be of considerable practical importance. Unfortunately, although many experiments have been tried, there is no evidence that the rate of disintegration of these elements can be altered in the slightest degree by the most powerful laboratory agencies. Apparently, the presence of a store of energy ready for release is not a property of all atoms, but only of a special class of atoms like the radioactive atoms which have not yet reached the final state for equilibrium.

In conclusion, Sir Ernest said that it was a great privilege to have witnessed this period, which might almost be termed the Renaissance of Physics. In watching the tide of advance he had been impressed by the results of combined imagination and experiment. There was an error, still too prevalent to-day, that science progresses by the demolition of former well-established theories. This was very rarely the case. So far as the work of Einstein is relevant to that of Newton it is simply a generalisation and broadening of its basis; in fact, a typical case of mathematical and physical development.

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Electricity Supply in Peterborough.

Stagnation to Activity in Four Years.

The opening of the reconstructed station at Peterborough on September 6th closes one chapter and opens another in the electrical history of that city. Not being prophets, we shall leave the new chapter almost alone and confine ourselves to saying something about what has happened up to date. This chapter may be divided into three paragraphs: slumber, awakening and technical. Of these three, Mr. W. M. Selvey, Mr. H. A. Nevill and the English Electric Co., all of whom have been responsible for bringing about the change we are about to chronicle, will agree that the last is the least interesting.

Slumber

Just at Christmas time, 1900, Peterborough received its first electricity supply. This was given from two 60 kW sets on the three-wire system. Some development took place until on March 31st, 1919, when the total connections were 1 340 kW, with a maximum demand of 633 kW. The output was 1 016 376 kWh. Peterborough is a town of 35 000 inhabitants, which works out at 30 kWh per inhabitant. At present the consumption per inhabitant is 63 kWh, and the plant capacity 7 000 kW. This rather spoils the rest of the story, but we thought we had better bring it in to satisfy impatient readers.

The Awakening.

In 1919 the City Council decided to extend their works to meet the rapidly growing demands for energy, and engaged Mr. W. M. Selvey to advise them in the preparation of the

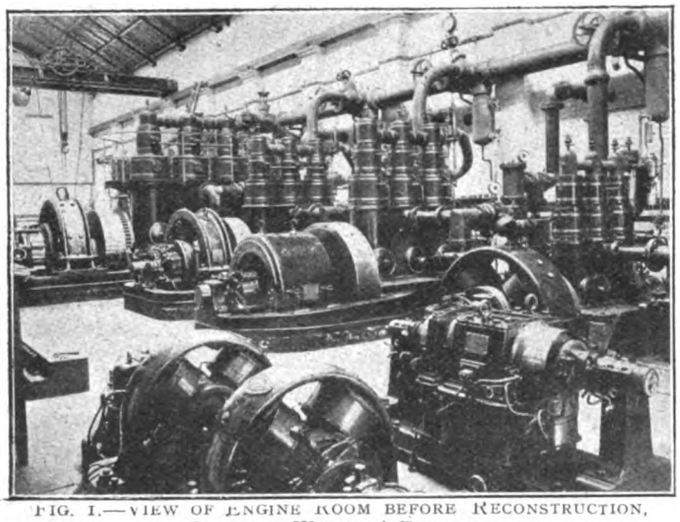

FIG. 1.—VIEW OF ENGINE ROOM BEFORE RECONSTRUCTION, SHOWING WILLANS' ENGINES.

scheme. The proposals provided for the extension of supply beyond the economical limit of the existing low tension direct current system, and it was decided to substitute alternating current generation for all power house extensions, with rotary converter plant to maintain the direct current supply. The alternating current generating plant was to provide a three-phase supply at a frequency of 50 cycles and a pressure of 6 600 V.

Owing to the economy of floor space shown by steam turbine plant as compared with the old reciprocating engines, it was found that the existing engine room could be utilised for the new generating plant. In the case of the steam-raising plant, however, a new boiler house was found to be necessary.

The reconstruction was to be carried out in three stages, as necessity arose, at a total cost of £275 000, including £55 100 for the provision of extra high tension feeders and sub-stations.

The present engineer, Mr. H. A. Nevill, was appointed in July, 1920, and Mr. Selvey's proposals were then placed before the Electricity Commissioners and received their early approval. An application for an extended area of supply was also made, and in December, 1922, the Corporation was granted the Peterborough Electricity (Extension) Order, 1922. This Order authorised a supply area 39 times greater than that of the 1894 Order.

The new work was commenced in 1920, immediately the Commissioners' approval was received, and owing to the growth of the demands for supplies being even greater than was expected, the three stages of the scheme followed immediately after one another, with the result that the whole is now completed.

The contracts for the whole of the work were entrusted to the ENGLISH ELECTRIC Co., with the Spearing Boiler Co. as sub-contractors for the boilers, and the Mitchell Conveyor and Transporter Co. for the building of the boiler house and the coal and ash handling apparatus. Peter Brotherhood acted as sub-contractors for the building of the third turbine and condenser and for the main circulating water pumps.

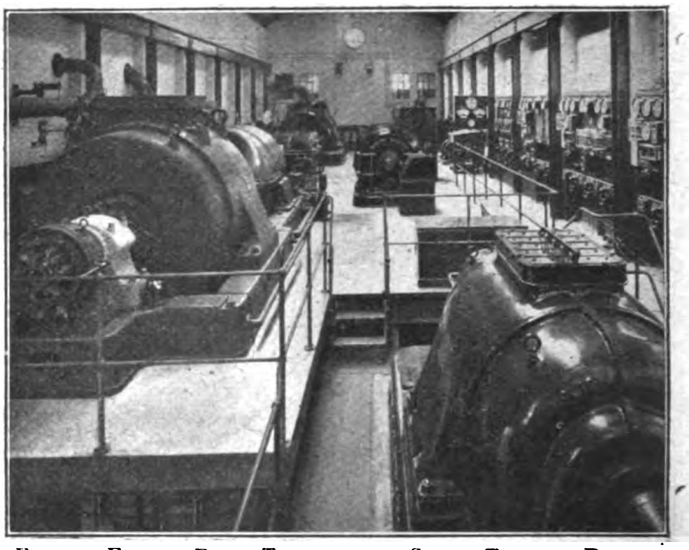

FIG. 2.—ENGINE ROOM TO-DAY WITH STEAM TURBINE PLANT.

The Chief Point of Engineering Interest.

One of the chief points of engineering interest in the works lies in the adaptation of buildings designed to accommodate small engine-driven units in order to make them suited to the use of modern turbine-driven plant.

It was decided that the raft in the engine room was sufficiently strong to carry the new plant and its foundations, and consequently its surface has been utilised as the floor of

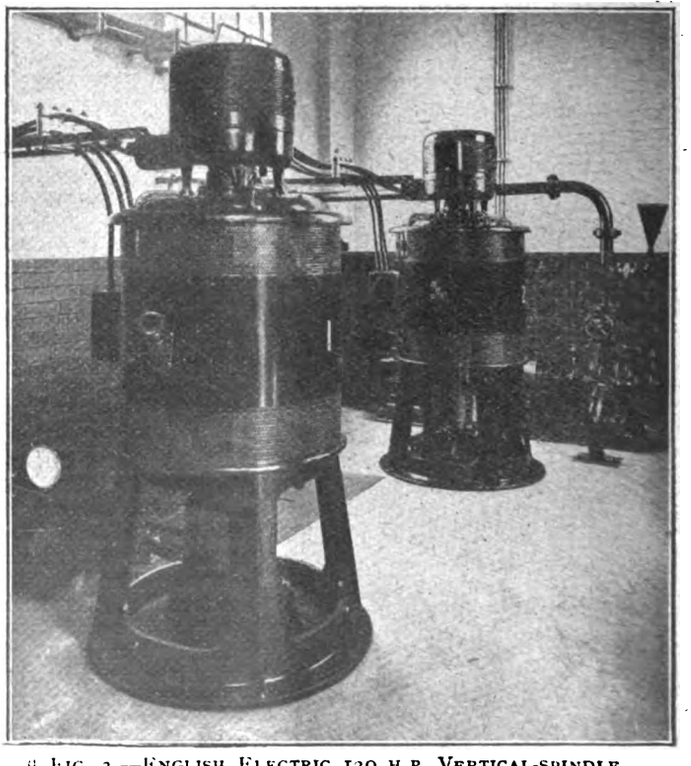

FIG. 3.—ENGLISH ELECTRIC 120 H.P. VERTICAL-SPINDLE THREE-PHASE MOTOR DRIVING CIRCULATING PUMPS.

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the new basement. The operating floor has been raised 8 ft. above the old floor to give sufficient head room for the condensing plant, and the roof has been lifted bodily 6 ft.

The whole of the basement has been made waterproof, but in order to provide against possible floods from the river the extraction pumps for the condensers are driven by vertical spindle motors, which are placed above the highest recorded flood level.

The whole of this work, together with the removal of the direct current switchgear from its original position near the north wall of the engine room to the west end of the building, has been carried out without interruption of the d.c. supply.

In a similar manner the old Lancashire boilers had to be kept in use for a long period in the open air during the erection of the first half of the new boiler house. It was at first intended to equip each of the four boilers with chain grate stokers, but in February, 1923, the Committee decided to substitute coal pulverising plant for Nos. 3 and 4 boilers, the unit type of pulveriser being adopted.

Generating Plant.

The equipment now installed consists of one 1 000 kW and two 300 kW turbo-alternator sets and auxiliary plant, one 500 kW and two 750 kW rotary converters, two 100 kW a.c./d.c. motor generators for tramway supply and e.h.t. switchgear and control panels.

The turbo-alternators are of the English Electric Co.'s standard design, running at a speed of 3 000 revs. per min., and are capable of giving their rated output continuously, and an overload of 25 per cent. for two hours. The turbines—two English Electric and one Brotherhood—operate with steam at a pressure of 250 lb. per sq. in. and 150 deg. F. superheat and exhaust into a vacuum of 28·5 in.

The rotary converters with their transformers and switchgear, the traction motor generator sets, and the motors for the engine room and boiler house auxiliaries, are of the latest English Electric design.

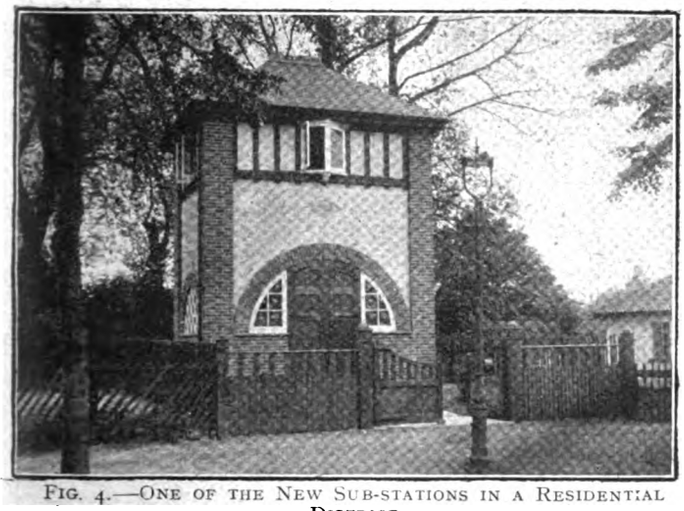

FIG. 4.—ONE OF THE NEW SUB-STATIONS IN A RESIDENTIAL DISTRICT.

Boiler House Equipment.

The boiler house equipment consists of two 25 000 lb. per hour water tube boilers with chain grate stokers and two similar boilers with pulverised fuel firing, two 100 000 lb. per hr. reciprocating feed pumps, one 100 000 lb. per hr. turbine-driven rotary feed pump, two induced draught fans and steel chimneys, one electrically operated telpher feeding coal to overhead bunkers and a water treatment plant.

The boiler house plant consists of four water tube boilers of the Spearing type, each having 5 250 sq. ft. of heating surface. Steam is generated at a pressure of 260 lb. per sq. in. and is superheated to a total temperature of 600 deg. F. Two of the boilers have chain grate stokers and the other two are arranged for firing with pulverised fuel on the unit system of Simon Carves.

Mains.

About 9 miles of e.h.t. feeders have been completed and sub-stations equipped on the premises of six large consumers taking a 6 600 V supply. In addition, two sub-stations have been put into operation in new areas for low tension a.c. distribution. At the present time an additional 4·36 miles of e.h.t. cables are being provided to serve another section of the Corporation's supply area.

The Manufacture of Steam.*

By W. E. HIGHFIELD.

During the last few years a good deal of attention has been given to boiler house problems, with the result that the central station engineer has been overwhelmed with advice from those who feel competent to instruct him in his business. Instruments and apparatus of every kind, guaranteed almost to compel efficiency by the mere fact of their presence, are offered to him, and if some of his advisers had their way, the generation of power, which is, after all, the main object of his plant, would almost be lost sight of in comparison with the analyses and tests which he is urged to carry out. Efficiency, however, is not to be obtained by decorating the boiler-room with expensive instruments. It calls for a thorough realisation of the simple fundamentals upon which good plant management is based, and, in so far as these essential matters are attended to, so will economy in generation be the result.

Boiler House Management the Criterion.

In contradistinction to the engine room the results obtained from a boiler plant are almost entirely dependent upon the manner in which it is operated and maintained. Boiler design has now settled down along fairly definite lines, and any reputable maker would guarantee to supply plant which would transmit 80 per cent. of the heat of the fuel to the steam produced. The competition between different makers rests rather on questions of cost, ease of cleaning, accessibility for inspection and similar points.

Essentials of Efficient Boiler House Management.

Efficient boiler house management consists in realising in practice that a boiler house is a steam factory, and the aim of the manager must be to produce his steam with the least possible cost in fuel, and it is absolutely essential to efficient operation that the manager of the "steam factory" should know exactly how much coal he uses and how much steam he makes with it. Coal should be weighed coming in, but it is also essential to know how much has been burnt on every shift, and how much water has been evaporated by its use, in order to rectify any source of inefficiency the moment it occurs, and to let the boiler house staff know exactly the results they are obtaining shift by shift.

To obtain the figures required, it is necessary to have some means of weighing the coal and metering the water or steam on every shift and it is preferable that measurements should be made in respect of every separate boiler. This is so essential that it may be said that no boiler house can be properly run without these measurements.

Inadequate Boiler House Equipment.

An examination of boiler houses in this country will show that not only are the facilities for these measurements often inadequate, but that frequently they do not exist. In particular must the small station be regarded, because there are so many small stations, and because there will continue to be a large number of small stations. According to the Commissioners' Summary, the total units generated by stations with an annual output of less than 50 000 kWh is approximately one-third of the total units generated in the country. That brings out the importance of the efficiency of the small station to the country. The average annual fuel consumption per kilowatt hour generated varies from 3·38 to 20·9 lb.

Presuming that the boiler house is equipped with apparatus for ascertaining the basic figures of operation—namely, the pounds of coal burnt and the pounds of water evaporated during every shift—the use that can be made of these figures must next be considered. The obvious thing to be done with the coal and water figures is to calculate the evaporation obtained per lb. of coal. Every station engineer knows that the greater the output the greater in general will be the evaporation figure, and it soon becomes evident that the effect of the variation of the output may be quite sufficient to mask important variations in operating efficiency. A direct comparison between the evaporation figures would, therefore, be misleading unless the fact was taken into account. This is possible by the method devised some years ago by Mr. R. H. Parsons. It is applicable to power stations of every size and type, and has been adopted by some of the most important ones in the country. It is commended as being the most practical means of deriving immediate benefit from the coal and water records of the station.

* Abstract of Presidential Address delivered to the National Association of Supervising Electricians.

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Recent Progress in Armourclad Switchgear.

A Design which Claims to Eliminate Existing Disadvantages.

As our readers will have gathered from these columns during the past few months, considerable activity is being shown by switchgear manufacturers in the development of armourclad compound-filled switchgear. Like all products of human endeavour, however, this equipment, while possessing many useful features, has also its disadvantages, though it is only just to add that the former far outnumber the latter. Nevertheless, as, in switchgear manufacture like in everything else, to stand still is the same thing as to go back, it is not surprising to find that endeavours to discover that improvements are constantly being made, though the search is rendered more difficult by the enormous expenditure on patterns, jigs and tools that is necessary before even the smallest new features can be

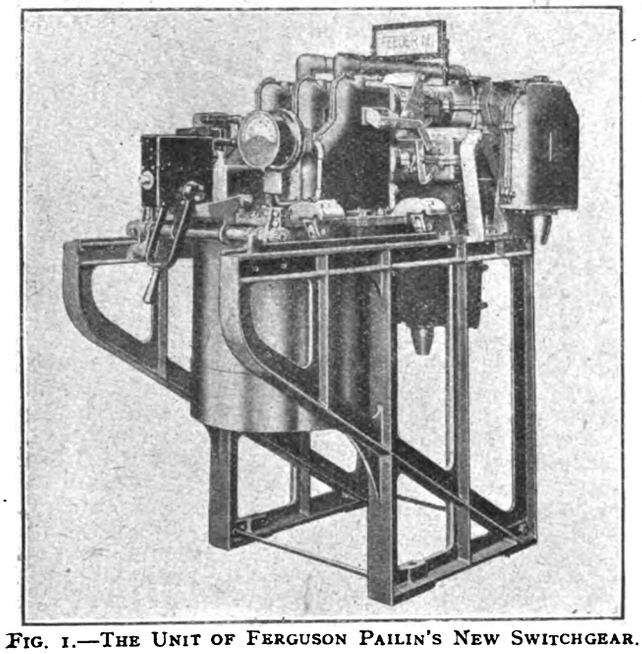

FIG. 1.—THE UNIT OF FERGUSON PAILIN'S NEW SWITCHGEAR.

incorporated. However, when the problem is tackled *de novo* this can often be done, and has been done, it is claimed, in FERGUSON PAILIN'S new switchgear, which we describe below.

To make clear the advance that has been achieved in this new equipment we may recall that the chief disadvantages of armourclad gear are its high initial cost, the inaccessibility of the current transformers, and a certain lack of flexibility, particularly where duplicate busbars are employed. These disadvantages are dealt with in the new design by making the unit compact and easily assembled. It is jig manufactured throughout on a quantity production basis, and its cost therefore is claimed to be comparable with that of open type gear. The current transformers are immersed in oil instead of in compound, and change-over switches also immersed in oil are provided for the selection of busbars on duplicate busbar units.

General Description of Unit.

Turning to actual details, this armourclad compound-filled switchgear is built on the well-known unit principle which enables either a single unit or a complete multiple unit switchboard to be erected. The current range is up to 1 200 A at any voltage up to 12 500 V. A standard single busbar unit is illustrated in Fig. 1.

Each section comprises two main elements: a fixed element containing the busbars and cable terminal boxes, and a moving element consisting of a carriage type oil circuit breaker and instrument transformers. Two massive cast-iron brackets form the main structural frame. These support the whole of the equipment, thus making it a self-contained unit and facilitating extensions or rearrangements of switchgear.

The wide upper surfaces of the two main brackets are machined to form beds for the rails on which ride the rollers of the circuit breaker carriage. To minimise wear and ensure alignment of the circular plugs and sockets, each of these rollers are mounted on roller bearings. The circuit breaker is built on a solid steel base which supports a massive solid-drawn cylindrical steel tank with dished bottom ¼ in. thick. Drain-off cocks, oil level gauges, etc., are provided, and the tank fixings are strong welded steel lugs.

Tank Construction.

The tanks, which are substantially lined, are provided with a wide machined flange and gasket, so as to make a tight fit against the base and prevent the emission of oil under working conditions. By means of the device shown in Fig. 2 the raising and lowering and transportation of the oil tank can be carried out with ease. Two large vents which are amply baffled prevent oil throwing, carry off the gaseous products of the arc and ensure that no dangerously high pressure is formed in the chamber above the surface of the oil. These vents can be coupled to a common pipe discharge system with its outlet outside the station; but non-return valves are then necessary on each breaker section.

Mechanical Arrangements.

The couplings between the circuit breaker operating mechanism and the moving contacts are steel links. The moving contacts are guided throughout the whole of their travel by plungers operating in tubes. The accelerating springs are also fitted in these tubes. Retardation at the end of stroke is accomplished without shock by allowing a quantity of oil to act as a cushion to the plunger. The oil supply for this purpose is automatically replenished from the oil tank and requires no attention.

The actual design and arrangement of the moving and fixed contacts is shown in Fig. 3. The latter are of the finger type, and give an increased contact pressure for an increased current. The insulation is bakelite throughout.

Interlocking and Safety Arrangements.

The insertion or withdrawal of the moving section is carried out by means of a simple racking device. This causes two small pinion wheels mounted at either end of a cross shaft to be given a rotary movement by means of a ratchet lever. These pinions engage with rackwork situated alongside the two runners on the main structural supports, and moves the circuit breaker in or out as desired. The provision of interlocks prevents the circuit breaker from being moved into the on position unless the breaker carriage is either right home or racked right out.

When the circuit breaker carriage is racked out an automatic shutter comes into operation, screening the stationary contacts; as a further precaution facilities are provided for padlocking

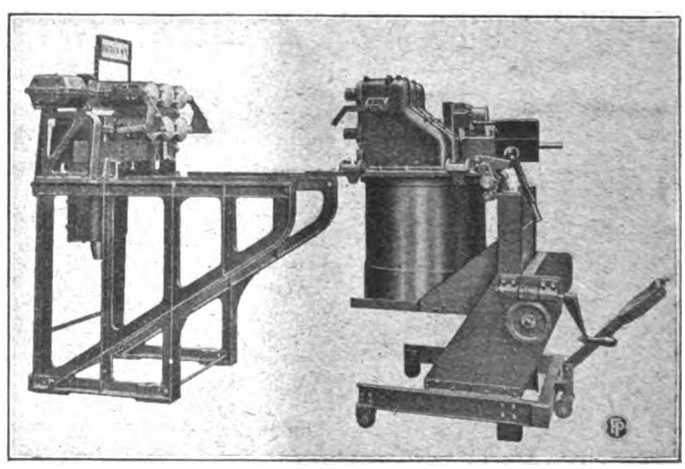

FIG. 2.—RAISING AND LOWERING DEVICE ON THE OIL TANK.

these shutters into position, preventing any contact with live parts being made.

The potential transformer is of the oil immersed type and is connected to the side of the breaker remote from the busbars. Special facilities have been provided for renewing the plugs or sockets in the event of them becoming damaged. It is possible to unscrew either the plugs or sockets from the outside and replace them without in any way interfering with the compound.

Busbar Design.

The busbars are enclosed in a cast-iron chamber and are adequately supported in moulded insulation. They are jig

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set into position together with the connections to the isolating plugs, perfect contact being ensured, and the whole of the surrounding space being filled in with compound. These circuit breakers can be operated by hand directly or remotely, or can be electrically operated by a solenoid device, a mechanical signal indicating the on and off positions.

While the circuit breaker tripping is quite decided in operation and stable even under considerable vibration, little power is required to trip the breaker automatically. The sensitive release provided enables relays to be dispensed with, as the fault current is generally sufficient to trip the breaker.

Easy Change-Over Arrangement.

The standard duplicate busbar unit also incorporates a number of interesting features. In the past cause for complaint has been found in the length of time necessary to change over a circuit breaker from one set of busbars to the other. This arrangement entails the opening and racking out of the circuit breaker and the changing over of plugs. Not only is it necessary to make the circuit dead, but it renders errors in operation possible. In the equipment we are describing now these disadvantages are overcome in two ways :

In cases where duplicate busbars are fed from the same system and cannot get out of synchronism it is possible to make the change-over switches so that they do not break circuit during the transfer from one set of busbars to the other.

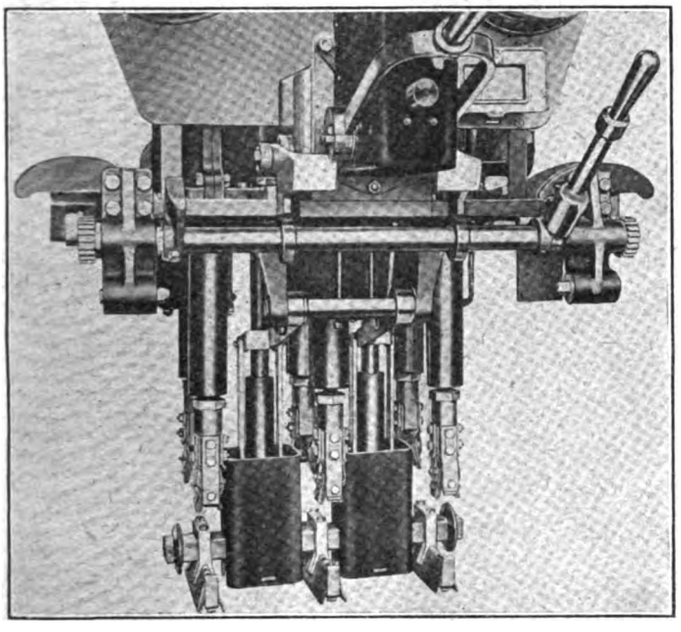

FIG. 3.—THE FIXED AND MOVING CONTACTS.

Where busbars may be running out of synchronism the change-over switches are so arranged that the busbars cannot be paralleled during transfer.

In each of the above cases the change over is effected by means of the selector switch, which is greatly simplified as regards the number of blades and type of interlock.

In the first case mentioned above, double-bladed switches are provided which enable the circuit breaker to be connected to both sets of busbars. It thus becomes a busbar coupler. Alternatively it can be changed from one set of busbars to the other without interrupting the supply. An interlock is provided that prevents the circuit breaker from being isolated or connected to the busbars when it is not off. This ensures that the switches are not used for breaking the circuit.

In the second case a single blade change-over switch is provided. By closing the switch on to one side or the other the circuit breaker can be connected to either set of busbars but not to both. An interlock ensures that the switches do not break the circuit before the circuit breaker, and the change over cannot be effected until the breaker is in the off position. A mechanical indicating device is fitted with both these types of selector switches, showing to which set of busbars the circuit breaker is connected.

The tank for the selector switch is separately mounted from the circuit breaker tank, being attached to the stationary portion of the unit below the busbar chamber. It is fitted with its own tank raising and lowering gear, the operating handle being brought out to the front of the unit and provided with a padlock.

Modern Cinema Lighting.

New Effect at London's Latest Picture Palace.

We are hoary enough to remember the old Tivoli music hall in the Strand. It was a place where a happy evening could be spent listening to the favourites of the day, and where the advantage of obtaining cheering liquid in the auditorium was not lightly to be disregarded. Times have changed, however, and the erstwhile music hall has become a super-cinema. The change has brought the opportunity for thoroughly modernising the lighting, and this opportunity has been seized in no uncertain manner by the architects, Mr. Bertie Crewe and Messrs. Gunton and Gunton, in collaboration with the GENERAL ELECTRIC Co. A word of praise must also be given to the builders, F. G. Minter and Co., and to the wiring contractors, the Berkeley Electrical Engineering Co., for the part they have played in the work. On Thursday evening last we had a chance of seeing the result of all this enterprise, of listening for one evening only to such artistes as Madame Kirby Lunn, Little Tich, Malcolm Scott and Miss Marie Dainton, and of seeing the latest infant film prodigy.

Some Details of the Installation.

In a recent issue we gave some details of lighting installation, but we may now add some further information and illustrations.

The exterior of the building facing the Strand is floodlighted by 24 floodlights, twelve of which are equipped with 500 W gasfilled lamps and twelve with 200 W lamps. These are mounted on ornamental bronze brackets and are hidden by bronze screens which form an attractive feature of the frontage.

The auditorium lighting is effected almost entirely by concealed lamps arranged on a flexible colour scheme. No fittings project from ceiling or walls, even the police lighting, except the exit signs, being included in the indirect lighting scheme.

The main illumination is derived from the domed ceiling, which consists of one large shallow dome 54 ft. in diameter and six subsidiary domes 16 ft. in diameter. Hidden within a moulded cornice round the circumference of each dome is a row of lamps contained in specially designed reflectors. These are arranged in three circuits and are coloured amber, blue and rose respectively. Each circuit is controlled by a dimmer, and the switching is so arranged that the colours may be used independently or may be blended together to obtain a variety of colour effects. Under the gallery and balcony the lighting is supplemented by a number of ceiling panels of special design which are arranged to reproduce the same colour effects as the main ceiling lights.

Additional illumination is obtained in various parts of the house by amber coloured panels let into the walls. A number of projectors with colour sprayed lamps are also sunk flush in the front of the gallery to illuminate the proscenium arch.

Great Increase in Power Supply.

The income of the BLACKBURN electricity department for the year ended March 31st last was £145 893, an increase of £29 447 over that of the previous year, and the net result of the year's working was a profit of £12 742, after providing for working expenses, instalments of loans, interest, etc., compared with a net deficit of £6 161 in 1921–2. The kilowatt-hours sold were 16 308 717, against 10 244 361. The maximum demand was 8 792 kW, compared with 6 394 kW.

In his report, the engineer and manager, Mr. P. P. Wheelwright, says the growth of the Blackburn electricity undertaking during a period of financial and business depression is a proof of the extent to which electrical energy has woven itself into the domestic and commercial life of the town. The efficiency of the modern plant in the Blackburn East station is clearly indicated in the accounts. Motors of an aggregate capacity of 904 B.H.P. have been connected to the mains during the year, and the total connections for motors (other than traction), heating and lighting are equal to 725 002 30 W lamps, or 21 750 kW. Consumers increased from 6 858 to 8 532. The consumption of energy for power purposes increased by 5 354 705 kWh, or 86 per cent., and the tramway demand increased by 182 144 kWh, or nearly 10 per cent. There is a substantial and growing demand for current for cooking and heating, and this will doubtless be accelerated by the new schedule of charges which is being introduced. Mr. Wheelwright considers it essential to have an extensive showroom and that all public utility undertakings should be able to give the public "service," which means considerably more than the supply of electrical energy.

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Shipping, Engineering and Machinery Exhibition.

(*Continued from page* 247.)

Temperature Control Apparatus.

An ingenious electrical arrangement for the automatic control of temperature is being shown by the CAMBRIDGE AND PAUL INSTRUMENT CO. There are many industrial processes which call for more or less constant temperature. The scheme adopted by the Cambridge and Paul Co. for controlling temperatures up to 1 400 deg. Cent. involves the use of an electrical indicator, which is connected to a sensitive element such as a resistance thermometer, thermo-couple, Féry telescope or thermo-pile. Attached to the pointer of the instrument is a light thermo-couple, which is electrically connected to a moving coil relay. At a point on the scale corresponding to the temperature desired a small electrically heated coil is placed and when this temperature is reached the thermo-couple on the pointer is brought opposite to the coil and is heated. The e.m.f. thus produced energises a relay which completes an electrical circuit and operates the mechanism which controls the supply of heat. When the temperature falls the thermo-couple leaves the coil and the process is reversed.

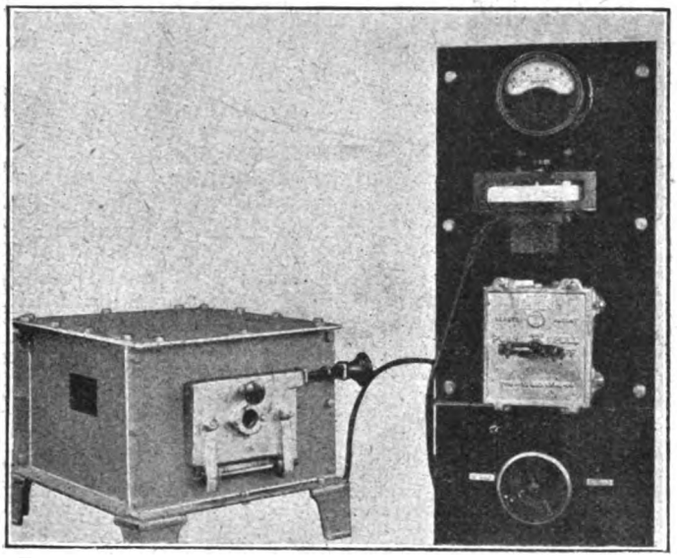

FIG. 6.—GENERAL VIEW OF TEMPERATURE CONTROL APPARATUS (CAMBRIDGE AND PAUL INSTRUMENT CO.)

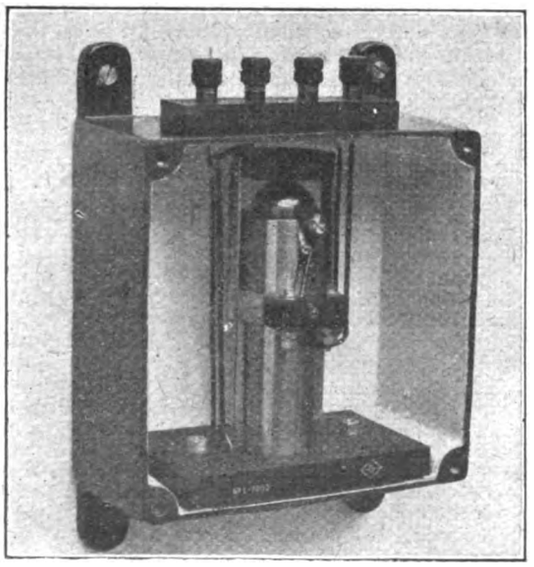

FIG. 7.—THE BALL RELAY WITH COVER REMOVED (CAMBRIDGE AND PAUL INSTRUMENT CO.)

Various forms of relays are used, one consisting of a glass sphere into which two electrodes are sealed. This sphere rests on a bell-shaped magnet, the vertical core of which being provided with a coil. One of the electrodes is covered by mercury, whilst normally the other is above the level of the mercury, upon which a hollow sphere floats. When the mercury is energised by the indicator the sphere is pulled downwards, the mercury is squeezed out laterally and the circuit between the two electrodes is closed. This either operates a valve or energises a circuit breaker according to the particular application of apparatus. At the exhibition the apparatus is shown controlling an electric furnace.

Electric Furnaces.

Hitherto the chief difficulty in the construction of high temperature electric furnaces has been met with in connection with the resisters or heating elements. Successful results have, however, been obtained by the use of re-crystallised carborundum, and in consequence of this AUTOMATIC AND ELECTRIC FURNACES are showing furnaces working at a temperature of 1 300 deg. Cent. These furnaces are chiefly designed for hardening high-speed tool steels. An electrically-heated furnace is ideal for this class of work, both from the heating and metallurgical points of view. The furnaces are constructed on the ordinary muffle principle.

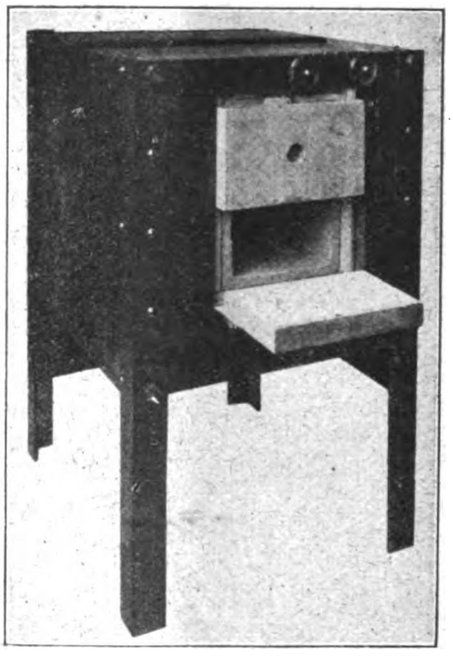

FIG. 8.—AN ELECTRIC FURNACE FOR INDUSTRIAL WORK (AUTOMATIC AND ELECTRIC FURNACES).

The refractory chamber is capable of withstanding high temperatures, and the roof and top heat insulating material are removable so as to permit of the introduction of the heating rods which rest in special contacts. These resister rods radiate the heat directly on to the floor of the muffle chamber, and are placed so that complete and uniform heating is assured. The furnaces are economical and, comparatively speaking, the heating-up process is rapid. The consumption is as follows :—

Size of Chamber in inches.	Consumption in kW.
4×3×2	4·5
5×5×3	6·4
9×5×3	9·0

All these furnaces are made for 200 to 250 V alternating or direct current. The method of operating is to switch on the current, cut out the resistance, and allow a period of one hour for the furnace to reach the working temperature of 1 300 deg. Cent., after which the temperature is regulated in the ordinary way by means of the rheostat. Temperatures above 1 300 deg. Cent. naturally reduce the useful life of the bars. Used in conjunction with a disappearing filament type of pyrometer, this type of furnace ensures the current temperature for the work, and gives an output which the makers contend can rarely if ever be obtained by the guesswork method.

Some Industrial Controllers.

Controllers designed for use with non-reversing warping capstans at docks or railway sidings, etc., are to be seen on

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the stand of THE ELECTRO-MECHANICAL BRAKE. These controllers are operated by a foot pedal and are designed so that the operator is compelled to make a pause at every notch and it is impossible to pass over more than one notch at a time. No air or oil dash-pot retarding device is used. On the release of the pedal the controller drum returns to the off position and opens the contractor. The circuit is made and broken by a contactor-type circuit breaker with over-load and no-voltage release, with the result that there is no arcing on the accelerating drum. These controllers, which are fool-proof and designed for rough usage, are particularly suitable for mounting in pits where space is limited, as no additional circuit-breakers are required. The controllers are made for three-phase and direct current motors, all the fingers of the controllers in the latter case being provided with a magnetic blow-out. When it is necessary to reverse the motor a reversing switch is interlocked with the foot-pedal.

Lighting Sets.

Although there are many small electric generating sets on the market for lighting cottages, bungalows, etc., and for charging accumulators for wireless work and other purposes, we do not remember having seen neater sets than those which are exhibited by STUART TURNER, LTD., of Kingston-on-Thames. A set which is creating no small amount of attention is rated at 120 W. The overall length is only 24 in., whilst the width is 13 in. The battery will light four 12 W gasfilled lamps and when the cells are fully discharged the generating

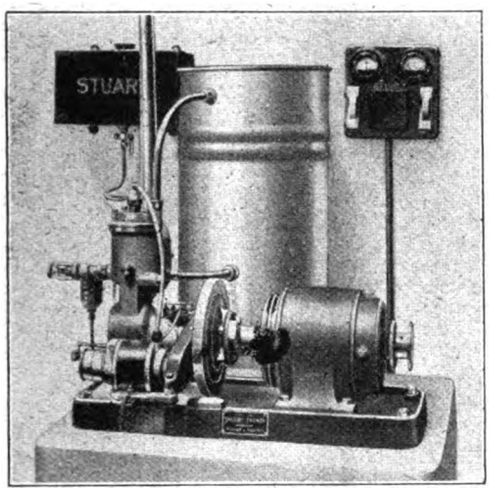

FIG. 9.—120 W GENERATING SET (STUART TURNER).

set will recharge them in about eight hours. The two stroke engine which runs at 1 300 revs. per min. will work from 10 to 12 hours with a gallon of petrol or about 20 cub. ft. of gas. The switchboard is fitted with an ammeter with the zero mark in the centre of the dial and registers the charge and discharge current. There is also an automatic cut-out and cut-in, two fuses and the usual terminals. Wireless experimenters who have difficulty in getting their accumulators charged and who are looking for a cheap and compact generating outfit should not fail to pay a visit to this company's stand. Larger sets constructed on the same neat and compact lines are also shown.

A Range of Electric Motors.

Direct and alternating current motors are being exhibited by the SWEDISH GENERAL ELECTRIC CO. One of the most interesting machines is a three-phase commutator motor with a speed range of three to one, the speed being changed by shifting the brushes. This type of motor is designed for all frequencies between 25 and 60 cycles per second, and for all commercial voltages. The motor is built in sizes ranging from 3 to 100 H.P. Throughout the whole range of speed nearly full load efficiency is maintained, and the power factor is also high. A "century" single phase motor is also exhibited. As is well known, this is a single phase self-starting repulsive inductor motor. It starts as a repulsion machine, and when normal speed is attained the brushes are thrown off the commutator, and the machine then runs as an ordinary squirrel-cage motor.

Motors of this type are made in sizes ranging from 1/10th to 40 H.P., and for all voltages and frequencies. At starting they develop a torque equal to 2½ times their normal full load torque. Standard direct current motors with enclosed ventilated covers, and motors with ventilated drip housings, are shown. The latter type of machine has been specially developed for use on ships and at collieries. There are also slip-ring induction motors with drip-proof housings, and constructed for general industrial use. A notable exhibit is a 250 H.P. slip-ring induction motor built for a speed of 480 r.p.m. and a pressure of 3 000 V, the machine having been designed for use in fiery mines.

The Neutrodyne Radio Set.

In our last issue we referred briefly to the Neutrodyne wireless receiving sets which are being exhibited by HAZELTINE NEUTRODYNE RADIO SETS, LTD. A back view of one of these sets is given in the accompanying illustration. There are four valves, two high frequency, a detector, and two note magnifiers, the first high-frequency valve also being used as a low-frequency amplifier, so that the scope of the outfit is

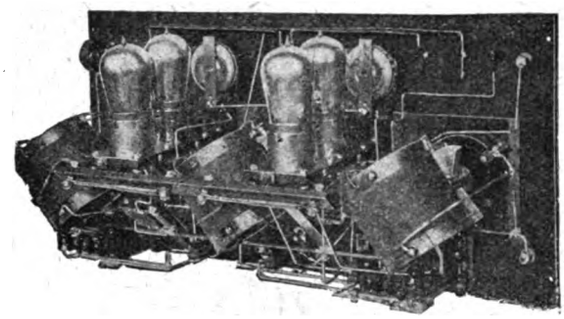

FIG. 10.—THE NEUTRODYNE RADIO SET (HAZELTINE NEUTRODYNE RADIO SETS, LTD.).

practically equivalent to that of one composed of five valves. As we previously explained, the principal novelty of these receivers is that the valve and other undesirable capacities are balanced out by means of small condensers, with the result that the set is made stable. It is also non-distorting, non-radiating, and very selective. The sets are beautifully made and are very efficient. The IGRANIC ELECTRIC COMPANY is showing on the same stand an extensive collection of wireless goods, including Honeycomb Duolateral tuning coils, vario-couplers, filament rheostats, and inter-valve transformers.

Automatic Telephones.

A complete private automatic telephone exchange is to be seen on the RELAY AUTOMATIC TELEPHONE CO.'S stand. The exchange consists of an automatic switchboard, power board, two sets of 24 V batteries and telephone instruments, all connected up ready for use. The Relay Co. can arrange for existing branch exchanges to be replaced on a rental basis by the "Relay" automatic combined system, which gives a four-second automatic interdepartmental service combined with public exchange facilities. An attachment is being exhibited for showing how the private branch exchange operates in conjunction with the public service.

Switchgear.

Protected type starters for direct-current motors, and having no voltage overload releases and hinged protecting covers for the reception of screwed conduit, are among the exhibits of the ELECTRICAL APPARATUS CO. There are also shunt regulators for motors and generators, a motor-operated starter for remote control, control devices such as float switches and ironclad push buttons, pillars for controlling direct current motors, steelworks' contactors with capacities ranging from 60 to 1 000 A, drum type controllers of the air break and oil immersed types, universal sealing boxes, oil switches with large and small current capacities with the usual automatic devices and the firm's patented relief bolts, oil immersed starters for controlling slip-ring and squirrel-cage motors, alternating and direct current house service meters, and moving iron ammeters and voltmeters.

ERRATUM.—We regret that the illustration (Fig. 3) on page 246 of our last issue was wrongly described as being Hollings and Guest "A" Type Tyre Press. The correct description should have been Hydraulic Plate Bending Press.

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Helping the Retailer to Sell Mazda Lamps.

B.T.-H. Advertising Plans for the Coming Lighting Season.

From advance information received it would appear that the 'Mazda" Advertising Campaign for the 1923–24 lighting season is to be of a comprehensive character. Nothing seems to have been omitted from the scheme which could possibly help the retailer in his efforts to sell more electric lamps. Although some of this advertising is, of course, addressed directly to the public through the medium of newspapers, etc., in all cases the readers are enjoined to go to their local dealers for any lamps that they may require. All the various forms of advertisement described in this article are, therefore, of direct benefit to the retailers of Mazda lamps.

The "Mazda" Advertising Campaign may be sub-divided into three main parts:—

1. Advertising in the General Press.
2. The supply of advertising devices such as signs, window displays and showcards to retailers for use in their own shops.
3. The supply of leaflets in quantity for distribution by retailers.

A "Daily Mail" Front Page.

Between the beginning of September and the end of the year an interesting series of advertisements will appear in all the most important papers in the United Kingdom. One of these will occupy the front page of the "Daily Mail" on September 14th (to-day).

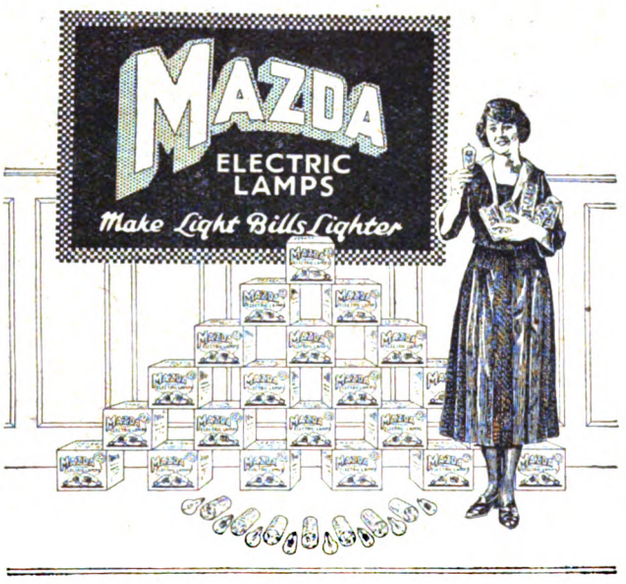

FIG. 1.—MAZDA WINDOW DISPLAY.
The figure of the Mazda girl is life-size and life-like.

The latter part of the "Daily Mail" copy runs as follows:—

"Artificial light has been used by mankind since the dawn of history. For many centuries the torch, the oil lamp and the candle were the only available illuminants. Without them the history of the world would have been very different, and a great deal of the material and intellectual progress made during the dark and middle ages and the Elizabethan period would not have been achieved.

"Progress was stimulated by the invention of gas lighting, which was an important factor in the establishment and success of Victorian industrialism.

"Those who are fortunate enough to know the convenience, comfort and brightness of electric light in the home are enjoying the benefits of the most recent advance in artificial illumination—for electric light is the best form of produced light, and Mazda is electric light at its best.

"The adjoining column indicates a few of the facts and theories about light which this series of Mazda articles endeavours to explain in simple, non-technical language. They will appear from week to week in the leading daily newspapers.

"Watch for them and read them. Together they form an encyclopædia of information upon the fascinating subject of light. Many parents will cut out and collect the series of advertisements, and perhaps paste them into a reference book or album. Such a book would be intensely interesting and instructive to children of all ages."

Of course, it is not proposed to issue a series of full pages, but the same underlying idea will run throughout all advertisements, whether large or small. It will be noted that these Mazda advertisements are to be of the "interest" type, and they will doubtless pique the curiosity of the average newspaper reader who is always eager for scientific facts so long as they are served up in a simple and palatable fashion.

Display Material for Dealers.

The British Thomson-Houston Co. have also produced some very attractive display material, certain items of which are shown in the accompanying illustrations. The window display itself (Fig. 1), of which the central figure is a life-sized cut-out of the "Mazda" Girl, is particularly fine. Not only is it life-sized, but it is also absolutely life-like in appearance. The figure is printed in natural colours, and is an excellent example of the lithographer's art. A coloured banner, printed on fabric and eyeletted for hanging, is also supplied for use in conjunction with the figure. It is intended that the dealer should use a number of Mazda lamp containers and wrappers to complete the display. There are only a limited number of these displays, and these will be sent to early applicants.

FIG. 2.—NEW MAZDA SHOWCARDS.
The same designs are also used on the covers of the new lamp folders.

Showcards and Signs.

Two showcards are being issued this year, one bearing a design incorporating the "Mazda Girl," and the other illustrating a cock crowing at a Mazda lamp under the impression, apparently, that he is addressing the sun. Both these showcards (Fig. 2) are supplied mounted on stiff board with cords for hanging, and copies will be sent to dealers on request. It is not possible to give any but an

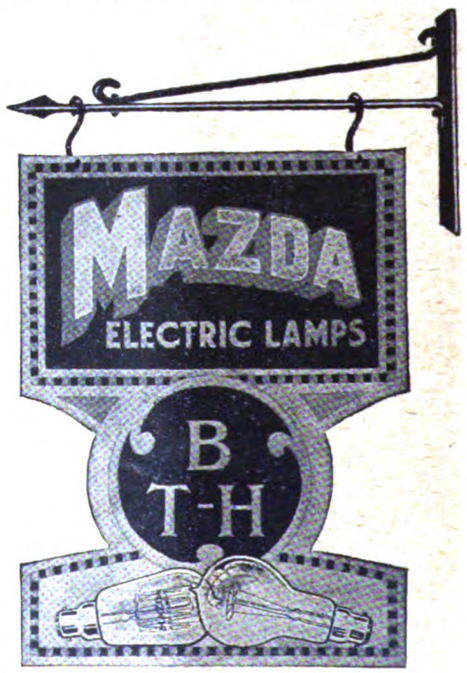

FIG. 3.—THE SIGN OF A GOOD LAMP.
This sign is being fixed all over the country.

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inadequate idea of the beauty and effectiveness of these showcards by means of illustrations, but they are quite out of the ordinary in colouring and general effect.

Another item of display material is the Mazda enamelled iron sign (Fig. 3), which bears an attractive and striking design in four colours. The curious contour and brilliant effect of this sign make it easily distinguishable from all other enamelled iron signs. These signs are being fixed up all over the country, and will no doubt, in a short time, become as familiar to the public as some of the better known petrol signs. People will recognise the sign from a distance and will know that it indicates the premises of a Mazda lamp dealer. The Mazda sign is the sign of a good lamp and of an enterprising contractor.

An Important Weapon.

Overprinted literature is an important weapon in the dealer's armoury, and the British Thomson-Houston Co. have this year produced leaflets of considerably more than average merit. In other trades the leaflets supplied in quantities to dealers are often badly printed on inferior paper in order to keep down the cost. This is, in a way, quite reasonable, because it is obviously an expensive matter to print millions of copies of leaflets for dealer distribution. The British Thomson-Houston Co., however, have always maintained a high standard in their printed matter, and this year the leaflets are particularly good in all respects —printing, paper, cover design and arrangement. Folder L.279 contains up-to-date prices on all standard vacuum and gasfilled lamps. The cover bears the same design as on the " Mazda " Girl showcard. A new feature is the inclusion of an interesting series of thumb-nail illustrations indicating the size and type of Mazda lamp to use in the various rooms of private houses, and in the various kinds of fittings used for residential lighting. Folder L.279A differs from folder L.279 in that its cover bears the " Crowing Cock " design instead of the " Mazda Girl " design. Otherwise it is exactly the same as L.279. Both these leaflets are, of course, available for overprinting with contractors' names and addresses.

For Students of History.

Another folder, No. L.280 (Fig. 4), in addition to giving up-to-date prices of all standard vacuum and gasfilled lamps, bears on the inside six-page opening a series of portraits of the rulers of Great

FIG. 4.—HIGH LIGHTS OF HISTORY.
Six-page inside opening of " Rulers of Britain " folder. Alongside each royal portrait is shown a typical lighting unit of the period.

Britain from King Alfred to the present time. Alongside each portrait is illustrated a typical lighting unit of the period. Needless to say, the portrait of H.M. King George V is flanked by illustrations of Mazda lamps. The panel underneath each illustration gives the name of the ruler and the dates of his reign, and it is expected that the folder will prove of great value to school children, especially to those who are " swotting " historical dates for examination purposes.

This " Rulers of Britain " folder is available in limited quantities for overprinting.

The above-mentioned folders give particulars of the latest addition to the " Mazda " family, namely the white Mazda lamp. This is a gasfilled lamp, in which the high intrinsic brilliancy is corrected in the lamp itself by means of a porcelain-like enamel sprayed upon the bulb. This enamel conceals the filament, and produces a uniform diffusion of light over the whole surface of the bulb.

A Broadcast Appeal.

Another important feature of the Mazda 1923-24 Advertising Campaign is the direct circularising of electric light users throughout the country. During the last few days a calendar mailing card (Fig. 5) has been mailed to over 500 000 electric light users. This card is attractively printed in colours. The calendar covers the six months of

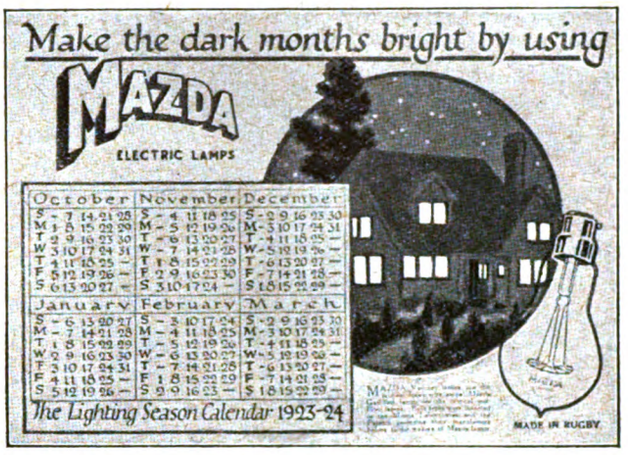

FIG. 5.—A MESSAGE TO 500 000 LAMP USERS.
Copies of this card are being sent through the post to over half-a-million electric light users in the United Kingdom.

the lighting season—namely, October, November, December of 1923, and January, February and March of 1924. Undoubtedly a great many of these cards will be kept by the recipients, and for the sake of the calendar will be set up in a prominent position on the mantelpiece or writing desk. In this way a long-period advertisement is placed within the houses of a substantial proportion of the electric light users of the United Kingdom. It is, of course, difficult to assess the exact value or effect of this kind of advertising, but from previous experience it is known that a considerable impetus in sales always follows the issue of such a circular. It should be remarked that this increase in sales comes through the retailers, thus indicating that the people who receive the circulars go to their local dealers for supplies of Mazda lamps. They are, of course, asked to do this on the circulars themselves, and in any case the address of The British Thomson-Houston Co. is not printed on the cards, so that enquiries are bound to be made through local dealers.

This point is emphasised here because if it indicates one thing more than another it is that dealers should carry adequate stocks of all standard sizes of Mazda lamps in order to ensure that they will be able to deal with the enquiries resulting from this general circularising of the light-using public.

Electrical contractors who desire further information regarding Mazda advertising plans for the coming season should communicate with The British Thomson-Houston Co., at Crown House, Aldwych, W.C.2, or at the nearest branch office.

Season Ticket Rates and Electrical Engineers.

Electrical engineers have this at least in common with the general public that they are not viewing with equanimity the prospect of increased season ticket rates. Apart from the direct effect on their own pockets such an increase will check the flow of the population to the outskirts of the town and so hinder a very hopeful source of electrical development. For these reasons we are pleased to give publicity to the National " Fair Fares " Fund which is being organised by the National Association of Railway Travellers in order that the whole question of standard season ticket rates may be fought out before the Railway Rates Tribunal. Contributions which may be from a shilling upward should be sent to the Honorary General Secretary of the Association, Mr. A. H. Garstang, 79, Queen Street, Mansion House, London, E.C.4.

The Association, in making this appeal, point out that there is every reason to suppose that the standard fare of 1½d. per mile on which the new rates are based is too high and that the economies which amalgamation is supposed to produce should render a reduction rather than an increase possible. Concentration on the reduction of the standard rate is therefore essential and the amount involved is made clear by the statement that in 1922 the passenger revenue of British railways amounted to over £101 000 000, so that even the reduction of ½d. in the standard rate would mean a saving to the public of some millions a year. Owing to the action of the National Association of Railway Travellers, season ticket holders have now a right to be represented before the Railway Rates Tribunal. They should seize the chance with both hands, otherwise they are likely to be saddled with more than a fair proportion of the sum required by the Railway Companies to make up the " standard revenue."

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A Real Automatic Winder.

A coil-winding machine which can be efficiently operated by almost unskilled labour is now available in the shape of "The Maradic Automatic Coil Winder," manufactured by the Automatic Coil Winder and Electrical Equipment Co., Buckingham Gate, London. The outstanding feature of the equipment is that it is, in the strictest sense of the word, really automatic.

We recently had an opportunity of seeing the machine at work, and were particularly impressed with the rapidity with which "change over" was effected to suit any size of wire or

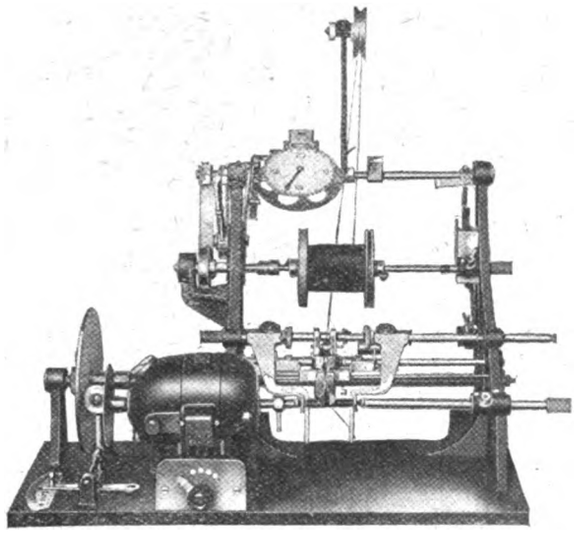

Fig. 1.—The Maradic Automatic Coil Winder.

bobbin. These observations, in fact, completely confirmed the manufacturers' claim that the time required for correctly setting the machine to wind any length of wire, or any size of wire on to any length of bobbin, is less than ten seconds.

The method of operation can be readily gathered from the accompanying illustration (Fig. 1). The scale on the extreme

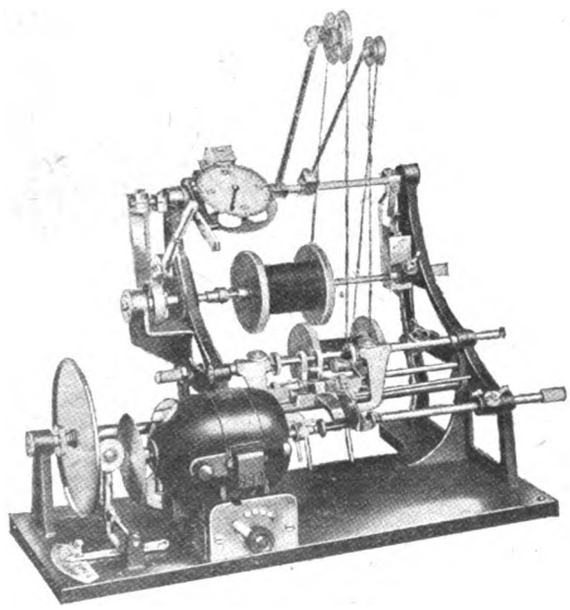

Fig. 2.—A Second Type of Machine for Two Thicknesses of Wire.

left of the machine is set at the size of wire to be used, extending from 1 unit to 18 units. The callipers in the front are then adjusted to the length of bobbin. The reel is then fixed at the top of the winder and the wire drawn over the arm on to the bobbin until fair tension is effected. All that remains is for the indicator to be set at the length of wire required to be wound, and the machine can then be started at such speed as may be deemed most suitable according to circumstances. A stop and four running positions are available.

The resulting work performed by the winder is entirely satisfactory, and there is no wastage of wire. As soon as the desired length has been wound the machine stops. It also stops automatically in the event of a break or of the finish of a reel. In such a case the coil is held firmly in position, leaving a loose end for joining purposes.

The second machine shown in Fig. 2 is fitted with a second arm for carrying a second wire for double winding. The method of operation is exactly the same, and in the case of a break on either wire the machine at once stops.

The machine, complete in one unit, is the result of many years' experience. It is extremely well produced, and nothing has been spared to ensure a very high standard of efficiency.

It is being marketed by the Automatic Coil Winder and Electrical Equipment Co., Ltd., of Wellington House, Buckingham Gate, London.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

BRITISH EMPIRE EXHIBITION, WEMBLEY, 1924.

To the Editor of THE ELECTRICIAN.

Sir,—May I suggest for the consideration of those who arrange visits to Works and other centres of interest for the various Scientific and Engineering Societies, that during the coming winter the site of the great Exhibition at Wembley would be a very suitable place to include in any such round of visits?

I believe there would be no great difficulty in obtaining passes from the authorities if party is a reasonable size, and although visits would have to be made during daylight there is no doubt they would be of value and increase general interest in this enterprise; even at the present time the buildings and constructional plant are most impressive to anyone interested in the engineering industry.—I am, etc.,

J. W. Beauchamp,
Director and Secretary, British Electrical Development Association.

London, September 10th.

Gas Managers on Electrical Competition.

At the annual meeting of the North British Association of Gas Managers last week Mr. James Bell said, in the course of a Paper on "The Conservation of the Lighting Load," if they continued indefinitely their rôle of passive resistance to the encroachments of their competitors it was not too pessimistic to prophesy that in certain departments of lighting gas would ultimately be superseded. Once electricity was installed for one purpose where was their protection from its further aggressions?

Mr. George D. Keiller said the lighting load in Greenock in midsummer was about 40 per cent. of the total load. Were they going to leave that to the electrical engineer?

Mr. J. Gracie said to retain the lighting load they must regulate and adjust pipes and appliances in consumers' houses and keep them in good condition.

Mr. Fairweather remarked that if they followed the gas from the gasholder to the burner and supervised the gas fittings they were assuming extra responsibility, because *accidents were rather common to-day with regard to slot meters and internal escapes.*

Mr. D. Fulton (secretary) said there seemed to be an idea in the minds of some people that when a man substituted electricity for gas lighting it was because he was dissatisfied with gas. That was not the case. He put in electricity because it was the fashion to do so.

There was some laughter at the last remark, but the members apparently failed to see the humour in Mr. Fairweather's suggestion that the gas managers should allow the accidents to continue rather than take measures to prevent them.

Excellent Results at St. Helens.

The annual report of the borough electrical engineer and manager of the St. Helens electricity undertaking states the net profit for the year ended March last was £8 621, compared with £6 310 in the previous year, although the charges for current were reduced at the beginning of the year from 80 per cent. over pre-war rates to 60 per cent. and from January last to 50 per cent. There was an increase of 1 018 kW in the maximum load, the highest load being 5 400 kW, an increase in the kW-hours sold from 13 187 606 to 19 135 823, and a remarkable reduction of works costs from 0·956d. to 0·438d. kWh sold. Total costs, including capital charges, were 0·856d., against 1·465d. The consumers have had most of the benefit of the economies that have been effected, as the average price per kWh sold dropped from 1·566d. to 0·957d. The thermal efficiency rose from 11·7 to 13·14 per cent. A further reduction of prices to 35 per cent. over pre-war rates came into operation on July 1st.

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Electricity Supply.

Extensions and Developments.

BEDWELLTY Council has applied for sanction to a loan of £10 000 for electricity supply purposes.

EAST GRINSTEAD Board of Guardians has decided to adopt electric lighting in the Institution.

STAFFORD Corporation has ordered two sets of switchgear for sub-stations at £397 each. The network is to be extended in Newton so as to supply Messrs. Venables, timber merchants, and other power demands.

WORCESTER Corporation has approved the arrangements made for supplying electricity to Malvern Urban Council. It is proposed to construct overhead transmission lines to Powick, and from the Mental Hospital to the Malvern generating station.

ROTHERHAM Corporation Electricity Department is supplying electricity in bulk to the Yorkshire Electric Power Co. for use at Orgreave Colliery. It is the beginning of a new scheme, and in the near future may lead to important extensions outside the borough.

STOCKPORT Corporation has received from the Electricity Commissioners sanction to a loan of £82 376 for electricity supply purposes. The Council applied for £120 000. The Commissioners have expressed the hope that application for sanction to borrow will in future be made before liability is incurred for the expenditure proposed to be made the subject of a loan.

The Electricity Commissioners have approved the scheme of PORTSMOUTH Corporation for supplying electricity in bulk to Fareham and other neighbouring districts, and the question of the future of Fareham Council's own undertaking has been raised. It is stated that the price at which Portsmouth Corporation offers to supply is not as low as was anticipated by Fareham.

The extensions of the BIRMINGHAM electricity supply system to various outlying districts, which has been in progress for some months, is approaching completion. Supply has already been commenced in Acock's Green and Bournville, and will soon be available in Weoley Hill, South Yardley, Cotteridge and King's Norton, Selly Oak, Stechford, Northfield, Alcester Lanes End and Hall Green.

British Insulated and Helsby Cables, Ltd., laid last week in and ACROSS THE RIVER SEVERN (between Lydney Dock and Berkeley Fell) the cables which are to transmit electricity from the large power station at Lydney to certain parts of Gloucestershire. Mr. G. H. Walton (of British Insulated and Helsby Cables), and Mr. Harry Brown (of the local firm of T. R. Brown and Sons) were in charge of the operations.

It is stated that great improvements will be made in the lighting of DUNDEE and BROUGHTY FERRY within the next month or six weeks. At about 30 street junctions and crossings high c.p. lamps are being placed, and of these units all but three are electric. For several gas lamps one large electric lamp will be substituted. This increased light will be a warning to motorists that they are approaching a point where traffic may be expected, and a further safeguard on certain standards is a second light to prevent motor cars running into the standard when the main light is not in use.

THE ELECTRICITY COMMISSIONERS have intimated that they are prepared to entertain an application by Wallasey Corporation for a Special Electricity Supply Order for MORETON. The Commissioners state that the changed economic conditions during the past 2½ years have already brought about a state of affairs under which it would be to the financial advantage of the Wirral authorities, including Wallasey, Birkenhead, etc., to participate from the outset in the formation of a Joint Electricity Authority for the whole district instead of being constituted a separate Joint Board, and an inquiry will be held in October to enable the Corporation to make further representations.

Mr. S. W. Baynes, chief engineer of the ST. PANCRAS (London) electricity undertaking, has recently submitted to the Electricity Committee a report on the use of pulverised fuel for the generation of electricity, and it is stated that the Electricity Committee have recommended, in view of the St. Pancras Council's large extensions at the King's Road power station, that the chairman of the Electricity Committee and the chief engineer be empowered to visit the United States, and inspect a number of the largest American power stations, with a view to the possible adoption of pulverised fuel at St. Pancras. Mr. Baynes, in his report, points out the rapid growth of the use of pulverised fuel in American power stations, which has been already dealt with in our columns.

The Mersey Scheme Withdrawal.

Liverpool Asked to Reconsider their Decision.

LIVERPOOL City Council last week received a letter from the chairman of the Mersey Docks and Harbour Board asking the Council to reconsider its decision to withdraw from the Provisional Committee relative to the MERSEY JOINT ELECTRICITY SCHEME. In reply to a question by Mr. L. Holt as to whether the withdrawal would prevent the Corporation from co-operating with the commissioners in trying to frame a fresh scheme for the unified control of electricity in the Mersey area, Mr. T. White, chairman of the Tramways and Electricity Committee, said if there were any scheme which appeared appropriate to the Liverpool Corporation they would consider it. They were simply safeguarding themselves from misrepresentation and the burden of expenditure which would be incurred in connection with this Provisional Committee. The matter was referred to Committee.

Inquiries and Orders.

KETTERING Urban Council seeks to amend the draft of the Special Order for which it has applied by including the parishes of Glendon and Barford in Kettering rural district. Objections should be sent to the Secretary, Electricity Commission, by October 1st.

The FIRST GARDEN CITY, LTD., LETCHWORTH, has applied for a Special Order to generate and distribute electricity in Letchworth, Baldock, the parish of Willian, part of the parish of Radwell in Hitchin rural district, and the parish of Stotfold in Biggleswade rural district. Objections should be sent to the Secretary, Electricity Commission, by October 1st.

Tapping New Areas.

Wakefield Corporation last week referred a proposal that the Corporation should supply electricity to Electrical Distribution of Yorkshire to serve residents in STANLEY. The company has authority to supply in the Stanley district.

The YEOVIL ELECTRIC LIGHT AND POWER Co. is erecting generating plant at the Nautilus Works and laying underground mains preparatory to supplying electricity to consumers in Yeovil. A local paper states that the price of the Corporation's gas will fall below 5s. per 1 000 cub. ft. on October 1st.

At a meeting of BOSTON (Lincolnshire) Corporation last week Mr. Salter, a Labour member, referred to the Council's failure to undertake the supply of electricity for the town. It was decided to offer the Boston and District Electric Supply Co. land near the docks for the purpose of erecting electricity works, on a lease of 75 years, at an annual rent of £40.

Miscellaneous Supply Items.

It is stated that QUEENSBURY (Yorks) Council has decided to ask for terms for a supply of electricity in bulk from Halifax and Bradford Corporations.

AUDENSHAW COUNCIL is circularising the ratepayers to ascertain the demand for electricity for lighting, and negotiations will be continued for a supply from Manchester Corporation.

BARNOLDSWICK URBAN COUNCIL has decided to take a referendum of the ratepayers to ascertain whether the town is in favour of an electricity supply scheme, and, in the meantime, to instruct Mr. Blackmore to prepare a scheme.

NEWTON AND EARLESTOWN (Lancs) Electricity Committee has decided to adopt the scheme prepared by Mr. Lacey for electricity supply in the Council's area. The Electricity Commissioners will be asked to approve the scheme and sanction a loan of £25 000.

DUNDEE Corporation has declined to endorse the action of the Electricity Committee in allowing £38 11s. 9d. discount on an account for electricity supply after the expiration of the four weeks allowed, owing to local holidays having intervened. The Council was unwilling to create a precedent by allowing the discount.

Interesting demonstrations of ELECTRIC COOKING, arranged by Liverpool Corporation electricity department, are being given in Francis' Café, Parker Street, Liverpool, until September 22nd. Officials of the Department are in attendance to explain the processes, and the public will have the opportunity of testing the merits of the electrically-cooked fish, entrées, joints, grills, sweets, etc. Firms prominently represented amongst the suppliers of the apparatus are the Carron Co., the Hotpoint Co., and the Metropolitan-Vickers Electrical Co., the Universal Washer Co., the Automatic Telephone Co., and the General Electric Co., and the special feature is the Westinghouse automatic commercial electric baker's oven, which has a capacity of 160 1 lb. loaves. It has six heaters each, taking 4·2 kW.

Belfast Electricity Committee has expressed its willingness to recommend the extension of the Belfast electric supply mains to enable a supply to be given in HOLYWOOD. The capital cost of 6 000 V cable to a central point in Holywood would be, roughly, £8 500, at which point it would be necessary for Holywood Council to erect a transformer chamber and supply a transformer. The electricity supply would be metered at the high-tension side in the transformer chamber, and Holywood Council would carry out all distribution. The charge would be 5d. per kWh with a guaranteed minimum payment of £1 700 per annum, which is equal to 20 per cent. of the £8 500 capital expenditure. This means that Holywood Council would have to pay for a minimum 81 600 kWh per annum. There seems to be little prospect of a demand of more than 50,000 kWh per annum until a power load can be picked up.

Personal Items.

Ald. J. H. KING and Coun. W. H. GILES have been appointed chairman and vice-chairman of Burton Electricity Committee.

We are pleased to learn that Sir TOM CALLENDER has recovered from an attack of pneumonia, which kept him from work for about a fortnight. He was at his office for a short time on Monday, and hopes to resume his full activities before very long.

Mr. OSWALD HOBBS, telegraphy instructor at the South Wales Wireless College, Cardiff, who is leaving to take up an appointment in the United States, was presented with a gold watch by Mr. Norman Drysdale (on behalf of the staff and students) on Friday last.

Mr. W. J. H. WOOD, chief engineer of Bolton electricity department, has been engaged as consulting engineer in connection with Horwich Council's electricity scheme.

Mr. D. JENKINS, of the Metropolitan-Vickers Co., has become a member of the Cardiff firm of Plevin and Partners, consulting engineers.

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Electric Traction.

Tramway Extensions and Developments.

Amongst the works to be carried out by SOUTHPORT Corporation during the ensuing winter is the relaying of tramway track at a cost of £14 000.

BLACKPOOL Corporation is applying for sanction to loans for tramways, including £1 351 for overhead motor tower wagon, £6 475 for new traction feeder and £14 000 for eight new saloon top-covered cars.

BROMLEY (Kent) Corporation objects to the L.C.C. proposal to construct tramways in the borough. Mottingham Parish Council also object to the L.C.C. proposals which provide for a tram route through the parish.

Westmorland County Council had before them on Friday last a proposal by Mr. Gordon Fell for the construction of a LIGHT ELECTRIC RAILWAY FROM KESWICK TO WINDERMERE. The matter was referred to the Main Roads Committee with power to confer with Cumberland County Council.

Mr. R. S. Pilcher, manager of the EDINBURGH tramways, is preparing a report on the suggestion of Coun. Robertson that Parliamentary powers should be sought for continuing the present tramway from the Jaw Bone Walk to Hope Park Terrace, and through Preston Street to Dalkeith Road.

A Sub-committee of the GLASGOW Tramways Committee has been appointed to deal with the underground railway subway, which was recently taken over from a company, and it is probable that electric will be substituted for the old system of cable haulage. The construction of sidings and a re-arrangement by which subway cars can emerge on to the street tramway system will be points for consideration.

At last week's meeting of SOUTH SHIELDS Council the Town Clerk reported that he had informed the Town Clerk of Sunderland that the South Shields Tramways Committee were not in favour of the proposal to negotiate for the joining up of the South Shields and Sunderland systems between Whitburn and Cleadon, but were prepared to continue negotiations on the original proposal for linking up with the Sunderland tramways at Fulwell.

The Tramways Committee of ABERDEEN Town Council has decided to recommend the Council to extend the tramway service from the Rubislaw terminus to the inner lodge of the Corporation's estate of Hazlehead, at an estimated cost of about £47 000. A discussion arose on a proposal to lay the new road with a concrete bed, under the rails, to a depth of 9½ inches, and topped with 2 inches of rock asphalt. The committee authorised the burgh surveyor, the tramway manager, and the convener to visit Leeds, and, if necessary, Sheffield, to inspect the roads there which are laid with asphalt.

Mr. H. J. Nisbett, manager and engineer of the TORQUAY TRAMWAYS Co., states that, in conjunction with the County Council, the company proposes to lay its tram lines in the centre of Torbay Road. This is now possible owing to the road having been widened. The work will probably commence this autumn. Three single-deck cars are to be used on the Torre Station—St. Mary Church route, and a 15-minute service run, instead of 30 minutes as at present. The cars will not have a conductor, the passengers entering and alighting from the driver's end. Four cars, each capable of accommodating 80 passengers, will be placed in service in time for the Easter holiday inrush.

Miscellaneous Traction News.

On Friday last NOTTINGHAM Tramways Committee decided to institute penny stages on the tramways.

During the past year the HASLINGDEN tramways made a profit of £411, compared with a deficit of £619 in the previous year.

Carmarthenshire County Council has decided to ask the Board of Trade to compel the LLANELLY TRAMWAYS Co. to improve the lines outside the borough boundary.

A new type of CHANGE-PLATE, which enables passengers to scoop up their change quickly after purchasing their ticket, has been installed at Victoria (London) Underground station.

Coun. Dennison has given notice to move a resolution in MANCHESTER City Council to appoint a Congestion Committee to report further on the traffic congestion in the central area and subsequently to deal with matters relating to the congestion as they arise.

Work on the UNDERGROUND RAILWAYS EXTENSION TO EDGWARE is making good progress. On Sunday morning a new bridge to carry the line over the road at Golder's Green was placed in position in about fifteen minutes. The bridge weighs about 300 tons.

Mr. Potts, manager of the DONCASTER Corporation tramways, is confident that the system of weekly passes adopted on tramways will prove successful, although, as the experiment has only been in operation about three weeks, it is too early yet to form a definite conclusion from the results. People are using the cars who have not used them in the past, and the privilege of being allowed to transfer the passes to ladies in shopping expeditions and to tradesmen when delivering goods is much appreciated. The pass system is helping to fill the cars in the slack hours of the day, and this, it is believed, will enable reductions of fares to be made.

Lectures.

Management and Industry.

A series of nine lectures on "Management and Industry," arranged with the co-operation of the Industrial League and Council, will commence at the Regent Street Polytechnic, London, on Friday, October 12th, at 8 p.m. The fee for the course is 5s., or for a single lecture 1s. The lectures will include "The Financial Organisation of Industry," by A. W. Kimberley, "Industrial Research," by A. P. M. Fleming, "Factory Management," by A. R. Stelling; "The Fundamentals of Economic Production," by J. F. Butterworth, and "The Economic Aspect of Cost Accountancy," by H. W. Allingham.

Industrial Welfare Society.

The fourth annual lecture conference of the Industrial Welfare Society will take place at Balliol College, Oxford, from to-day (September 14th) to Wednesday next, inclusive. The opening address will be delivered by Mr. W. L. Hichens after dinner this evening, and during the conference twelve other lecturers, well versed in their subjects, will speak on factory administration, industrial psychology, the Factory Acts, thrift schemes in industry, welfare possibilities and kindred matters.

Educational.

The Board of Education announces the result of the 1923 competition for WHITWORTH SCHOLARSHIPS. For the two senior scholarships awarded (each £250 annually for two years) there were 19 competitors, and there were 142 competitors for Whitworth Scholarships of whom 12 were successful and were awarded scholarships of the value of £125 annually for three years. Twenty-five unsuccessful competitors for scholarships were awarded Whitworth prizes of £10 each. The regulations for the 1924 competition can be purchased from H.M. Stationery Offices.

The Calendar for the 68th (1923–4) session of the MERCHANT VENTURERS' TECHNICAL COLLEGE (in which the Faculty of Engineering of Bristol University is provided) has just been issued. It contains, in addition to excellent pictures of the interior and exterior of the building and the plant and apparatus used therein, the general rules of the College, a list of the teaching staff and examiners, the "sandwich" system of training engineers, the degrees and diplomas in engineering and the courses leading up to the same, scholarships, exhibitions, prizes, and time tables. Evening classes commence on Oct. 1 and day classes on Oct. 2.

Particulars of the arrangements of the UNIVERSITY COLLEGE (LONDON) FACULTY OF ENGINEERING for the 1923–1924 session have just been published. The first term commences on October 1st, and intending students should apply to the Provost as soon as possible. Intermediate examinations are held at the end of each session, and candidates for the final examination for a first degree must have completed a three years' course of study after matriculation. Information is given regarding the David Hughes and Salomons and other scholarships, the Vernon Harcourt prize in civil engineering, and numerous other prizes and bursaries, and the syllabus and timetables for the diploma and degree courses are set out. Certificates are awarded for post-graduate study. The facilities offered in the department of electrical engineering and the engineering laboratory and workshops are described as well as the arrangements for the mathematics, physics and chemistry classes and the societies connected with the University.

West of Scotland Electricity District.

Representatives of local authorities, electricity supply companies, and railway companies in the West of Scotland met in the City Chambers, Glasgow, on Friday last, to determine what action should be taken in view of the Electricity Commissioners having defined certain territory in the West of Scotland as an electricity supply district. The district consists of the county of Ayr, including the burghs of Ayr and Kilmarnock; part of Renfrewshire, including Paisley and Greenock; the city of Glasgow; part of Lanarkshire, including Hamilton, Motherwell, Airdrie, and Coatbridge; and a small part of Dumbartonshire. The principal question involved was whether a joint electricity authority with powers of administration or merely a joint advisory board should be established. The proceedings were private, but it was learned that some of the authorities proposed amendments regarding representation and other matters, and a draft scheme constituting the West of Scotland electricity district and establishing the West of Scotland electricity advisory board was approved. The scheme has to be lodged before December 31st.

Imperial Economic Conference.

The business of the Imperial Economic Conference, which will open early in October, will include the consideration of the following subjects:—(1) Ways and means for the fuller development of the natural resources of the Dominions and the Colonies; (2) Inter-Imperial commerce, shipping and communications generally; (3) Co-ordinated action for the improvement of technical research; (4) The organisation of economic intelligence; and (5) The unification of law or practice in the Empire in certain matters affecting trade development.

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Tenders Invited and Accepted.

GREAT BRITAIN.

ABERSYCHAN URBAN DISTRICT COUNCIL, September 17th.—Electric light works within the urban district. Form of tender, etc., from the Clerk to the Abersychan Council, Pontypool, or Dr. J. A. Purves, 15, Queen's Terrace, St. David's, Exeter.

LONDON COUNTY COUNCIL, September 17th.—Machine tools for tramway central repair depot. Particulars from the General Manager, Tramway Offices, Victoria Embankment, W.C.2.

CROYDON GUARDIANS, September 17th.—Six months' supply of electrical and engineers' appliances, tools, etc. Forms of tender from the Clerk, Mayday Road, Thornton Heath, Surrey.

WARRINGTON CORPORATION, September 18th.—Electric vehicle battery charging plant, for the Sanitary Works Committee. Specification from the Borough Electrical and Tramways Engineer.

WEST KENT GENERAL HOSPITAL, MAIDSTONE, September 21st.—Electric light wiring in additions to the hospital. Particulars from Ruck and Smith, 86, Week Street, Maidstone.

BRADFORD CORPORATION, September 22nd.—200 steel poles Specification from the City Engineer.

WINDSOR GUARDIANS, September 24th.—Wiring of the institution for electric lighting. Current will be obtained from the Windsor Electrical Installation Co.

ILFORD URBAN DISTRICT COUNCIL, September 25th.—E.H.T. cable. Specification from Mr. A. H. Shaw, Electricity Works, Ley Street, Ilford.

COMMISSIONERS OF H.M. WORKS, ETC., October 3rd.—Electric wiring, in steel conduit at the New Science Museum, South Kensington, London. Specification, etc., from the Contracts Branch, King Charles Street, London, S.W.1.

METROPOLITAN ASYLUMS BOARD, October 10th.—Electric light installation in the old East Cliff House, Princess Mary's Hospital, Margate. Specification from the Board's Office, Embankment, London, E.C.4.

LONDON COUNTY COUNCIL, October 15th.—15 000 kW steam turbo-alternator, condensing plant, etc. Specification from the General Manager, Tramways Department, Victoria Embankment, W.C.2.

AUSTRALASIA.

VICTORIAN RAILWAY COMMISSION, October 24th.*—Electric hoists for Bendigo and Ballarat workshops.

IRELAND.

BELFAST CORPORATION, September 17th.—Three-phase e.h.t. switchgear for Harbour power station. Specification from the City Electrical Engineer.

SOUTH AFRICA.

JOHANNESBURG CORPORATION, September 24th.* Tramcar axles and wheel-centres (contract 138).

URUGUAY.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO. October 25th.*—130 000 metres of electrolytic tinned copper wire.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO, November 1st*.—35 500 metal filament lamps.

J. and S. Farr have secured the contract for wiring the institution for BASFORD BOARD OF GUARDIANS, at £1 805.

THORNABY COUNCIL has accepted the tender of Pickersgill and Sons for electric light wiring in the Town Hall, at £89.

MAIDSTONE CORPORATION has accepted the tenders of the Craigpark Cable Co. for cable at £189 12s. and Johnson and Phillips for a transformer at £28 9s. 11d.

LYTHAM ST. ANNES COUNCIL has accepted the tender of Siemens Bros. and Co., for e.h.t. main and pilot cables from Squire's Gate to St. Anne's electricity station.

Cammell, Laird and Co. have received an order from the GREAT INDIAN PENINSULAR RAILWAY for 77 motor and trailer coaches in connection with the electrification of the Bombay lines.

The tender of the Northern Counties Electricity Supply Co. has been accepted by THIRSK PARISH COUNCIL for street electric lighting by 77 lamps for seven months, at £3 6s. 6d. per lamp.

GLASGOW CORPORATION has accepted the following tenders: Haddow and Co., wiring Shettleston and Tollcross libraries, £365 13s. 3d.; Western Electricity Co., cable for fire alarms, £136 11s. 4d.; J. Lavid and Co., wiring in connection with Coplawhill housing scheme, £387 3s.

DONCASTER CORPORATION has accepted the following tenders:—General Electric Co., 1 250 kW rotary converter and switchgear, £6 020, and street lamp fittings, £212 10s.; Callender's Cable and Construction Co., cables, £774 2s.; British Mannesman Tube Co., street lamp standards, £468 14s.

The SWEDISH STATE RAILWAYS DEPARTMENT received, in response to the first invitation, 13 tenders for the supply of 50 electric locomotives. The lowest price was quoted by the Siemens-Schuckertwerke and the Allgemeine Elektricitäts Gesellschaft, of Berlin, Kr. 229 000 per locomotive, and the highest tender was Kr. 264 000. Amongst the six firms outside Sweden who tendered was the Westinghouse International Electric Co., of London. As all the offers were considered too high, tenders were again invited, and had to be in by Wednesday last.

* Particulars from the Department of Overseas Trade.

The Disaster in Japan.

British Subjects Saved.

British engineers in Japan seem generally to have escaped the death and disaster which followed the earthquake. We learn that Mr. W. A. Coates, of the Metropolitan-Vickers Electrical Co., who was in Japan on a special mission, is safe, and the same good news has also been received in reference to Mr. H. K. Rodwell, the principal representative, and Mr. G. Scott, another member of the staff of the same company, Mr. George Barr, of Vickers, Ltd., Mr. W. C. McCallum, of the English Electric Co., Mr. Chisholm and the other members of the staff of Babcock and Wilcox (except Mr. Thomson), Mr. Carter, of Siemens Bros., and Co., Mr. Morley and Mr. Moseley, of the Underfeed Stoker Co., the European staff of Brunner, Mond and Co., Mr. J. B. Pearson, managing director of Cowans, Sheldon and Co., and the staff of Alfred Herbert, Ltd., including Mr. T. C. Howden, general manager in Japan, Mr. A. E. Avery, Mr. C. D. Harvey, Mr. Tennent, Mr. H. A. FitzPatrick, and Mr. H. Wilkinson. The two last mentioned had left for England before the disaster occurred. Information has also been received that the following are safe: Mr. B. S. Anderson, Mr. Swift and Mr. E. Lewis (English Electric Co.), Mr. A. H. Ginman (Chinese National Wireless Telegraph Co.), Mr. Drane and Mr. A. Russell (Underfeed Stoker Co.).

Lord Mayor's Fund.

Up to September 12th, the amount received in answer to the appeal of the Lord Mayor of London for the relief of the inhabitants of the stricken country was £100 000. Amongst the contributors are the English Electric Co., £1 050; Vickers, Ltd., £1 000; Metropolitan-Vickers Electrical Co., £500; Frederick Braby and Co., £105; Metal Traders, Ltd., £105; Marconi's Wireless Telegraph Co., £1 000; the Eastern and Associated Telegraph Companies, £1 000; Belliss and Morcom, £105; British Thomson-Houston Co., £200; Albright and Wilson, £105; W. T. Henley's Telegraph Works Co., £100.

Technical Exhibition in France.

An international exhibition and congress of ironfounding was opened on Wednesday at the Ecole Nationale des Arts et Métiers, Paris, and will remain open until the 16th inst. An electric power station has been provided to supply current for driving apparatus used in demonstrations. An electric lighting exhibition, organised by the Union des Sydicats d'Electricité, the Chambre Syndicale des Fabricants de Bronzes, and the Société d'Encouragement à l'Art et à l'Industrie, will be held in Paris in 1924. Prizes amounting to 50 000 fr. will be awarded. The objects of the exhibition are to encourage originality in electric lighting plants and to induce manufacturers of fittings to co-operate with artistic inventors.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Raw Materials and Supplies for the Furnishing Trade: Veneers"; "Made by Machinery"; "British Institute of Industrial Art Exhibition."

THE CHEMICAL AGE.—"British Association: Presidential Addresses by Sir E. Rutherford and Professor F. G. Donnan"; "Progress in British Chemical Porcelain Industry," by Dr. G. N. White.

THE EUROPEAN COMMERCIAL.—"Customs Formalities—Measures for Simplification"; "The New Franco-Czechoslovak Commercial Agreement"; "Free Discharge of Bulk Cargoes."

THE FRUIT GROWER.—"Dutch Roses and Bulbs—A Reply"; "Gooseberry Disease in Sussex"; "Efficiency of the Spray Spreader."

GARDENING ILLUSTRATED.—(Special Bulb Number). "Late Flowering Tulips," by Joseph Jacobs; "Carpets for Bulbs," by H. Graves; "Bulb Bowls in the Decorative Scheme."

THE GAS WORLD.—"Notes on Works Costs"; "Combination of Gas and Electricity Services"; "Conservation of the Lighting Load."

THE HARDWARE TRADE JOURNAL.—"Gas Lighting for 1923–24"; "Another Link with Georgian Days"; "Red Stains on Sheet Brass."

Forty Years Ago.

"The Electrician," September 15th, 1883.

THE ELECTRO-MAGNET AND OPHTHALMIC SURGERY.—Mr. Simeon Snell, the author of a recently published work on this subject, gives the honour of the introduction of the magnet into ophthalmic surgery to Fabricius Hildanus in 1646.

OVERHEAD WIRES.—Bethnal Green Vestry are of opinion that legislation which will give vestries the control of wires crossing public streets is necessary, and have instructed their Parliamentary Committee to give their attention to the matter.

ONE WAY OF LOOKING AT IT.—In "Practical Electrical Units" by James Swinburne, recently published, the author says:—"Force is generally looked upon as what tends to move matter, and the term 'electromotive force' seems, therefore, a misnomer at first sight. Science does not know what electricity is, but it is supposed to be a kind of motion of molecules or of ether, very closely related to heat and light. Science knows little about molecules or ether, and does not even know if there are such things, but thinks the next thing to understanding anything is naming it."

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Latest News from Wembley.

The Royal Society and a Pure Science Exhibit.

At the request of the organisers of the British Empire Exhibition, the Council of the Royal Society has appointed a committee to organise a central exhibit at Wembley to illustrate the fundamental principles of certain departments of pure science, with special reference to the share taken in developing those principles by the Empire. A small sum of money has been placed at the disposal of the committee and space allotted in the Central Pavilion. The committee, of which Sir Richard Glazebrook is the chairman, represents all branches of science.

The Lighting Arrangements.

Hundreds of miles of electric cable are now being buried in the grounds at Wembley, as part of the task of lighting next year's great British Empire Exhibition.

Evening being the most popular time for visiting exhibitions, we are glad to hear that great care is being devoted by the electrical engineers of the British Empire Exhibition to the illumination of next year's show. An interesting point is that, vast as the exhibition is, the whole of the lighting will be under the control of one man. The power station which will supply the current will be of a size equal to that required for a city of 100 000 population.

Illumination to Change with the Weather.

The general aim of the lighting section of the exhibition is to produce a broad luminous effect, which will show up the buildings, emphasize the beauty of their structure and outlines, and, in addition, harmonise with the changes of temperature. This will be achieved by an elaborate scheme of colour lighting. On a cold night the whole Exhibition will radiate under a warm orange or red glow. On hot, close evenings the lighting will change to a cool moonlight effect. With a touch of the hand, the controller of the lighting, necessarily a man of artistic taste, will be able to change the colour of the whole Exhibition, either in one flash or in successive waves of colour. In every case the source of light which illuminates the buildings will be carefully concealed, thus preserving the illusion of artificial sunlight or moonlight.

Street Lighting Arrangements.

The main avenues and roads will be lighted up by globes 2 ft. in diameter, mounted on stone columns 10 ft. high. These also will change in harmony with the rest of the lighting. Perhaps the most wonderful of all the lighting schemes in the exhibition will be that employed in connection with the ornamental lake, which stretches from east to west across the centre of the main exhibition grounds. The only lighting on the lake will be from four floating boats, which will project powerful beams of coloured light below and along the water's surface. The beams of light below the water's surface will be caught by mirrors on the bed of the lake and reflected upwards at various angles. At night a certain amount of mist always arises from a large expanse of water. Full advantage will be taken of this, and the various beams of light passing through it will give the illusion of an incandescent lake on which visitors may float in various weird craft, typical of those used in different parts of the Empire.

The sky will also be used to show up the effect of powerful beams of light, and everyone within a distance of forty miles will know that the British Empire Exhibition is open. This will be effected by a perpendicular beam of light 200 ft. sq., many times greater in intensity than all the searchlights which were used during air raids on London put together, which will be sent up into the heavens from the electrical section of the Palace of Engineering.

World's Power Conference.

Canadian Participation being Arranged.

As readers of THE ELECTRICIAN well know, a World Power Conference is being arranged by Mr. D. N. Dunlop, of the B.E.A.M.A., in connection with the British Empire Exhibition at Wembley next summer. This conference will be held during July, and it is hoped that many technical and scientific institutions and industrial organisations in Great Britain and other countries will participate.

It is hardly necessary to say that the object of the Power Conference will be to consider how the industrial and scientific sources of power may be adjusted nationally and internationally. This will be done by considering the potential resources of each country in hydro-electric power, oil and minerals; by comparing experiences in the development of scientific agriculture, irrigation and transportation by land, water and air; by conferences of civil, electrical, mechanical, marine and mining engineers, technical experts and authorities and industrial research; by consultation of the consumers of power and the manufacturers of the instruments of production; by conferences on technical education to review the educational methods in different countries, and to consider means by which existing facilities may be improved; by discussions on the financial and economic aspects of industry; by conference on the possibility of establishing a permanent world bureau for the collection of data, the preparation of inventories of the world's resources and the exchange of industrial and scientific information through appointed representatives in the various countries.

We are glad to hear that in response to the invitation for Canadian participation, the Hon. Charles Stewart, Minister of the Interior, has sent Mr. J. B. Challies, the Director of Water Power, to London to confer with the British authorities with a view to having the Dominion's co-operation made both adequate to Canada's unique achievements in hydro-electric matters and acceptable to the plans of the British Committee.

Important conferences with the British Committee in London, and with the French Committee in Paris, at which representatives of other European countries were in attendance, have just been concluded, as a result of which a mutually satisfactory basis for the first World Power Conference has been agreed to by all the principal countries concerned, including Great Britain, France, Switzerland, Italy, Belgium, Spain, Norway and Sweden, the United States and Canada. Germany, Austria and Russia have not yet been invited to the Conference.

As is not unnatural, great interest is being taken throughout Europe in the progress of Canadian power development, in nearly every aspect of which Canada has to her credit remarkable achievements. The Dominion's participation in the Conference in July, 1924, will, as a result of the Hon. Charles Stewart's active interest, prove commensurate with the part Canadian enterprise has already played in the development of this "Age of Power."

It is understood that the Director of Water Power is returning to Canada immediately to report the results of his conferences to the Minister of the Interior, following which a Canadian National Committee, representative of all the agencies concerned with power production throughout the Dominion—Governmental, co-operative and private—will be constituted.

Organisation of Exhibits.

A list has been issued of the headings under which the exhibits at next year's BRITISH EMPIRE EXHIBITION at Wembley are being arranged. There will be a PALACE OF ENGINEERING in which (*a*) the shipbuilding, marine, mechanical and general engineering section is being organised by the British Engineers' Association, 32, Victoria Street, London; (*b*) electrical and allied engineering section (British Electrical and Allied Manufacturers' Association, 36-38, Kingsway, London); (*c*) marine transport; (*d*) land transport, exclusive of motors; and (*e*) motor vehicles and cycles (Society of Motor Manufacturers and Traders, 83, Pall Mall, London). The remainder of the sections will be in the PALACE OF INDUSTRY, and amongst them will be (*a*) chemical (Association of British Chemical Manufacturers, 166, Piccadilly, London); (*h*) building materials, central heating, ventilation, etc.; (*t*) scientific instruments; and (*u*) indiarubber, gutta percha and balata.

Imperial Notes.

Canadian Water Power.

Mr. J. B. Challies, representative of the Canadian Ministry of the Interior, has issued a memorandum dealing with Canadian water power. Mr. Challies says: Not only is Canada one of the greatest water-power countries of the world, but she has a greater actual hydro-electric production than any other country—four times as great as the United States. Water power generates 88 per cent. of the electricity used in Canada, whereas in the United States it is only 24 per cent. Since 1910 the total horse-power utilised for electrical purposes has increased from 975 000 to 2 974 000. The present value of water-power installations is £124 000 000. Favourable opportunities are afforded British manufacturers of hydraulic and electrical machinery by the rapid and assured annual increase in Canada's power production capacity. Equipment valued at £12 000 000 will, it is estimated, be purchased during the next five years. The Government will give encouragement to British concerns which show interest in hydro-electric enterprise in Canada.

Electric Power for N.Z. Industries.

The New Zealand Minister of Public Works, in his annual statement, states that the development of hydro-electric power is progressing steadily and will assure the utilisation of a total of 181 000 kW by 1930. Special attention is being given to the provision of cheap power to encourage the growth of special export industries. The Dominion is now too dependent on the export of agricultural produce, which is liable to serious price fluctuations. A determined effort will be made to develop the manufacture and export of chemical and metal products.

South African Demands for Electrical Plant.

The "British and South African Export Gazette" states that one of the two 10 000 kW generators required for the Johannesburg Corporation's new power station will probably be purchased very shortly. The consulting engineers are G. M. Clark and Partner, of Johannesburg.—The same journal calls attention to the improving market in the Union of South Africa for imported electrical machinery and material. The value of such imports in the first four months of this year was £465 966, against £308 172 in the corresponding period last year.

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Association of British Exhibitors.

Overlapping to be Prevented.

A meeting of this Association, which has been formed to protect the interests of exhibitors at exhibitions, was held at the Cannon Street Hotel, London, on the 6th inst., MAJOR W. J. MCNAB, of the Noiseless Typewriter Co., presiding.

After some preliminary business had been transacted, the CHAIRMAN, in reply to Mr. Bangert, of Messrs. Condrup ("Primus" stove makers), said the Committee thought it desirable that the question of the terms on which trade associations should become members of that Association should be left for the consideration of the Committee after that meeting.

Mr. W. A. PARKER (British Engineers' Association) said he thought the Association would have the hearty support of the Council of the B.E.A., particularly in relation to the overlapping of exhibits. This question of overlapping should be dealt with by a joint body. His Association had on some occasions managed to bring about the stoppage of exhibitions which they thought superfluous. An organisation such as the Association of British Exhibitors would, he thought, be very helpful. His Association was representing all the engineering exhibitors at next year's British Empire Exhibition.

A suggestion was made that the London Chamber of Commerce, who had vast power abroad as well as in this country, should have some arrangement with the new Association.

The Support of the F.B.I.

The CHAIRMAN said the Committee wished to learn the views of all important public bodies. They had approached the Federation of British Industries, who assured the Association of their interest. His (the Chairman's) own firm was a member. of the Office Trade Appliance Association who took care of their interests in special exhibitions, but when they took part in a big general Exhibition they felt that they were left in the cold. That was where this Association would be of value.

Another speaker said he had been assured by a gentleman in charge of the arrangements for the British Industries Fair that he was in favour of the formation of this Association and would be only too glad to co-operate with it.

Mr. G. A. MALLINSON (Chemists' Association) said his Association was in favour of the formation of the new body, but its strength would lie in the combination of the actual exhibitors and not in a loose affiliation of trade organisations, although, of course, if a large number of trade associations were affiliated to it it would be stronger.

Representatives of other trade societies also emphasised the desirability of getting as many individual exhibitors as possible to become members, and the suggestion was made that if the trade societies were all affiliated to the new Association the firms might hold aloof in the expectation of getting the protection they wanted through their trade societies.

Electrical Industry Already Organised.

Mr. R. O. ACKERLEY (General Electric Co.) said his own trade association already looked after the interests of exhibitors. No member of a trade association would join this Association unless it had the trade association's blessing. They wanted the blessing of the trade associations, and also, if possible, some of their cash, but they could not offer the trade associations the benefits they offered exhibitors.

The CHAIRMAN said the remarks that had been made indicated that it was to the interest of every firm who spent money on exhibiting to join this Association, which would represent their interests in dealing with promoters of exhibitions, and would speak with authority and with knowledge of the best way of running exhibitions.

Further particulars regarding the Association can be obtained from the Secretary, 69, Victoria Street, London, S.W.1.

Institution Notes.

The Fifth Annual Dinner to the members of the National Executive Council of the ELECTRICAL POWER ENGINEERS' ASSOCIATION, on the invitation of the Southern Division, will take place at the Hotel Cecil, Strand, London, W.C., on Saturday, October 20th, at 5.30 for 6 p.m.

The INSTITUTE OF TRANSPORT will hold the first ordinary meeting of the Session at the Institution of Electrical Engineers on October 1st, at 5.30 p.m., when Sir J. G. Broodbank will deliver his Presidential address. On November 5th, at the same place, the annual general meeting will be held and will be followed by a paper by Mr. T. Salkield on "A Transport Adventure in Persia." On October 16th, Mr. P. Burtt, hon. treasurer, will lecture on "The Institution Examination Scheme." Admission cards from the Secretary, 15, Savoy Street, W.C.2.

The programme of the INSTITUTION OF THE RUBBER INDUSTRY for the ensuing session has just been issued. The meetings of the London section, held at the Engineers' Club, Coventry Street, commence on September 17th, when a paper by Mr. E. J. Edwards on "Rubber Floors and Rubber Roadways" will be read. There will be at least one ordinary meeting each month ending in May, and some of the papers will be of interest to those engaged in the electrical industries. The Manchester section has arranged for at least five meetings and the programmes of the Birmingham and Edinburgh sections are in course of compilation. The address of the Institution is Faraday House, 10, Charing Cross Road, London.

Wireless News.

The British Association and Broadcasting.

Sir Ernest Rutherford's Presidential Address to the British Association at Liverpool, of which we give an abstract on p. 272, was simultaneously broadcasted from the London, Birmingham, Glasgow, Cardiff and Newcastle stations at 8.55 p.m. on Wednesday. In the case of the Manchester station, connection was made to Liverpool by land line. The other stations were connected by telephone through London to Liverpool.

Military Wireless Sets.

During the recent Army manœuvres new military wireless sets were thoroughly tested. "The Engineer" says the "C" set, with a range of from 20 to 60 miles, has been successful for communication between divisional and brigade headquarters. The light "A" set, which can be carried in mule panniers, has linked up brigade headquarters to battalions, and wireless telephony between "contact" aeroplanes and various land formations has been effected and telephonic communication between tanks on the move has been shown to be possible if the tanks are not more than 5 or 6 miles apart.

South African Regulations.

The Government of the Union of South Africa has drawn up regulations for broadcasting which provide that any person may apply to the Postmaster-General for a licence to establish a wireless telephony broadcasting service, and such licences will be for five years, and their terms must be carried out as soon as possible, and approved apparatus provided capable of working over a specified distance. No other broadcasting licence will be issued for operating within the distance specified during the tenure of the licence, which may be renewed. Fees for listening-in, payable to the broadcaster, will range from £2 per annum for private houses to £6 for licensed hotels, with special rates for other premises, subject to the approval of the Postmaster-General.

Experiments on Moving Trains.

"The Engineer" states that several experiments have been made recently in America and in France with the object of installing a complete radio telephonic set in express trains. In the fast express train between Hoboken and Buffalo this has been done. Passengers can continue conversations with their friends which are interrupted by the train starting. They can also receive radio telegrams from their friends while the train is in motion. On the Paris-Orleans Railway saloon cars have two loud-speaking telephones fitted at each end. Up to a distance of 210 miles from Paris, the Eiffel Tower concerts are heard satisfactorily. When going round curves discordant sounds are heard owing to the friction of the flanges of the wheels on the rails.

An All-British Wireless Exhibition.

There seems no doubt that the popularity of "Wireless" during the coming winter will exceed all previous records, and that popularity is likely to be increased by an All-British Wireless Exhibition and Convention which is to be held at the White City, Shepherd's Bush, London, November 8th to 21st.

This Exhibition is being organised in conjunction with The National Association of Radio Manufacturers, by Messrs. Bertram Day and Co., 9 and 10, Charing Cross, London. There will be a number of special attractions including broadcast demonstrations by the British Broadcasting Co.

Municipal Electricity Finance.

Poplar Again Shows Good Results.

The profits of the POPLAR (London) electricity undertaking are, like Dr. Coué's patients, getting better and better. The gross profit for the year ended March last was £64 992, this being an increase over that of the preceding year of £14 695, or 29½ per cent., and the net balance of income over expenditure, including capital charges, was £12 157, increase £5 920, or 95 per cent. Revenue was £168 717, compared with £182 092, and total cost of production was £103 775 against £131 795, leaving the gross profit mentioned above, from which net revenue charges £53 330 had to be deducted, and after adding income from property £83 and profit from sales department £413, the annual surplus of £12 157 is arrived at. Fuel cost only 0·477d. per kWh sold, against 0·904d., which, of course, goes far towards accounting for the improved surplus, and total cost of production was 0·903d., against 1·404d. The efficiency of the system was 82·15, against 81·52 per cent.; maximum load was 12 000 kW, against 9 700 kW; and load factor 27·77 per cent., compared with 28·11 per cent.; kilowatt hours generated were 29 521 480, against 23 255 590, purchased 4 925,531, against 4 377 733, and sold 27 556 971, against 22 526 506. Charges for supply were reduced from 85 per cent. advance on power and public lighting and 70 per cent. on private supply to an all-round advance of 50 per cent. as from April 1st, 1922, which makes the increase in profit of 95 per cent. all the more satisfactory. The plant will have to be augmented during the current year by one 50 000 lb. boiler and cooling towers now in course of erection. At present the capital employed is £27·97 per kW installed.

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J. Scott-Taggart. A Limiting Device (*Wireless Weekly*, 1, p. 541, June 6th, 1923). R.430.
E. W. Marchant. Interference Prevention (*Wireless Weekly*, 1, pp. 789–790, July 11th; 2, pp. 20–22, July 18th, 1923). R.431/432.
Y. Marrec. Eliminating Atmospherics (*Electrician*, 91, p. 9, July 6th, 1923). R.431.
A. F. Evens. A wavetrap and wavemeter for C.W. reception (*Q.S.T.*, 6, p. 32, July, 1923). R.432/384.
Gesellschaft fur Drahtlose Telegraphie. A Rejector System (*Wireless World and Radio Review*, 12, p. 441, July 7th, 1923). R.432.
E. Redpath. Local Interference (*Wireless Weekly*, 1, pp. 553–556, June 6th, 1923). R.432.
C. W. Geiger. The World's Longest Line Radio System (*Radio News*, 5, p. 15, July, 1923). R.470.
F. Luschen. Alternating Current Telegraphy (*Elektrotechnische Zeitschrift*, 44 pp. 1–4, January 4th; pp. 28–31, January 11th, 1923). R.470.
F. Eppen. Value Rectifier for the Reception of High-Speed Wireless Signals (*Jahrbuch der drahtlosen Telegraphie*, 20, pp. 173–189, September, 1922). R.485/342.
High-speed transmission (*Wireless World and Radio Review*, 12, pp. 452–453, July 7th, 1923). R.485/611.
High-Speed Wireless Telegraphy (*Wireless Weekly*, 1, pp. 739–740, July 4th, 1923). R.485.
H. W. Nichols and L. Espenscheid. Radio Extension of the Telephone System to Ships at Sea (*Proceedings of the Institute of Radio Engineers*, 11, pp. 193–242, June, 1923).
An exhaustive account of much experimental work and the practical results obtained. R.480/412.

R.500. APPLICATIONS OF RADIO.

B. Rosenbaum. Radio Telephony from Trains (*Jahrbuch der drahtlosen Telegraphie and Telephonie*, April, 1923; *Electrical World*, 81, p. 1536, June 30th, 1923). R.533.
Wireless on Trains (*Wireless Weekly*, 1, pp. 362–363, May 16th, 1923). R.533.
Wireless Underground (*Wireless Weekly*, 1, pp. 558–559, June 6th, 1923). R.536.
Wireless telegraphy to communicate with entombed miners (*La Nature*, 21, supplement, p. 89, March 24th, 1923). R.536.
Radio used to locate line trouble (*Electrical World*, 81, p 1096, May 12th, 1923). R.537.
Amateur Radio shoves off for the Pole (*Q.S.T.*, 6, pp. 7–9, July, 1923). R.545.
Amateur Wireless in Polar Regions (*Wireless World and Radio Review*, 12, p. 488, July 14th, 1923). R.545.
English 5 M.S. Heard Here (*Wireless Age*, 10, p. 56, May, 1923). R.545.
In which we get across (*Q.S.T.*, 6, pp. 9–10, January, 1923). R.545.
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Official European Report on the Transatlantics (*Q.S.T.*, 6, pp. 15–17, June, 1923). R.545.
Pacific Completely Bridged by Amateur Sigs. (*Q.S.T.*, 6, pp. 27–30, February, 1923). R.545.
Result of the third attempt at Amateur Transatlantic Radiotelegraphy (*Genie Civil*, 82, p. 340, April 7th, 1923). R.545.
The Status of the Amateur (*Q.S.T.*, 6, pp. 35–38, July, 1923). R.545/007.
The Transatlantic Triumph (*Q.S.T.*, 6, pp. 7–20, February, 1923). R.545.
Trans-Pacific Amateur Reception (*Q.S.T.*, 6, pp. 24–27, January, 1923). R.545.
10 000 miles in four minutes (*Q.S.T.*, 6, pp. 11–14, January, 1923). R.545.
The Broadcasting Committee—Memorandum of evidence submitted to the Committee appointed to consider the agreement between the Post Office and the British Broadcasting Company, and the future of Broadcasting, by the Executive Committee of the London Labour Party (*Wireless Weekly*, 1, pp. 503–504, May 30th, 1923). R.550.
The Broadcasting Committee (*Wireless Weekly*, 1, pp. 616–617, June 13th, 1923). R.550.
Broadcast Reception and Spark Interference (*Wireless Weekly*, 1, pp. 479–481, May 30th, 1923). R.550/432.

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Companies' Reports, Dividends, etc.

MACKAY COMPANIES.—A quarterly dividend of 1¾ per cent., less tax, on the common stock is payable on October 1st.

SIR W. G. ARMSTRONG, WHITWORTH AND CO.—An interim dividend on the ordinary shares of 6d. per share, less tax, has been declared.

P. AND W. MACLELLAN.—An interim dividend at the rate of 6 per cent. per annum on the 6 per cent. cumulative preference shares is announced.

MANILA ELECTRIC CORPORATION.—A dividend of 2 per cent. for the quarter ended September 30th on the common capital stock is recommended.

STEWARTS AND LLOYDS.—An interim dividend for the past half-year at the rate of 10 per cent. per annum has been declared on the preferred ordinary shares.

GLOBE TELEGRAPH AND TRUST CO.—Quarterly interim dividends of 3s. per share on the preference shares, less tax, and 5s. per share net on the ordinary shares are recommended.

CANADIAN GENERAL ELECTRIC CO.—A quarterly dividend of 1½ per cent. on the common stock, and a half-yearly dividend of 3½ per cent. on the preference stock of this Company are announced

WESTERN TELEGRAPH CO.—A final dividend of 5s. per share, making 10 per cent. for the year, tax free, is announced. For each of the three preceding years the dividend has been at the same rate.

BRITISH ELECTRIC TRANSFORMER CO.—The directors announce that, owing to trade depression and foreign competition, they are unable, at present, to pay the preference dividend due on September 1st.

DIRECT SPANISH TELEGRAPH CO.—The directors have decided to pay, in addition to the dividend at the rate of 10 per cent. per annum on the preference shares, an interim dividend at the rate of 8 per cent. per annum, tax free, on the ordinary shares, both for the half-year ended June 30th.

BRITISH INSULATED AND HELSBY CABLES.—An interim dividend of 1s. per share, less tax, has been declared, compared with an interim dividend last year of 9d. per share. The final dividend of 6¼ per cent. and bonus of 5 per cent. last year made a total of 15 per cent. the same as in 1920 and 1921.

DUNDEE, BROUGHTY FERRY AND DISTRICT TRAMWAYS COMPANY.—For the year ended July 31st the profit, after payment of income tax on traffic profits and including £240 brought forward, was £5,607. Debenture interest requires £1,183, and a dividend on the ordinary shares of 7 per cent. for the year, less tax, is to be paid, £623 being carried forward.

EASTERN TELEGRAPH COMPANY.—On October 15th this company will pay a dividend at the rate of 3½ per cent. per annum, less tax, on the preference stock for the quarter ending September 30th, and the second quarterly interim dividend of 2½ per cent. on the ordinary stock, tax free, in respect of profits for the year ending December 31st, 1923.

Supply and Lighting.

CITY OF LONDON ELECTRIC LIGHTING CO.—The directors have declared the following dividends: 7·2d. per share, being at the rate of 6 per cent. per annum, on the first preference shares; 9·6d. per share, being at the rate of 8 per cent. per annum, on the 8 per cent. second preference shares, and 1s. per share, being at the rate of 10 per cent. per annum, on the ordinary shares for the half year ended 30th June, 1923. The above dividends will be subject to the deduction of income tax at 4s. 7½d. in the pound, and will be paid on September 29th to all shareholders registered on or before August 29th.

New Companies.

LONGFORD INSULATING CO., LTD.—Private. Cap., £1 500 in £1 shares. Manufacturers of and dealers in wires, cables, electrical accessories, etc. Reg. office: Thynne Street, Warrington.

VALVES AND BULBS, LTD.—Private. Cap., £100 in £1 shares. Electrical engineers and contractors, manufacturers of and dealers in wireless and electrical installations, etc. Reg. office: 94, Hurst Street, Birmingham.

LISSEN, LTD.—Private. Cap., £3 000 in £1 shares. To take over business of manufacturers of and dealers in wireless and other apparatus and accessories carried on by T. N. Cole and G. L. Ward at Woodger Road, Goldhawk Road, Shepherd's Bush, W., and elsewhere, as the "Lissen Co."

POOLE SHEET METAL AND MANUFACTURING CO., LTD.—Private Cap., £1 000 in £1 shares. To adopt agreement with W. J. R. Drewett, and carry on the bus. of sheet metal and radiator manufacturers, mechanical, electrical and radio engineers, etc. Reg. Office: West Quay Road, Poole, Dorset.

W.B.C. LTD.—Private. Cap., £1 000 in £1 shares. To adopt agreement with W. H. A. Terrill and to carry on the business of manufacturers of and dealers in motor accessories and parts, electrical goods, wireless equipment, etc. Reg. office: 1 and 2, Ham Yard, Piccadilly Circus, W.1.

SPRINGFIELD ELECTRIC MOTORS, LTD.—Private. Cap., £10 000 in £1 shares (5 000 7 per cent. cumulative preference). To acquire business carried on by S. Ellis as "Springfield Electric Co.," to carry on business of motor manufacturers and electrical engineers, etc. Reg. office: Ings Mill, Guiseley, Yorks.

Business Items.

The registered address of C. A. VANDERVELL AND CO. has been transferred from Pinner's Hall, Austin Friars, London, E.C.3, to Warple Way, Acton, W.3.

The BRITISH THOMSON-HOUSTON COMPANY has opened a new branch depot at 31, Linenhall Street, Belfast, where a well-equipped showroom and stores have been established. This depot will deal with all business in the north of Ireland.

SIR CHARLES BRIGHT, F.R.S.E., wishes it to be understood that he has withdrawn from the Board of Sir Charles Bright and Partners, Ltd. The Company is at present retaining his name for its title, but Sir Charles himself is no longer associated with its activities, and temporarily his only business address is 25, Victoria Street, Westminster. Telephone No. Victoria 650.

The Kartret Switchgear Co., Ltd., has been formed to carry on the sale of the switch and fuse gear hitherto manufactured by the Kartret Engineering Co., Ltd. The address of the old company, 7, Carteret Street, Westminster, is retained. The apparatus handled by the company includes switches and fuses, ironclad switchgear, distribution boards, switchboards, feeder pillars, power plugs, etc. Mr. V. G. Middleton and Mr. C. J. Baker, both of whom have been closely identified with the Kartret Gear since its inception, are directors of the new company.

The D. P. BATTERY CO.'s works at Bakewell are being extended considerably. The short first charge batteries introduced by the company about two years ago have attracted many new clients. Increased facilities are being provided in the electric vehicle department to deal with the large number of orders now being received for Kathanode vehicle batteries, which the company state have been adopted as standard by various vehicle builders.

Catalogues, Price Lists, &c.

"Steemkleen" is a new trade word for contractors and retailers and others to note. It is an intriguing trade word adopted by a very useful device manufactured by Steemkleen, Ltd. Secure a copy of the descriptive folder, and there will be revealed to you the secret of the "Steemkleen."

The custom of the trade is such that it is very difficult for a fittings manufacturer to publish an illustrated price list which is really different to the lists with which we are all familiar and which have become commonplace. PULLARS ELECTRIC SIGN CO. have succeeded, however, in their new list, which they have just published.

Books Received.

"Lighting Circuits and Switches." By Terrell Croft. (London: McGraw-Hill Publishing Co.) Pp. 472. 15s. net.

"Wireless Receivers of To-day: their Use and Adjustment." (London: E. J. Burrow and Co.) Pp. 144. 1s. net.

"The British Acetylene and Welding Handbook." (London: "The Acetylene and Welding Journal."). Pp. 384. 7s. 6d. net.

"Electrical Measuring Instruments and Supply Meters." By D. J. Bolton. (London: Chapman and Hall.) Pp. xvi+328. 12s. 6d. net.

"Science Abstracts." Sections A. and B. August 25th. Vol. 26. Part 8. Issued by the Institution of Electrical Engineers, London. (London: E. and F. N. Spon.) 3s. per section.

Prices of Metals, Chemicals, etc.

TUESDAY, September 11.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£67 0 0	£1 5 0	—
Electro Wirebars ..	„	£69 15 0	15s.	—
H.C. Wire, basis ..	per lb.	9 15/16 d.	1/16 d.	—
Sheet	„	10 5/16 d.	—	1/16 d.
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 1 15/16 d.	1/16 d.	—
Brass 60/40—				
Rod, basis	„	7½d.	—	—
Sheet, basis	„	10d.	—	—
Wire, basis	„	10½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 3 6	—	4s.
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
Lead Pig—				
English	„	£27 0 0	15s.	—
Foreign or Colonial	„	£25 12 6	10s.	—
Tin—				
Ingot	„	£199 5 0	£4 7 6	—
Wire, basis ..	per lb.	2s. 7½d.	½d.	—
Aluminium Ingots ..	per ton	£120 0 0	—	—
Spelter	„	£33 12 6	12s. 6d.	—
Mercury	per bottle	£8 15 0	—	—

Sulphur (Flowers)—Ton £8 10s. *Sodium Chlorate*—Per lb. 2¾d.
„ (Roll-Brimstone)—„ £8 10s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. „ £25 10s. per ton, £7 10s.
Boric Acid (Crystals). „ £48 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2d.; plantation 1st latex, 1s. 3½d. to 1s. 3¾d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.,

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

BEAUFOY ELECTRIC CO., 675, High Road, Tottenham. £17 6s. 8d. July 25th.

BELDON, G. R. AND CO., 7, Lampton Road, Hounslow, electrical engineers. £12 7s. 1d. June 20th.

BILLINGS, Mr. R. W., 29A, Archway Road, N., electrical engineer. £14 6s. 9d. July 17th.

COHEN, Mark, 36, Old Montague Street, electrical engineer. £14 11s. 1d. June 12th.

PRENDERGAST ELECTRICAL CO., LTD., 12, Lower Seymour Street, Portman Square, W. £17 13s. 6d. July 24th.

STOODLEY, P. W., 60, 61, London Road, Camberley, electrical engineer. £16 7s. July 13th.

WARD, Mr. W., Barclay's Chambers, Hinckley, electrical engineer. £21 10s. 4d. July 17th.

WARD, Walter, and WARD, Harry Payne, 8, Alma Road, Hinckley, electrical engineers. £20 6s. 2d. August 8th.

WHOLESALE ELECTRIC CO. (1922), LTD., 78, Charlotte Street, W., manufacturers. £37 16s. 9d. July 18th.

WIRELESS INSTALLATIONS, 81, Turnmill Street, wireless manufacturers. £10 19s. 4d. July 28th.

Deed of Arrangement.

DAVEY, Horatio Harold, trading as CITY WIRELESS SUPPLIES, 280, City Road, Hulme, Manchester. Filed, September 3rd. Trustee, E. Royce, 22, Cooper Street, Manchester, C.A. Liabilities, unsecured, £725; assets, less secured claims, £599.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

HAYDON (H.) AND CO., LTD., Leicester, electrical engineers.—Registered September 4th, £1 200 debentures; general charge.

HEXHAM AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Registered August 25th, £2 000 debenture, to W. Hall, 9, Prior's Terrace, Tynemouth, electrical engineer; general charge (subject to mortgage and debenture dated February 24th, 1922). *£23 000. June 9th, 1923.

SOUTH WALES POWER CO., LTD. (late TREFOREST ELECTRICAL CONSUMERS CO., LTD.), Cardiff.—Registered August 30th, £750 000 debenture stock and a premium of 3 per cent. secured by Trust Deed dated August 13th, 1923, present issue £600 000; charged on £876 000 prior lien debenture stock of South Wales Electrical Power Distribution Co., also general charge. *£90 000. May 18th, 1923.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Bankruptcy Information

ELLIOTT (J. E.) AND CO., 12, Broad Street, Oxford, electrical engineers. First meeting, September 17th, 12 noon, 1, Saint Aldates, Oxford. Public examination, October 15th, 10.30 a.m., County Hall, Oxford.

Partnerships Dissolved.

IDEAL ELECTRICAL SUPPLIES CO. (Jack LEACH and Harold William SILSON), electrical engineers and contractors, at 11, Russell Street, Keighley, by mutual consent, as from August 11th, 1923. Debts received or paid by H. W. Silson, who will continue the business.

PRESTWICH AND BALL. Vincent Robert PRESTWICH and Ernest BALL, electrical engineers, 79, Long Street, Middleton, by mutual consent as from August 21st, 1923. Debts received and paid by E. Ball.

RADIO INSTALLATIONS (Frederick John CUMMING and Robert John HODGES), wireless installators, 52, Northcote Road, West Croydon, Surrey, by mutual consent as from August 14th, 1923.

THE VICTORIA ELECTRIC PLANT CO. (Norman Elling BREVIG and Horace BLOODWORTH), electrical engineers, 8 and 10, Spenser Street, Westminster, S.W.1, by mutual consent as from August 10th, 1923. Debts received and paid by N. E. Brevig, who will carry on the business.

Edinburgh Gazette.

The Firm of WILLIAM ARNOT, carrying on business as consulting electrical engineers, at 163, Hope Street, Glasgow, has been dissolved as at February 1st, 1923, of mutual consent, by the retiral of Walter M'Lellan Arnot. The business will continue to be carried on by William Arnot.

YOUNG, Frank Broadwood, trading as FRANK BROADWOOD YOUNG AND CO., mechanical and electrical engineers, 45, Queen Street, Edinburgh. In this summary sequestration, W. B. Galbraith, chartered accountant, 87, St. Vincent Street, Glasgow, has been elected trustee; and T. S. W. Smith, 45, Queen Street, Edinburgh, J. Russell, 13, Lilyhill Terrace, Edinburgh, and A. J. Davidson, commissioners. Examination of bankrupt at the Sheriff Court House, George IV. Bridge, Edinburgh, Tuesday, September 18th, at 2 p.m. Creditors' meeting in the trustee's chambers, Wednesday, October 24th, at 3 p.m.

Bankruptcy Proceedings.

BAPTY, Samuel Lee, and MILES, Neville, wireless instrument manufacturers, Avenue Works, Avenue Road, Willesden Junction, N.W. At the first meeting of creditors the Official Receiver said that according to a joint statement of their affairs the debtors estimated their liabilities at £1 152, in addition to which there were preferential claims amounting to £76, while the assets were valued at £1 168, exclusive of bad book debts of the nominal value of £2 000 or thereabouts. About Christmas, 1919, debtor Bapty began business on his own account as a scientific instrument maker and dealer in electrical goods in Crawford Street, W. He secured the patent rights over a blow pipe which he afterwards sold for £5 000, but he had only received £250, his claim in respect of the balance of the sale price being disputed. In June of last year he began business in partnership with the debtor Miles as wireless instrument makers at 132, Northcote Road, Battersea, under a verbal agreement for the profits and losses to be equally divided. The trading proved a success and a few months later the business was removed to Willesden to enable the firm to carry out a contract for the manufacture of wireless goods for the Modern Electrical Supply Co., Ltd. They traded under the style of BAPTY AND MILES, and on the removal of the business to Willesden they registered the trading name of THE WIRELESS INSTRUMENT MANUFACTURING CO. The business was continued with success until the beginning of November last, when the Modern Electrical Supply Co., Ltd., which owed them £722 on bills in respect of goods supplied went into voluntary liquidation. The meeting appointed Mr. E. H. Hawkins, I.A., 4, Charterhouse Square, E.C., as trustee to wind up the estate in bankruptcy.

BRADSHAW, Albert O'Hara, 6, Old Square, Birmingham, general merchant. According to this debtor's statement of affairs liabilities amount to £10 750 against assets estimated to produce £872, a deficiency of £9 878. At the first meeting of creditors the Official Receiver stated that the statement would have to be amended, and he expected the deficiency would be in the neighbourhood of £15 000. After being associated with a company which went into liquidation in November, 1922, debtor commenced business on his own account in December, 1922, dealing in wireless goods, accessories and toys. Debtor stated that in April last a slump took place in wireless goods, at which time he was overstocked and under contract to take goods from one of his creditors to whom he was now indebted for about £7 000. He stated also that he had been compelled to dispose of goods below cost price, in addition to which he had to contend with German competition, goods being sent to this country at a price which was below that for goods he was under contract to buy. The debtor never attempted to ascertain his financial position. It was decided to appoint Mr. C. T. Appleby as trustee of the estate.

STOCKEN, Cyril Walter, and FINK, Conway, trading as THE WYNDHAM RADIO SUPPLIES, 80, Redcliffe Street, Bristol. According to the statement of affairs liabilities amount to £754 and assets are estimated to produce £347, a deficiency of £407. Debtors attribute their failure to insufficient turnover since the commencement of the business, slackness of trade during the summer months, want of capital, and pressure by creditors. In September, 1921, debtor Stocken commenced business without capital at Colas Mews, Birchington Road, Kilburn, as an electric lamp factor, but he did not trade successfully, and in the following December he gave up the business and arranged to pay his creditors by instalments. On March 22nd, 1922, the debtors commenced business in partnership at Bristol as wireless engineers. About a month later they removed to their present address, but neither of them had any capital, and they borrowed £150, which they expended in stock, and a month later they borrowed a further sum of £12 to meet an account. The debtors stated that most of their business is done principally in the winter months, but owing to the delay in establishing British broadcasting, which did not come in force until January last, they have been unable to develop their business. They state that they became aware of their position about a month ago.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

187 198 Soc. INDUSTRIELLE DES PROCEDES W.A. LOTH. Process of and apparatus for electrically steering movable objects at a distance. (12/10 21.)
201 585 E. GREEN. Thermionic generators of high-frequency electric oscillations. (2/3/22.)
201 591 E. Y. ROBINSON. Systems of reception for modulated wave telegraphy and telephony. (28/3/22.)
201 592 H. T. BOOTHROYD. Electro-magnetic friction clutches, specially applicable to reversing-gearing. (28/3/22.)
201 594 N. A. BLOCK and J. W. COWARD. Electric switches for use in motor road vehicles. (1/4/22.)
201 599 L. A. GOMERSALL and J. S. ROSS. Devices for recording telephone calls. (8/7/22.)
201 603 F. E. PERNOT and L. J. RICH. Multiplex telegraphy. (8/4/22.)
201 629 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electric incandescent lamps. (2/5/22.)
201 633 E. SCHRODER. Electric welding or heating machines. (2/5/22.)
201 638 F. P. FLETCHER. Electric lighting fittings. (3/5/22.)
201 641 INDUSTRIAL APPLIANCES and J. E. HAMILTON. Electrically-propelled vehicles. (3/5/22.)
201 662 R. G. CUNLIFFE, R. BROOKS, and METROPOLITAN-VICKERS ELECTRICAL CO. Manually-operated controllers for electric traction and other electric systems or apparatus. (9/5/22.)
201 679 F. ALDENDORFF. Electric relays. (10/5/22.)
201 684 A. H. RAILING, C. C. GARRARD, and W. WILSON. Starting and controlling apparatus for electric motors. (23/5/22.)
201 687 ENGLISH ELECTRIC CO. and R. A. R. BOLTON. Automatic electric circuit breakers. (24/5/22.)
201 703 G. W. HUMPHREY. Means for insulating and protecting electric wire or cable joints. (6/6/22.)
201 713 WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO., INC.). Telephone exchange systems. (23/6/22.)
201 720 A. E. CHAPMAN. Electrical variable condensers. (27/6/22.)
201 724 J. A. CRABTREE. Electric switches. (29/6/22.)
201 725 A. BARNETT. Method and means for obtaining intermittent unidirectional currents of electricity from alternating currents. (29/6/22.)
201 732 T. W. ROSS, C. RYDER, and METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Electric motor converter sub-stations. (7/7/22.)
201 733 BRITISH THOMSON-HOUSTON CO. (INTERNATIONAL GENERAL ELECTRIC CO., INC.). Electrically-heated ovens or the like. (8/7/22.)
182 817 GES. FUR DRAHTLOSE TELEGRAPHIE. Cathodes of electric discharge tubes. (11/7/21.)
186 032 SIEMENS & HALSKE AKT.-GES. Distributing apparatus for alternating electric currents, for use in signal receivers and for other purposes. (13/9/21.)
201 741 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). X-ray apparatus. (14/7/22.)
201 748 W. H. SCOTT and A. WYATT. Device for opening and closing electric circuits or contacts. (18/7/22.)
201 753 E. E. MOORE. Form of detector galvanometer. (21/7/22.)
201 782 R. H. MARRIOTT. Diaphragms, particularly for telephone receivers. (21/8/22.)
201 788 E. JOHNSON. Automatic circuit-breaking device. (25/8/22.
201 789 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Pneumatically operated electric controllers. (26/8/22.)
201 794 F. A. FREETH and L. A. MUNRO. Electric batteries. (2/9/22.)
189 425 WESTERN ELECTRIC CO. Contact-regulating devices. (25/11/21.)
201 802 V. E. SOSTENE. Methods for insulating the coils of static transformers. (20/9/22.)
201 810 C. BRANDES, INC. Apparatus for fixing spool heads on electro-magnet cores. (11/8/22.)
201 816 H. SAVILLE and C. H. THORNTON. Variable condensers for electrical purposes. (14/10/22.)
201 835 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Casings for electrical apparatus. (28/11/22.)
190 153 E. PFIFFNER. High-tension electric transformers. (6/12/21.)
201 841 F. HOPPE. Electric heating-stove. (11/12/22.)
201 845 W. DORNIG. Electrical condensers. (27/12/22.)
201 856 M. J. ARCHER. Electric lamp fittings. (30/1/23.)
201 859 A. C. GREENE. Means or couplings for connecting aerials to radio apparatus or for connecting together other electrical conductors. (7/2/23.)
201 865 B. E. D. KILBURN (NAAMLOOZE VENNOOTSCHAP DE NEDERLANDSCHE THERMO-TELEPHOON MAATSCHAPPIJ). System of long distance telephony. (7/3/23.)
196 591 BRITISH THOMSON-HOUSTON CO. Sealing-in machines for electric lamp bulbs and the like. (24/4/22.)
201 871 R. BROOKS, W. T. GRAY and METROPOLITAN-VICKERS ELECTRICAL CO. Controllers for electric traction and other electric systems of apparatus. (9/5/22.) (Divided Application on 13 082/22.)
201 586 B. GILL. Winding, forming and like operations in making coils for dynamo-electric machinery. (11/5/22.)
201 673 WHITECROSS CO., H. D. LLOYD, and W. W. WILSON. Electrodes for welding and like purposes. (4/2/22.)
201 947 H. HAWKINS, H. J. CHAYTOR, and L. R. LEE. Means for protecting the joints of underground electric cables. (9/2/22.)
201 950 E. L. BURNE. Charging secondary batteries. (16/2/22.)
201 972 F. HOLDEN AND MEASUREMENT, LTD. Prepayment electricity meters. (6/4/22.)
184 774 WESTERN ELECTRIC CO. Long telegraph poles. (16/8/21.)
201 975 W. GEE. Electrical distribution boards. (4/5/22.)
201 978 J. A. CRABTREE. Electric switches. (13/4/22.)
201 984 W. B. SHAW. Jointing of the glass protective covers of electric lamps and other apparatus to their fittings or casings. (1/5/22.)
201 985 H. A. THOMAS. Electrical means for indicating, measuring, and/or recording small movements and vibrations of solid bodies. (1/5/22.)
202 000 E. T. R. MURRAY. Tubular electric lamp fittings. (4/5/22.) (Addition to 173 052.)
202 001 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Methods of making tungsten wires. (4/5/22.)
202 005 SIEMENS BROS. AND CO., E. A. PETITHORY, and J. E. COLLYER. Selecting devices for telephone systems. (5/5/22.)
202 009 A. N. HAWORTH. Shades for application to or use with electric lamps requiring shades. (6/5/22.)
179 930 AUTOMATIC TELEPHONE MANUFACTURING CO. Telephone systems. (14/5/21.)
202 025 J. H. COMPTON. Electrically operated organs. (9/5/22.)
202 027 H. S. POTTER, and M.-L. MAGNETO SYNDICATE, LTD. Electric lamps suitable for use in mines and other places. (10/5/22.) (Cognate Application, 2 805/23.)
202 036 BRITISH ELECTRIC TRANSFORMER CO., and J. ROOTHAAN. Electrical transformers. (11/5/22.)
202 037 F. CRAWFORD. Electrically driven road vehicles. (11/5/22.)
202 047 WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO. INC.). Electric discharge devices. (12/5/22.)
202 048 OILLESS BEARING CO., O. AND S., and R. B. WIGGINS. Checking apparatus for telephone calls. (12/5/22.)
02 051 J. DUGHILL. Movable supports for electric light, gas and other purposes. (13/5/22.)

APPLICATIONS FOR PATENTS.

August 27th.

21 577 A. T. W. GOLDSMITH. Construction of inductance coils.
21 581, 21 582 and 21 583 W. SANTERS AND CO. and W. PRESTON. Electric switches.
21 598 C. W. COOK. Safety switchgear for automobiles, etc.
21 600 J. E. HOUGH, LTD. and F. W. PLEASANCE. Automatic earthing plug and switch.
21 613 H. E. THOMPSON. Plug adaptor for mounting crystals.
21 619 W. H. WILSON. Interrupters for producing high tension discharges.
21 631 G. F. MANSBRIDGE. Variable inductances.
21 643 J. H. THOMPSON. Electric signalling apparatus.
21 647 CLARKE, CHAPMAN AND CO. and R. C. HARRIS. Control of electric motors.
21 648 BRITISH THOMSON-HOUSTON CO. Electrical distributers.
21 653 IGRANIC ELECTRIC CO. and A. H. CURTIS. Variable inductance device for wireless apparatus.
21 667 J. HALL. Machine for stripping cable.
21 674 SOC. INDUSTRIELLE DES TELEPHONES. Cables. (28/4/23, France.)

August 28th.

21 683 H. L. WOOD. Wireless receiving apparatus.
21 685 M. ANTHONY. Wireless telegraph condensers, etc.
21 686 D. E. BARNETT. Terminals for electrical apparatus.
21 687 W. WALKER. Means of fitting head telephones.
21 690 HARRIS AND SHELDON and T. E. SELLERS. Electric horns.
21 691 JACKSON BOILERS, LTD. and H. HARGREAVES. Electric heating apparatus for motor-car radiators, etc.
21 703 G. I. WEBB AND CO. and J. H. BARKER. Electric fuses for detonators.
21 714 H. J. HARVEY. High tension battery fuse plug.
21 724 WAYGOOD-OTIS, LTD. (OTIS ELEVATOR CO.). Rotors for squirrel-cage motors.
21 726 W. E. ELLIOTT. Crystal detectors.
21 727 WESTERN ELECTRIC CO. Electric transmission systems (8/9/22, U.S.)
21 740 BRITISH THOMSON-HOUSTON CO. Engineering circuit for electro-responsive devices.
21 744 METROPOLITAN-VICKERS ELECTRICAL CO. and E. Y. ROBINSON. Motor control systems.
21 745 METROPOLITAN-VICKERS ELECTRICAL CO. and T. W. ROSS. Protective apparatus for electric circuits.
21 747 METROPOLITAN-VICKERS ELECTRICAL CO. Driving mechanism for electric locomotives.
21 746 R. N. CONWELL. Electric relays.
21 751 C. CREMER. Insulated conductor for production of non-inductive cables. (8/12/22, Germany.)
21 752 AKT.-GES. BROWN, BOVERI ET CIE. Dynamo-electric machines. (28/8/22 Germany.)
21 761 T. BADER. Electric melting pots for type casting.

August 29th.

21 798 W. H. MATTHEWS. Connection of electrical apparatus.
21 802 R. M. CHAMNEY and C. ROBINSON. Reduction of echo in telephone lines.
21 809 D. W. DRON and C. W. REDWORTH. Electrical switch.
21 831 RAIL-WELDING CO. (GLAEZEL). Clamps for connecting electric leads to overhead conductors.
21 814 ENGLISH ELECTRIC CO. and F. MORRIS. Circuit breakers.
21 825 GENERAL ELECTRIC CO., LTD. and B. F. POCHOBRADSKY. Steam turbines.
21 834 E. A. GRAHAM. Telephone receivers.
21 835 and 21 837 E. A. GRAHAM. Loud-speaking telephones.
21 836 E. A. GRAHAM. Sound-amplifying horns.
21 838 BRUSH ELECTRICAL ENGINEERING CO. and W. E. HALL. Tramway vehicles.
21 839 MARREC, LTD. and Y. MARREC. Variable self-induction apparatus.
21 840 MARREC, LTD. and Y. MARREC. Conductors for high-frequency currents.
21 841 MARREC, LTD. and Y. MARREC. Reception of constant frequency electro-magnetic waves. (6/9/22, France.)
21 847 SIR C. A. PARSONS. Turbine blading.
21 848 MEASUREMENTS, LTD. and F. HOLDEN. Electricity meters.

August 30th.

21 878 E. REDPATH. Variable inductances.
21 884 W. J. NICHOLAS and P. W. ROBERTS. Electric lighting sets for vehicles.
21 896 BERKELEY AND YOUNG and H. C. E. JACOBY. Governors for electric motors.
21 899 T. C. GIBSON and M. COMPARE. Systems for varying electrical frequencies.
21 900 COMPAGNIE FRANCAISE THOMSON-HOUSTON. Microphones. (30/8/22, France.)
21 903 C. SEYMOUR and H. G. HUGHES. Thermionic valves.
21 910 CHILE EXPLORATION CO. Electrodes. (16/3/23, U.S.)
21 937 AKT.-GES. BROWN, BOVERI ET CIE. Connections for rectifier plants (1/9/22, Germany.)
21 938 AKT.-GES. BROWN, BOVERI ET CIE. Igniting apparatus for mercury vapour rectifier. (7/9/22, Germany.)

August 31st.

21 941 E. S. RAYNER. Tramcar and railway carriage bodies.
21 949 R. REID. Headpiece telephones.
21 960 HARRIS AND SHELDON and T. E. SELLERS. Electric horns.
21 965 R. W. STRAWSON. Transformers.
21 969 W. PRESTON and G. H. WALKER. Electric switches.
21 982 B. HODGSON and C. SEYMOUR. Thermionic valves.
21 985 E. B. HAZLETON. Spark-gap for diathermy high frequency currents.
21 990 J. H. BROWN and E. SCOTT. Electric terminals.
21 998 WESTERN ELECTRIC CO. Switching devices for telephone systems.
22 007, 22 008 and 22 009 METROPOLITAN-VICKERS ELECTRICAL CO. (WESTINGHOUSE ELEC. AND MANUFACTURING CO.) Electric furnaces.
22 012 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.) Cements or pastes for incandescent lamp filaments, etc.
22 024 MORGAN CRUCIBLE CO. and C. W. SPEIRS. Resistances for electric heating.
22 040 A. ENGEL. Carrier device for connector plugs. (31/8/22, Germany.)

September 1st.

22 055 G. W. HUMPHRY. Electric water heaters.
22 063 COVENTRY AUTOMATIC TELEPHONES, LTD. (MCBERBY AND ARTER.) Telephone exchange systems.
22 066 CALLENDER'S CABLE AND CONSTRUCTION CO. Bonding devices.
22 069 G. J. MOULDER. Electric switching devices.
22 073 R. F. COBB. Wireless receiver.

Arrangements for the Week.

FRIDAY, SEPTEMBER 14th, to WEDNESDAY, SEPTEMBER 19th.
BRITISH ASSOCIATION.
Liverpool Meeting.

MONDAY, SEPTEMBER 17th.
INSTITUTION OF THE RUBBER INDUSTRY.
8 *p.m.* At the Kelvin Room of the Engineers' Club, Coventry Street, W. Paper by Mr. Evan J. Edwards on "Rubber Floors and Rubber Roadways."

TUESDAY, SEPTEMBER 18th.
ELECTRICAL SOCIETY OF GLASGOW.
6 *p.m.* Visit to Glasgow Corporation Lighting Department, 20, Trongate.

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THE ELECTRICIAN

VOL. XCI.—No. 2366. FRIDAY, SEPTEMBER 21, 1923. SIXPENCE

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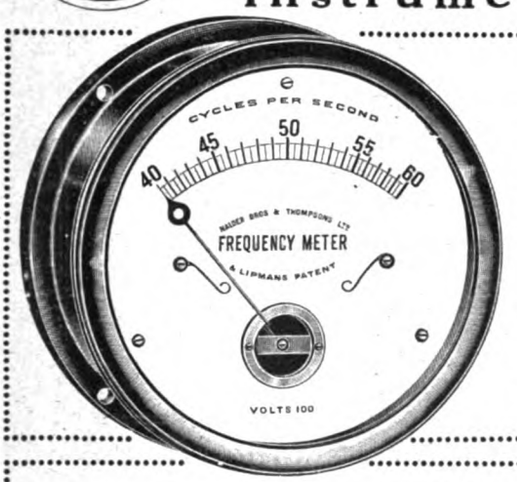

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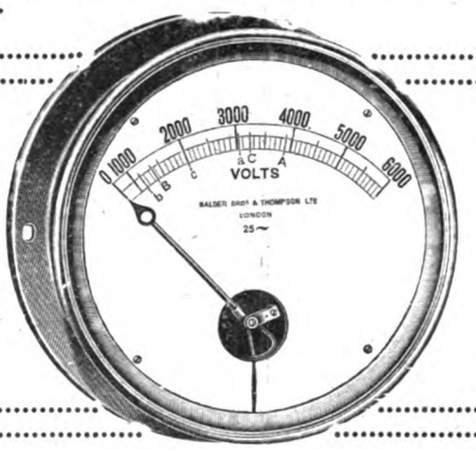

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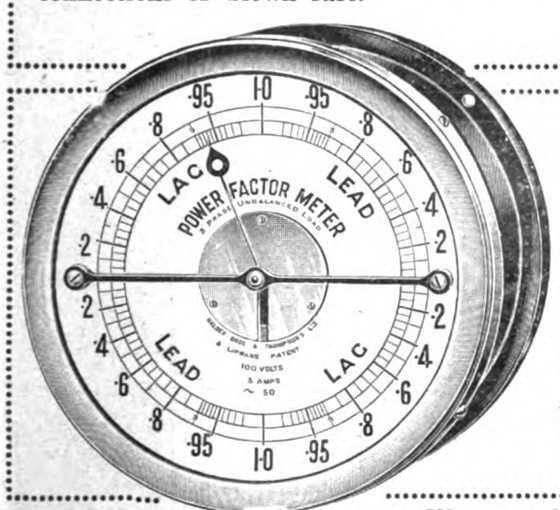

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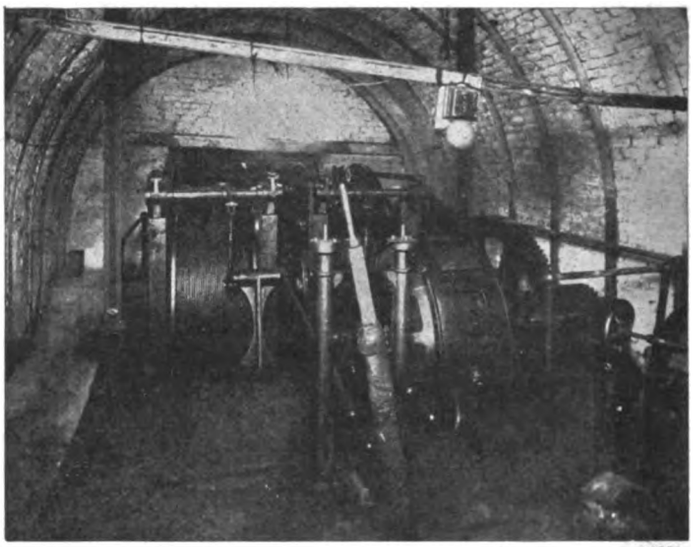

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THE OLDEST WEEKLY ILLUSTRATED JOURNAL OF

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Notes of the Week.

The Electron Theory—A Philosophic Doubt.

On another page of this issue we publish an article by Mr. H. M. Sayers which we think will appeal to a large number of our readers It falls within the category of "what oft was thought, but ne'er so well expressed." For many electrical engineers brought up like Mr. Sayers in the school of Kelvin and Clerk-Maxwell must have felt his difficulty in reconciling what they were taught with the theories of recent investigators. The difficulty is enhanced and argument made harder by the fact that these theories are admirably supported by experimental results. Leaving aside for the moment the metaphysical possibility that there are some things and events which cannot be brought within the scope of physical laws—for in fact knowledge has already overstepped the boundaries of direct sensory perceptions—there still remains the weakness in the electronic idea that it seems inconsistent with other presumptions which have successfully withstood both the test of time and the attacks of experimenters. Principal among these is the electromagnetic theory of light, with certain discrepancies connected with which Mr. Sayers deals in detail.

The Electronic and Electromagnetic Theories.

The electronic theory assumes that an electric current is a procession of discrete particles of negative electricity, each with a definite mass and definite charge. The normal atom is collectively neutral in charge, the forces which control it are electromagnetic and an external electrostatic field will affect it, much as gravitation affects a solar or planetary system. This theory does not fit in with Clerk-Maxwell's theory of light. If the electrons in a perfect dielectric are subjected to an electrostatic field they move in the direction of that field and produce a magnetic field at right angles to the direction of the movement. Conversely a directed magnetic field set up in a perfect dielectric would set up an electric field definite in direction and varying with the variation of the magnetic field. This, Mr. Sayers points out, is a statement of the electromagnetic theory of light consistent with our knowledge of electromagnetic laws. In trying to conciliate the electron theory with this the most serious difficulty is that in the newer idea matter, in the form of electrons and positive charges, is assumed to be present. But if light is a succession of alternating electrostatic and magnetic fields, then what is an electrostatic or a magnetic field in the ether of space if there are no electrons? One possible way of reconciliation is that the ether of space contains a fairly large density of free electrons, and the view that electrons form part of the space content of the solar system is supported by the conditions which cause auroras and magnetic storms. Perhaps it is possible that the differences may be solved in this way, and we should like to have the views of our readers on the subject. Especially should we like to see the mental difficulties which are raised by this and similar thoughtful speculations cleared up. A theory is only useful so long as it is sound. It is for those who have propounded it to prove its soundness under all conditions.

Matter and Radiation.

The problem, though we do not know that it will provide the explanation that Mr. Sayers requires, is approached in another way by Sir Oliver Lodge in the Paper on "Matter and Radiation" which he read last Friday before Section A of the British Association. In this the author speculates on the relation between radiation and matter and the possible generation of electrons by otherwise waste radiation. In the theory of relativity, matter and energy are closely related, and an expression is forthcoming for the absolute energy of a moving body, whereas what has always been hitherto dealt with is the energy of relative

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motion. In the case of an electron the absolute term in the expression for energy exhibits itself to us quantitatively as the energy of its electrostatic charge. Light is also a motion in the ether, and an advancing wave front is known to exhibit some of the properties of matter. It also ejects electrons in a curious way. The problem is to find a method of converting wave energy into stationary vortex motion, which may be the converse operation to that of exciting light or X-rays by accelerating electrons. If all the motion of matter is a modification of circulatory constitutional motion and if we can represent energy as a change of mass, it seems possible to represent all material phenomena as changes in the intrinsical rotational motion of the ether of space.

A Great Technical Achievement—

THE Broadcasting Co. must have been surprised at the reception given in certain quarters to their enterprise in simultaneously broadcasting Sir ERNEST RUTHERFORD'S address from seven centres. Their surprise will be shared by electrical engineers when they know the facts. There is no doubt that the transmission was a great technical success. Sir ERNEST'S voice was picked up by a microphone only 6 in. in diameter, was amplified and transmitted to another hall in Liverpool, where it was reproduced on a loud speaker. It was transmitted by wire to Manchester and reproduced; it was also amplified and transmitted by a telephone line to London, where it was broadcast and retransmitted to Cardiff, Newcastle, Birmingham and Glasgow, in which cities it was also broadcast. The result was that owners of even the cheapest sets were able to hear the address distinctly, and the Broadcasting Co. thought it was well worth while sacrificing a part of the ordinary programme to obtain so interesting a result. We are glad to learn that letters received by the company are 55 to 1 in favour of big events of this kind being simultaneously transmitted in future.

—And Some Ill-founded Criticism.

BUT as opposition is always more noisy and attracts more attention than agreement, it is worth while to give a paragraph to the other side of the case. The complaint of the critics is that they did not understand what on earth Sir ERNEST was talking about. We gather that this lack of understanding is the fault of the Broadcasting Co. and of the speaker in that order; and that this fearful *faux pas* will only be forgiven on the distinct understanding that nothing of the sort is ever done again. "Song and dance" stuff are to be the only fare; and anything "high-brow" is to be absolutely eschewed. At first the Broadcasting Co. seemed inclined to bow to the storm, but later we are glad to see they adopted a firmer attitude. This change was partly caused by the chorus of congratulation we have noted above and partly, we hope, by the realisation of the rightness of their case. It would be the greatest pity if broadcasting should be degraded, as the cinematograph has been, solely to the purposes of entertainment. Up to now the programmes have held the balance well between the instructive and the non-instructive. We hope they will continue to do so and even to increase the proportion of the former. The criticism of Sir ERNEST RUTHERFORD'S address is particularly ill-judged. Without his work and that of other scientists broadcasting would have never been possible. Moreover, it is surely something that a whole country should be able to listen simultaneously to the words of one man. For those reasons, if for no other, the grumblers should remain silent.

The Physical Chemistry of Interfaces.

IN the course of his Presidential Address, "The Physical Chemistry of Interfaces," before Section B (Chemistry) of the British Association, Prof F. G. DONNAN pointed out that in the case of an air-water surface a potential difference existed in the surface layer, and that certain substances could produce variations, or even reversals in sign, of this electrical double layer. It was, therefore, a matter of great interest to inquire whether similar phenomena occurred at the the interface between two immiscible liquids, and, if so, to ascertain whether such electrical charges have any relation to the stability of pure emulsions or fine dispersion of one liquid in another. Experiments had brought out the fact that when the interfacial potential difference was above a certain value, about 0·03 V, the rate of coagulation of the oil drops was very small, but increased rapidly when the potential difference fell within the zone −0·03 to +0·03 V. When the potential difference was outside this zone the emulsion was comparatively stable, and very small concentrations of electrolytes would increase this stability. As soon as the concentration of any electrolyte was sufficient to bring the potential difference into the central zone the stability of the emulsion underwent a sudden and marked decrease, and coagulation occurred. These studies of oil emulsions had thrown a great deal of light on many previously ill-understood points in the theory of colloids.

Season Tickets—A New Idea.

THE controversy over season-ticket rates is given a new turn by an article contributed by Mr. G. H. SNOW to the "Railway Gazette." He suggests that while it is economically impossible for the railway companies to accede to demands for largely reduced rates and fares, a gross annual revenue of £110 000 000 could be obtained from passenger train traffic by offering season-tickets entitling the holder to travel on any railway between any points and at any time at a price of £35 first class and £20 third class. He estimates that 3 000 000 persons purchased season-tickets in 1922, or 200 per cent. of those who would take advantage of this arrangement and bring in a revenue of £75 000 000. He also estimates that the remaining revenue from passengers and parcels traffic should produce £35 000 000, and that the number of season-ticket holders could be increased from 1 000 000 to 3 000 000 without extra expense. This is all very well, and we have no doubt that such an arrangement would be welcomed not only by those to whom travelling is part of their business, but by those whose season tickets for comparatively short distances cost about the proposed annual rates. But we cannot help thinking that the railway companies will not give it so hearty a welcome. A large proportion of the present passenger revenue is derived not from holiday-makers and casual travellers, but from those who travel regularly. These would be the people who would unanimously take advantage of the new rates and a loss in revenue would result. The traders' tickets now issued are more limited in scope than Mr. SNOW'S passes; yet the charges for them are considerably higher. Moreover, it is not certain that anything like the number of people suggested would take advantage of the new arrangement, while of those who did, most would come from that class of passenger who already spend more on travelling than the rates proposed. We therefore do not think the idea, interesting as it is, will catch on at present.

An Electric Water Flow Meter.

AN addition to the numerous instruments which are now being used in the boilerhouse that has the distinction of being electrical is described in a recent issue of the "Schweizerische Bauzeitung." It consists of a water flow meter, which is practically a small dynamo provided with a propeller which is driven by the flowing water. The instrument is torpedo shape and consists of two portions which fit into one another. It is sufficiently strong to bear immersion to considerable depths. The front of the torpedo carries a two-bladed propeller outside, and inside a shaft which runs on roller bearings immersed in oil. The permanent field magnetos are in the other portion of the armature, being simply a coil. At the highest probable water speed of over 4 m. per sec. the power generated would

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not amount to more than a few hundredths of a watt at a potential of 0·75 V. The instrument is said to be very little influenced by temperature changes, and will work equally well in open and closed systems. It has the advantage over the usual type of instruments that it indicates the instantaneous and not the average flow.

The Transport Problem.

That something is very wrong with the state of our transport organisations no one can fail to realise who passes through our streets or travels on our railways or listens to what is said at conferences or reads the papers and articles which are written from time to time. On the railways the service provided, whether freight or passenger, is in no sense better than it was in 1914, and in many ways it is a good deal worse. Commodities which are urgently required still spend a wondrous long time on their way, and often arrive in a more or less battered condition. Complaints of overcrowding are rife, especially on suburban lines, where anything seems to be good enough for the season ticket holder, even an increase in fares. The lighting of the carriages is not seldom poor, and hygienic conditions leave much to be desired. The streets of our large towns, especially of London, become more and more congested with vehicles of all kinds, and the control imposed by the police only makes an inextricable tangle rather worse. To journey from Waterloo to Paddington in the middle of the day by taxicab requires the patience of Job and a purse almost as bottomless as that of Crœsus. The motor omnibuses become ever more gargantuan and more difficult to board and alight from, yet they are generally uncomfortably crowded. The same congestion is not unknown on the various tramway systems, yet their financial conditions and the disabilities under which they suffer is the theme of constant complaint. On the country roads safety is sacrificed to speed, and they are fast becoming unusable by anything other than a mechanically propelled vehicle. Only the aeroplane seems immune from the common censure, and that is at present so little used that it can hardly be looked upon as a solution of the problem. It is therefore well that the Presidential Address to Section G of the British Association and the rest of the proceedings on Friday morning last were devoted to the question of transport in its various aspects. We hope that the points of view then illuminated will do something —we do not say to solve the problem, but to postpone the inevitable day of breakdown.

The Transport that Aids Civilisation.

A large part of Sir HENRY FOWLER'S address, which we give in abstract elsewhere in this issue, was devoted to history. Problems of transportation, he said, have been solved more or less successfully in all ages. We hope history will quickly repeat itself. But he rightly added that the transportation which aids civilisation is that which cuts down wastage of power to a minimum and reduces the time occupied in carrying this out. We suppose before long the transport problem will be considered by yet another Royal Commission or similar body. This sentence might well be included in their terms of reference. He also pointed out that under modern conditions some form of mechanical propulsion is necessary and that electric traction, the only obstacle to whose extension is financial, has rendered existence in our large towns possible and given millions of workers a wider outlook on life and the opportunity of living amongst healthier and more pleasant surroundings. The development of the internal combustion engine has made aerial transport possible and largely increased the scope of the motor car. All this has been mainly brought about by researches which have increased our knowledge of the nature of the steels and other materials employed and of the methods used in converting them from raw material into the finished article. A great deal of scientific information is available to-day and the dissemination and utilisation of this knowledge should be helped in every possible way, especially by transport companies making their performance figures public.

Diffidence and Optimism.

Four detailed Papers on the same large subject were subsequently read by Mr. A. E. BERRIMAN, Col. H. E. O'BRIEN, Maj.-General Sir SEFTON BRANCKER and Mr. A. T. WALL. They dealt with road, railway, air and sea transport respectively, and between them gave a concise account of the present position in these branches. But the authors were all a little diffident about the future or about how the present chaos is to be solved. There was a great deal of optimism about what has been done but a distinct shirking about what has to be done—a much more important and difficult question. The result is, we feel sure, that if some perfectly unbiassed person were to read these Papers and then patrol our streets and railways to compare conditions with those existing twenty years ago, he might be forgiven for coming to the conclusion that matters are much worse now than they were then. The fact is that the same competition that used to exist between the gun and the means of defence against it is taking place in the transport world. The means of locomotion—the vehicles—have been improved, but the roads or railways by which they have to be borne have not seen an equal development, so that neither can we make a full use of the means of transport at our disposal nor will improvement in those means of themselves make matters any better. In other words if the railways and roads can carry no more vehicles, to increase the efficiency of those vehicles, especially their speed, is to make the problem more difficult eventually, if not at once, rather than to solve it.

Electrification—Its Real Benefits.

We do not say that this is not altogether realised, but it is not put in the forefront as it should be. The directors of the South Eastern and Chatham Railway decided to electrify their suburban lines, not to save money but to do away with congestion—in other words, to improve the load factor of their tracks. The result of that conversion will not only be to their financial benefit because it will draw people away from other means of transport, but it will lighten, for the time being, the traffic carried by the roads in the districts served. We should have thought this was axiomatic, yet we find Col. O'BRIEN dealing with the subject from the narrow standpoint that the cost of electric power delivered for use in locomotives is practically as great as coal delivered for the same purpose, and giving it as his opinion that though there is a *great future* (the italics are ours) for electric traction for suburban traffic, the steam locomotive will persist for years to come. The fact is that the present is the time for electric traction, and the inertness of the railway companies to realise this and their disregard of the just demands of the travelling public for better facilities are fast bringing the times when they will be forced to take action. Financial stringency will not be accepted as an excuse. They will either have to provide a better service or take the consequences.

New Method of Attack Necessary.

It may be argued that electrification of itself will not relieve congestion, and the London Underground Railways will be quoted as an example. But here again our thesis really holds good. These railways were not designed to cater for modern traffic requirements. They require extension laterally, better inter-connection and through running facilities and better means of exit and egress. More railways are also required until the ideal is reached when only the shortest of journeys is made above ground. The principle of underground conveyance must also be applied to goods transport or alternatively the points of inter-connection of our trunk lines must be increased. The right way to tackle the traffic problem is by fresh means which research and experience have put into our hands, not to continue to tinker with worn-out methods.

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Electrons and Ether.

By HENRY M. SAYERS.

In this article Mr. Sayers considers recent developments in electrical theory from the point of view of an engineer brought up in the school of Kelvin and Clerk Maxwell. These developments are not only puzzling, but seem a throwback to the days before Faraday. Doubt is not thrown on the electronic theory, which is supported by experiment, but certain mental difficulties, which its teachers do not seem to recognise, are discussed. These arise when an attempt is made to deal with the electromagnetic theory of light by new methods with which it hardly fits. In it it is assumed that matter is absent; yet as electrons are present, the theory is made more difficult instead of more intelligible. A possible way of reconciliation is mentioned and some other interesting speculations are outlined.

What Is It?

The electrical engineer who has in the course of his avocation designed, constructed, handled and used, batteries, dynamos, motors, transformers, measuring instruments, telegraphs and telephones, wired and wireless, overhead and underground lines, any or all of these, without speculating upon and trying to form a mental concept of the ultimate nature and mechanism of the agents involved, ought to be a rare specimen.

Necessarily the men who have done these things, excepting those who have just done what they were told in mere mechanical routine, have had some knowledge of "theory" more or less according to their need, opportunities and measure of scientific curiosity. But the theory which has sufficed for practical applications has not, as a rule, reached out to the ultimate nature and mechanism of electric and magnetic forces, and a man may be a thoroughly competent electrical engineer without holding any particular views on these things, and even without knowing the trend of contemporary thought about them.

Those electrical engineers who do feel the push of scientific curiosity, and those who realise their ignorance of the real nature of the agents and forces with which they work, have, during the last few years, had plenty of food for thought, and perhaps some reason for puzzlement from the excursions of physicists and mathematicians into the difficult region of ultimate natures and mechanisms.

Laws of Nature and Reality.

The tacit assumption that all natural phenomena may be classified in sequence of cause and effect—"laws of Nature"—and that these "laws" and the mental concepts to which they attach (or to which they give rise) are a representation of "reality" which underlies scientific curiosity, research, and speculation; may be only a consequence of the form and mechanism of the human mind itself. The apparent necessity for such sequences, and the notion of ultimate form and mechanism of the agents and forces which we regard collectively as the physical universe, may really be qualities or properties of our own minds, just as all our conceptions of the physical universe are necessarily the resultant of our sensuous perceptions and our mental equipment. No man can know that the sensations he experiences from external objects are the same as the sensations experienced by another from the same objects. The sensation which A experiences on looking at a scarlet geranium blossom may be identical with the sensation experienced by B on looking at the green leaves of the plant.

This line of thought leads one into metaphysics, and whoso would pursue it can read Willie James, Hegel, Kant, and many others who have spread themselves over the matter. It is simpler to go on the tacit assumption above set out. It is a working hypothesis which has given results. Some day it may have to be recognised that it is worked out, that the human senses and mental equipment have reached the limit of their powers, that beyond all classification of things and events in the sequential form of "laws" and equations there is that which cannot be reached, comprehended or defined in any such way. It is possible that in some directions we are approaching that boundary of human knowledge. Certainly our "knowledge" has long overstepped the boundary of direct sensory perceptions.

The Puzzled Engineer.

Recent developments of electrical theory are quite definitely puzzling to the electrical engineer who imbibed his theoretical knowledge in the school of Kelvin, Clerk Maxwell, and their contemporaries and followers during the last forty years of the nineteenth century. This may be illustrated by reference to one or two matters.

The electronic theory seems to such engineers at once revolutionary and a throwback to ancient history, ante-dating Faraday even.

We were told that of electricity itself nothing positive could be stated. It was not even possible to say that any such entity existed. An "electric current" was certainly not a movement of anything material. An "electric charge" was certainly not an accumulation of anything which could be called material. An electrostatic field was a state of strain—tension—in a dielectric. It could be set up by a change in the magnetic field. Under the conditions which set up an electrostatic field in a dielectric an electric current would be produced in a conductor. The subject need not be pursued into magnetism and magnetic fields further than to say that it was known and taught that as these had kinetic properties analogous to inertia, magnetism appeared to involve motion.

A Procession of Electrons.

Now we are taught that an electric current is a procession of electrons, that electrons—for this purpose—must be regarded as discrete particles of negative electricity each with a definite mass and definite charge.

So far, the theory appears to be a reversion to the ancient "single fluid" theory of electricity, with differences, of course.

It is not to be disputed that this theory is supported by experimental evidence, nor is it sought to throw doubt on it; only to indicate the mental difficulties which, in connection with other statements and certain phenomena, it raises, and which its teachers hardly appear to recognise. At least they do not specifically mention them, though they admit generally the existence of difficulty.

Whilst the present theory is "single-fluid" in respect to current, the existence of discrete particles of positive electricity is held as proven. It does not appear that separate positive particles have been demonstrated, or that an electric current has ever been shown to be a procession of positive particles. Positive particles or unit charges are parts of the nuclei of atoms. They each have a charge equal to that of an electron, but are of much greater mass. It is irrelevant to the present subject to go further into the presently accepted views of material atoms each built up of a nucleus composed of both positive and negative charges, with the positive predominating, and a "solar system" of electrons in orbits around the nucleus; views, it may be said, deduced from experiment. The relevant fact on this side is that a normal atom is collectively neutral in charge, the orbital electrons just neutralising the preponderating positive charge of the nucleus, that the forces which control the atomic "solar system" are electromagnetic, electrostatic attractions taking the place of gravity, and that an electrostatic field from an external source will affect the atomic system much as gravitation from external bodies may affect a gravitating solar or planetary system.

A Discussion of the Difficulties.

Now for some of the difficulties. They come out very forcibly in trying to apply the electron theory to the electromagnetic theory of light. It can be taken to be well established that a ray of light consists of a succession of electrostatic and magnetic fields which are both transverse to the direction of propagation and at right angles to each other. That is, supposing a ray of light of circular cross section (assuming light of one wave length and completely polarised), at a particular instant there would be an electrostatic field, say, parallel to the horizontal diameter of the circle viewed end on, at a later instant, corresponding to half a wave length an electrostatic field in the same spatial direction but reversed, and at a second equal time interval an electrostatic field in the original direction. Similarly, there would be a magnetic field parallel with the vertical diameter and reversing at the same time intervals as the electrostatic field.

This view of light, suggested by Clerk Maxwell, experimentally proved by Hertz and others, fell into line with the known principles of electromagnetic action, on what one may briefly term the Kelvin ideas. But it does not so easily fit the electronic theory.

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Magnetic and Electric Fields.

Taking things known on an engineering scale, the establishment of a magnetic field in any direction sets up an electromotive force at right angles to that direction whilst the magnetic field is increasing, and an opposite electromotive force in the same spatial direction whilst it is decreasing, but no such force whilst the magnetic field is unchanged. This electromotive force produces a current if the medium is a conductor, if the medium is a dielectric it produces an electrostatic field in it. On the electronic theory one may imagine a conductor as a medium in which there are electrons under no elastic restraint, they are free to move in any direction, but encounter something akin to frictional resistance to their motion. This frictional resistance consumes energy, manifests itself as Joulean heat, and is in fact what we recognise as the specific resistance of the material.

In a perfect dielectric, on the other hand, the electrons are under elastic restraint. Subjected to an electrostatic field they move in the direction of the field—towards the positive—stretching their elastic bonds until the elasticity balances the force of the field. When the field is restored they spring back. Now this movement of electrons in a dielectric is just as much an electric current as a corresponding movement of electrons in a conductor, and as such it produces a magnetic field at right angles to the direction of electron movement. In an ideal or perfect dielectric there is no frictional resistance to this movement or displacement current, and no evolution of heat. (The case in which the imposed electrostatic field overcomes the elastic restraint acting on the electrons, producing a breakdown and making the dielectric for the time a conductor is outside present consideration.)

Fields in the Ether.

Now we cannot experiment on the ether; the highest vacuum we can produce has enormous numbers of gas atoms in it, and these may vitiate any results obtained, but it is assumed on good grounds that the ether is a perfect dielectric in the sense that there is no frictional resistance to either electrostatic or magnetic field changes.

On the Kelvin and Clerk Maxwell view, the electromagnetic theory of light seems consistent with our experience.

Imagine a directed magnetic field set up in a perfect dielectric then we would reason, there will be an electrostatic field set up in its neighbourhood whilst it is growing, perpendicular in spatial direction to the magnetic field, and quantitatively related to its rate of change—not, be it noted, to its intensity. Thus if the magnetic field is reversed at regular intervals, and if its variation with time is harmonic—in other words, if the field density in relation to time follows a sine law—then the resultant perpendicular electrostatic field will also follow a sine law in relation to time, but it will be in quadrature phase. That is, the electrostatic field will have its greatest value when the magnetic field has its zero value, because then the latter is changing most rapidly, and will have zero value when the magnetic field has its maximum value, because at the top of the crest the time rate of change is zero. Reciprocally, the displacement currents represented by the changing electrostatic field set up in the surrounding medium a magnetic field perpendicular to the electrostatic, and similarly in quadrature phase relation. This seemed to be a statement of the electromagnetic theory of light consistent with our knowledge of electromagnetic laws on the molar scale. It does not involve any particular theory of the mechanism of the action or the nature of electricity. We find that in the material mediums on which we can experiment this sequence follows. We assume that the same sequence—the same "laws"—will hold good in the ether, a dielectric perfectly elastic to electromagnetic disturbances or impulses.

An Energy Difficulty.

It is true that there is a little difficulty now in this application of our knowledge, for we are assured that in a beam of light (or of wireless waves), the electrostatic and magnetic fields are in phase, with simultaneous maxima and minima, and that seems inconsistent with our experiences in material dielectrics. Our experience is that when current and voltage are in phase, there is either a source or a sink of energy involved, and it is not easy to see how this can be the case in a perfectly elastic electromagnetic medium.

But there is another difficulty of a more serious character arising out of the electronic theory. This theory does involve a part of the mechanism of electromagnetic induction, and something about the nature of electricity. A current is a procession of electrons, definite unit charges of negative electricity. An electric charge is an excess or a defect of electrons in the charged body. As electric charge appears to be always relative and duplex, one may say that an electric charge always involves at least two regions, one with an excess and the other with a defect of electrons. Excess and defect in this connection means that one body has more electrons than its positive nuclei can neutralise, and the reciprocal body has fewer electrons than its positive nuclei can neutralise. An electrostatic field means, on this theory, an interval between at least two bodies with such a difference in their relative densities of negative and positive unit charges, across which there is a force, electrostatic attraction, such that any electrons in the space will be impelled towards the positively charged (electrons defective) body and away from the negatively charged (electrons excessive) body, and any positive charges will be impelled in the opposite direction. Any dielectric in this space or interval will have its constituent electrons and positive nuclei pulled in opposite directions. Any conductor in the space will have its free electrons congregated towards the positively charged body.

How does this fit in with the electromagnetic theory of light? That light is propagated through the ether one may take for granted. It is assumed that matter is absent, i.e., that electrons and positive charges are absent. Light is a succession of alternating electrostatic and magnetic fields. Take first the electrostatic field. So far as we know by experiment an electrostatic field is determined by an excess of electrons on one hand and a defect on the other. What is an electrostatic field in the ether of space if there are no electrons?

Similarly for a magnetic field. A magnetic field is set up by a current, either a procession in a conductor or an elastic displacement in a dielectric. How is it set up in the ether of space, if again there are no electrons there?

Hence it seems that in purporting to supply a part of the mechanism of electromagnetics the electronic theory has actually made the electromagnetic theory of light more difficult instead of more intelligible.

Guesses.

One possible way of reconciliation is that the ether of space contains—or perhaps is constituted by—a fairly large density of free electrons. The suggestion is rather daring because, although the mass of an electron is very small, $\frac{1}{1800}$ of a hydrogen atom it is computed, the aggregate mass of the electrons in say the space occupied by the solar system would be a pretty big quantity, and the gravitational effect might not be insignificant. Presumably it would operate as if at the centre of gravity of the system, not far from that of the sun, and might not, therefore, produce any astronomical perturbations.

Some Entertaining Speculations.

There are some other entertaining speculations. Would such a medium oppose measurable frictional resistance to planetary motions—if it would that negatives the hypothesis—would the electrons gravitate to the sun and planets and form electron atmospheres around them, or would radiation effects offset the gravitation? The writer did not set out to frame a new theory or hypothesis, and is certainly not competent to support this one by computation. But he may remark that there is considerable evidence that streams of electrons emitted or repelled by the sun cause our auroras and magnetic storms, so there is some reason to accept electrons as part of the space content of the solar system.

Having gone so far, the writer would like to air another suggestion. He is bound to admit that he cannot see far enough into four dimensional geometry to see all its implications, nor has he the imagination to form a mental concept of the consequences.

Suppose that in light propagation, the magnetic vector lies not in any spatial dimension, but in the time dimension? It would in that case be perpendicular to the electric vector, whatever spatial direction that might occupy, and to the direction of propagation—which is a spatial direction. It seems as though quite an entrancing set of four dimensional equations and consequences could be worked out on such an hypothesis, but the writer is not the man to work them or to understand them if someone else does so. He would ask, however, if this would help the apparent difficulty of reconciling the phase relationship of the electric and magnetic vectors of a light wave front with ordinary electromagnetic theory.

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Transport and its Indebtedness to Science.*

By SIR HENRY FOWLER, K.B.E.

Problems of transportation have been solved more or less successfully in all ages. Such works as the moving of the stones to Stonehenge, and the larger ones of the East, excite wonder and admiration; but they could be accomplished by quite crude methods if unlimited labour was available and time of no consequence. The transportation which aids civilisation is that which cuts down wastage of power to a minimum and reduces the time occupied in carrying this out.

Transport is mainly dependent on three things—method of propulsion, material available for use, and the path over which traction takes place. Advance in transport only really became rapid when methods of propulsion other than those of animals and the force of the wind became available. The greatest step was the development of the steam engine—like other great achievements, the result of efforts by many individuals. The first attempt to apply it to traction, by Jonathan Halls in 1736–7, failed from lack of knowledge. James Watt, though not directly associated with traction, was largely responsible for its development. It was Richard Trevithick, with his steam carriage in 1801 and 1803, and his ill-fated railway in 1804, who first showed that practical application of the steam engine to traction could be made. Stephenson doubtless learned much from his associates and was essentially a scientific man. It is often thought that because men of that age had not a scientific education they were not "men of science." But it was then possible much more easily to obtain all the information on a subject than in the present date, when knowledge is so much more varied and extensive.

Progress from the Time of Stephenson.

From the time of Stephenson progress in propulsion on rails by steam locomotives has been steady, if slow. The greatest advance has come to steam locomotives by the use of superheated steam—no new thing, for Papin in 1705 seemed to have an appreciation of its value. As pressures and the resultant temperatures increased there came difficulties (ultimately overcome) with lubrication.

Although the utilisation of steam for giving rotary motion is old, its commercial adaptation in the turbine is modern. Rarely, if ever, has there been such a direct and instantaneous application of science to practice. The work done by De Laval, Curtis, Rateau, and the brothers Ljungstrom is realised, but the name which will always be associated with the steam turbine, as firmly as that of James Watt is with the inception of the steam engine, is that of Sir Charles A. Parsons. Apart from its application to marine work, the turbine has made possible the economical production of electrical energy, which is doing so much, and will do so much more in the future, for rail transport. To-day there are no real mechanical or electrical difficulties in the electrification of railways, the only difficulties being financial ones. It is impossible here to trace the development of electrical science from the experiments described by Gilbert in 1600 to the equipment of electric locomotives on the railways of Switzerland and the United States of America, a gradual but a continuous and ordered increase of knowledge of natural phenomena.

Development of the Internal-Combustion Engine.

The last method of propulsion is that by means of the internal-combustion engine. This is the result of the cycle adopted by N. A. Otto in his gas engine in 1876. The advance has been more rapid than in the case of the steam engine and electrical machinery because of the more advanced state of scientific knowledge, and it furnishes an example of the assistance which this gives to progress. In relation to transport the work has proceeded on two distinct lines, the Daimler and the Diesel engines. The development of the Daimler engine has itself proceeded in two directions. It has been made more flexible and silent in its adaptation to motor-car work, and has rendered possible the aeroplane as we have it to-day. The Diesel engine was invented in 1894 by Rudolph Diesel, and consists of the injection of oil or pulverised fuel into the engine cylinder. Although considerable progress has been made with land engines, it has chiefly been used for marine transport. The internal-combustion engine has not been largely used for rail transport owing to its comparatively high cost of fuel per horse-power and lack of flexibility.

Transport by Sea, Road and Air.

It was only natural that the work of Watt on land should be followed by application of the new power to propulsion on the water. Saving of fuel has played a much more important part here than with the locomotive. The great advance came with the turbine, and it is interesting to notice that whereas in early days engines were geared up, most of them are now geared down to the screw. The application of liquid fuel and the introduction of Diesel engines, both with the object of increasing the space available for cargo, have been carried out on true scientific lines.

The commercial inception of transport by road came at a time when scientific knowledge was well advanced, and its progress was in consequence more rapid. The development of the aeroplane has been even more rapid than that of the motor-car. It was not until the development of the internal-combustion engine that the matter became a really practical one. Step by step investigations have led towards the perfecting of this type of transport. In all cases the developments have followed careful scientific research. Amongst our fellow-countrymen the work of Rolls, Godden, Cody, Busk, Keith-Lucas, Hopkinson, Pinsent and others has unfortunately been terminated by their deaths in the cause to which they were devoting their lives. In no other field has scientific work demanded so great a toll. This must be so when one is dealing with transport in such a medium as air. There is no greater instance of the indebtedness of transport to science than the rapidity with which the possibilities of transport by air have advanced. That the realities have not advanced at the same rate is due to financial reasons. In this instance, owing to the demands of war, we have the knowledge before we are financially able to use it to the greatest advantage.

The Problem of Material.

Early builders of steam engines were not only troubled through inability to get their engines machined properly, but also with the difficulties of obtaining suitable material for the parts they required. Steel has been known for thousands of years, but its rapid and economic production is of very recent growth. Every great metallurgical discovery has led to a rapid advance in other directions. Of this the railway is a conspicuous example. There have been few more epoch-making announcements made at meetings of technical subjects than S. G. Thomas's announcement of the discovery of the "basic" process, which he made at the meeting of the Iron and Steel Institute in March, 1878. His work, associated with that of his cousin, Gilchrist, was the result of close scientific research. Another investigation which has given great results in transport has been the ever growing use of alloy steels. For the scientific inception of these we owe a great debt to Sir Robert Hadfield, whose inventive genius and scientific mind are still active in that field he has made so particularly his own. His first investigations materially affect transport to-day. In 1882 Hadfield had produced manganese steel, remarkable for its great toughness, and extensively used for railway and tramway crossings. In 1889 he produced the compound of iron and silicon known as low hysteresis steel. From these early uses of alloy steels there has grown up a large number of various alloys, many of which are of the very greatest use for various transport purposes. It is not too much to say that the modern aeroplane is the result of material now at the designers' disposal both for the engine and for the structure itself. Research has been equally beneficial in the case of light alloy with aluminium as a base.

A War Accumulation and Its Uses.

A very large amount of scientific information available to-day was accumulated during the war. The dissemination and utilisation of this knowledge should be helped in every possible way, in particular by a freer disclosure of results obtained in practical working. One of the troubles often encountered by manufacturers who are applying some new method is the difficulty of getting dependable figures of performance. With transport companies this should not be a difficult matter, for they have no trade necessity to hide their results in any way.

* Abstract of the Presidential Address delivered to Section G (Engineering) of the British Association.

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The Future of Railway Transportation.*

By Col. H. E. O'BRIEN, D.S.O.

The most radical innovation in rail transport in recent years has been the application of electric power to transportation. The principal developments of its use have been for suburban services and main lines with heavy gradients—and there is still a large field for the further extensive application of electricity to suburban traction. A double-track suburban railway if electrified can provide a service of 30 trains of eight cars each per hour, equivalent to 15 000 passengers per hour or 30 000 passengers in the two rush hours inwards or outwards. This means that such a route can serve a suburban population of about 200 000, and that a reduction in time of transit from suburb to business centre of about 25 per cent. can be effected economically. At present, but four of the large towns in this country have a portion of the suburban services worked electrically. The cost of operation of these faster and more frequent electrically-operated services is but slightly higher per train mile, allowing for interest and depreciation on the outlay involved, than that of the slower and less frequent steam services. The profit per passenger carried, therefore, remains constant, but as in nearly every case the carrying capacity of the line electrified has been doubled and the increased capacity has been absorbed by the increase in passenger traffic, it is clear that such electrifications have been profitable to both railway companies and public alike. A slight lowering of rates of interest and in the price of the material required for such electrifications is likely to produce a considerable development in future.

No Engineering Difficulties.

There are no engineering difficulties to be overcome, while the only technical point at issue is the most suitable voltage for the third rail; natural development has standardised 600 to 650 V in the London area, but if the recommendations of the Departmental Committee of the Ministry of Transport are followed 1 500 V will be used in future round other cities.

The 1 500 V under-contact third rail as now developed is likely to prove perfectly safe and satisfactory, and will permit of the future use of either 3 000 V overhead collection or 1 500 V third rail collection for main-line work where required in future.

Future of Main Line Electrification.

It is of interest to consider whether there is any future for main-line electrification in this country. The average thermal efficiency of the steam locomotives in Great Britain probably is not in excess of 2 per cent.; tests of modern steam locomotives in first-class condition with the best coal under conditions of maximum efficiency do not reveal an average thermal efficiency of more than 4 per cent. on the basis of the actual coal burned between terminals, and exclusive of coal used for lighting up, shunting, etc. The greater horse-power of an electric locomotive will enable a much higher speed on up-gradients to be maintained with heavier trains. The thermal efficiencies of large modern power stations working at 40 per cent. to 50 per cent. load factor may be expected in the near future to be as high as 20 per cent.; allowing for 84 per cent. for the efficiency of transmission and conversion, 90 per cent. for the rail and 75 per cent. for the electric and mechanical efficiency of the locomotive, equivalent to 56·6 per cent. overall, the total thermal efficiency from coal pile to drawbar for the electric locomotive is about 11 per cent. A general electrification of an average section of busy main line might therefore be expected to diminish the coal consumption by at least two-thirds.

Effect of Coal Costs.

The cost of coal for generating current, however, is roughly only one-third of the total cost of current delivered to the locomotive, so that as a matter of finance, as coal prices now stand, coal on the tender and equivalent current at the collecting shoe of the locomotive will be about equal in price after covering all capital charges on the electrical equipment. But other economies apart from advantages will, however, be obtained as the result of electrification, and there is no doubt that the electrification of any main line containing gradients of 1 in 300 or greater and averaging over two trains per hour in each direction would at least involve no loss of any kind to the company undertaking it, while the indirect advantages to both the railway company concerned and the electrical industry of the country would be very large. Where the traffic was denser and the grades heavier than mentioned above a handsome return on the capital expenditure might be expected.

The Financial Question.

On the assumption that a saving of one-third of the cost of locomotive operation would be effected by electrification the total saving in the cost of operation would be 11 per cent. Owing, however, to the enormous capital expenditure which would be involved in the electrification of the many branch lines with sparse traffic the economy effected would not be anything like 11 per cent. If a general electrification became possible due to some invention reducing the capital cost involved, and particularly if the cost of construction of the electric locomotive could be reduced, no doubt the result would re-act favourably on the public, but for the time being only special sections will be worth electrifying from the railway companies' point of view.

DISCUSSION.

In the course of the discussion on the above Paper and other Papers on transport questions, Prof. T. HUDSON BEARE said there was undoubtedly a great field for improvement in the railway services of this country at the present time. We were suffering cruelly from unemployment, and it would be a wise step if the railway companies were to undertake some great improvements immediately. That was emphasised also in connection with road transport.

* Abstract of a Paper read before Section G (Engineering) of the British Association.

Conservation and Control of Water Resources.

In a Paper on "Conservation and Control of Water Resources," read before Section G (Engineering) of the British Association, Mr. JOSEPH PARRY pointed out that in the various recommendations which have been made with regard to needed reforms in water administration, stress has been laid on two points, a survey and control.

The urgent need of a comprehensive survey is shown by the rapid manner in which the best upland sources are being taken possession of by the great industrial centres, by the alternative schemes so often set up before Private Bill Committees, also by the projects now being brought forward for power schemes which involve the construction of catchment reservoirs. To carry out a complete survey is undoubtedly a big task. It should include not only engineering facts as to areas and levels but also geological facts as to suitability of sites for reservoirs, rainfall returns, chemical and medical reports on quality, particulars of population affected and character of soil in the several areas, actual yield and use of any areas already appropriated, also suitability of direct river supplies at low levels by pumping. These are matters of fact to be ascertained by qualified experts and should be published for the public benefit.

Need for a Royal Commission.

The determination of a national policy to be adopted and of new legislative provisions required need not be postponed until the whole of these facts have been recorded. To find a comprehensive foundation for such a policy a Royal Commission would be the best preparation. For the ascertainment of facts a Government department may suffice, but for laying down principles on which legislation affecting the whole country is to be founded a higher authority is required. Such a Royal Commission, with its public sittings, would attract the attention of the country and would elicit the views of public authorities and professional men interested, thus providing an adequate foundation for recommendations to Parliament.

Prominent among the subjects calling for consideration by a Royal Commission are: (*a*) The quality of water to be distributed for domestic purposes in the light of recent investigations, notably those of Sir Alexander Houston; (*b*) the amounts and method of delivery of compensation water to rivers; (*c*) the rights of rivers and fishing boards to exact penalties for failures to deliver prescribed quantities of compensation; (*d*) the desirability of substituting filtered river water as compensation instead of water from unpolluted sources (as in a recent Sheffield case); (*e*) an amendment of the law as to flowing surface water; (*f*) amendment of the law as to underground supplies.

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Triple Frequency Currents in Earth Return Circuits.*

By Prof. E. W. MARCHANT, D.Sc.

It is often found in large central stations that a current flows through the earth return lead to the neutral of the three-phase generators. It is well known that when the neutrals of a number of three-phase machines are connected together, large circulating currents will flow through the neutral connections of the machines. This phenomenon was described in some detail in a paper published by Mr. Catterson Smith and the author in THE ELECTRICIAN.† It is now common practice to earth only one neutral in a generating station, but recently it has been observed that even when this is done there may still be a comparatively large current flowing through the neutral. One or two cases of this kind have come to the

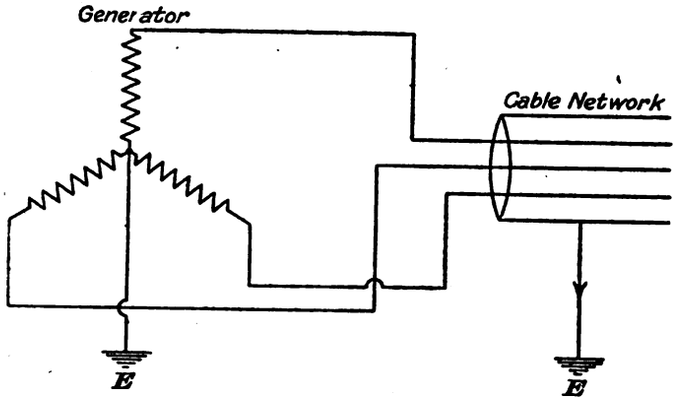

FIG. 1.

author's notice, and it may be of interest to describe the results of the observations and tests that have been made and to explain the phenomenon. In one case of a large system, a current of nearly 40 A was observed when the neutral of a machine, recently installed, was earthed. It was further noticed that the amount of this current depended on the size of the cable network that was connected to the station—i.e., when part of the cable network was disconnected the current flowing was reduced. It was surmised at first that the current was due to leakage, but an examination of the wave shape of the neutral current showed that it was a capacity current flowing through the cable. Most of the high-tension transmission

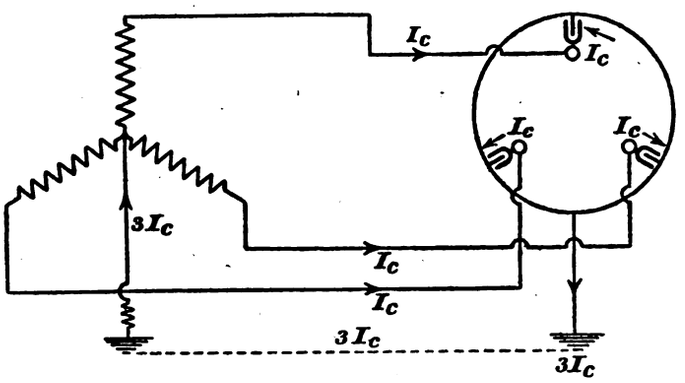

FIG. 2.

systems that have been laid in this country consist of three core cables with the sheaths earthed. A diagrammatic representation of such a network is shown in Fig. 1.

Genesis of Capacity Currents.

The capacity currents flowing through the cables in the system due to the three-phase pressure applied give no resultant current through the sheath, or whatever conductor is used as a neutral. But if there is a triple frequency component in the wave of pressure between phase and neutral, a triple frequency capacity current will flow, and the three currents in the three phases will produce a resultant triple frequency current through the earth return. This current will flow as shown in Fig. 2. The three currents will flow to earth from the sheath of the cables, and if the neutral of the generators is earthed the current will return through the earthing resistance. Examples of the currents observed through the earthing resistance are given in Figs. 3 and 4.

It will be noticed that the current flowing has a complex wave shape, a relatively strong 15 times frequency

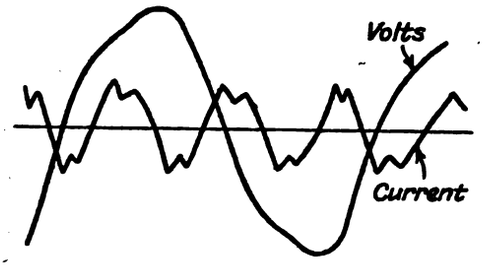

FIG. 3.

component being present—see Figs. 3 and 4 This current is due to a tooth ripple in the wave shape of the alternator, and is not usually very large. The magnitude of the triple frequency current flowing is not greatly affected by the value of the earthing resistance, since the reactance due to the capacity of the cables is usually high. For a network of 60 miles of high-tension cable, the effective reactance will be about 50 Ω for triple frequency current at 150 cycles per second, and an earthing resistance of, say, 4 or 5 Ω will not reduce the earth current appreciably. For the higher frequency currents the capacity reactance is correspondingly decreased. For currents of 15 times the fundamental frequency the capacity reactance in the above system will be only 10 Ω, and is, therefore, more comparable with the values of earth resistance ordinarily used. The increase in the higher frequency harmonics produced by short circuiting the earthing resistance is shown in Fig. 4. If the neutral of the alternator is not

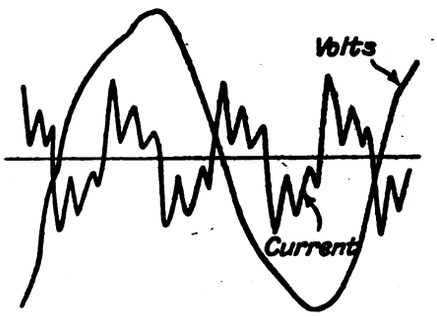

FIG. 4.

earthed there is clearly no return circuit for these currents and the voltage of the neutral of the alternators will have a triple frequency pressure measured to earth equal to the triple frequency component of the pressure wave. In this case no triple frequency currents will flow to earth through the cable sheath as the pressure difference between the cable cores and the earthed sheath will have no triple frequency component. This condition, however, does not usually exist in practice.

These earth currents do not do much harm as far as the central station itself is concerned, and it is therefore, as a rule, not necessary to get rid of them, except in special cases. When it becomes necessary to reduce them, either the alternators must be rebuilt so as to give no triple frequency components of e.m.f. in their phase pressures, or else some device similar to that described in the paper read by Mr. Turney and the author before this section must be used. I am indebted to Messrs. Crompton, Ramsay and Young for assistance in taking oscillograph records and for analysing the curves.

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* Abstract of a Paper read before Section G of the British Association.

† THE ELECTRICIAN, vol. lxiii, p. 674, August, 1909.

Some special features in a NEW ELECTRIC LAMP for microscopic work are noted in the "Engineer." An obscured electric lamp is used, but is so arranged that there is no interference with the image by a projected granular luminous surface. The size of the luminous source can be adjusted by shutters, and there is a special holder permitting the use of colour-filters of any size.

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The Conversion from Alternating to Direct Current by Means of Mercury Arc Rectifiers.*

By R. L. MORRISON.

The lighting consumer and the tramway services in this country are usually supplied on the direct current system, and recent decisions in connection with main line electrification schemes are also in favour of this form of supply. For economic reasons generation and distribution to converting sub-stations at high pressures requires the use of alternating current.

Conversion from alternating to direct current has up to quite recently been effected by means of rotating converters of one form or another, all of which possess the inherent disadvantages of rotating machinery. After many difficulties have been overcome this position has been changed by the development, by Brown, Boveri and Co., of the high power mercury arc rectifier. The difficulties had reference to physical phenomena about which very little was known, and with continued experience we can look forward with complete confidence to the production at no distant date of stationary plant for conversion from alternating to direct current equal in reliability to the static transformer.

Advantages of Rectifier.

For high tension direct current electrification the rectifier is ideal because of the ease with which the pressures employed can be handled, while the overall efficiency is higher than that obtained by any other known type of converter, and its low maintenance and attendance charges are other great advantages.

The mercury arc rectifier is the outcome of the discovery of Mr. Cooper-Hewitt that the mercury arc when operating in high vacua had the property of permitting the passage of a current in one direction only. This rectifying effect is not the peculiar property of mercury, but is due to the arrangement of two electrodes, one of which (the cathode) is raised to a high temperature of about 3 000 deg. C., the other being maintained at a temperature (400 deg. C. to 600 deg. C.) below that at which the formation of electrons is possible.

As the arc only deals with the positive half of the alternating wave, a step-down transformer with a divided secondary is used so that both half waves are completely utilised. Reactance is inserted in the rectified circuit to prolong the wave and to prevent it dropping to zero, and by making this reactance large enough it is possible to reduce undulations in the rectified wave so that even a single phase primary supply can be satisfactorily converted and commercially used. The connection in general use, however, is six-phase, because this gives a straight line wave and simplifies the design of the rectifier and transformer.

Glass bulb rectifiers can be manufactured to deal with outputs of up to 50 kW, and where larger outputs are required the units can be multiplied.

High Vacua Essential.

For successful operation high vacua is essential, the normal range being 0·01 mm. of mercury. In the high power arc rectifier the first problem was the production of large steel cylinders which would be accessible and gastight, and the mercury seal was finally adopted as giving the best results. It consists of mercury and asbestos for the hotter portions, and mercury and rubber for the cooler parts.

"Back-firing" was for a long time the one really serious difficulty. This is primarily due to one of the iron electrodes becoming hot enough to start electronic emission, so causing the valve effect to cease. This trouble has now been practically overcome by the use of more suitable anode material, though it may be pointed out that serious harm is rarely done by an internal short circuit.

In the latest design of Brown-Boveri rectifier, so far as a rectifier proper and vacuum pump are concerned, it is essential that the material used shall be the best procurable. Extremely fine limits are worked to, and the whole assembly is a piece of work requiring the very highest class of workmanship.

Auxiliary Equipment.

In its present state of development the arc rectifier requires certain auxiliaries, of which the most important is the vacuum pump set, which consists of a high vacuum mercury pump in series with a rotary oil immersed pump. Other apparatus required is the McLeod's type of vacuum gauge and the ignition converter which provides an independent source of current to start the arc. This consists of a 0·5 kW motor generator, which is only run for a few seconds when required.

The simplest combination of rectifying apparatus has a shunt characteristic, and for all ordinary purposes its regulation is close enough, though where level or over-compounding is necessary the desired result can be obtained by the use of an induction regulator whose pressure is automatically controlled.

The rectifier can be given any desired overload capacity depending on the continouus current rate which is taken for any particular cylinder, while its capacity to deal with very high momentary overloads make it pre-eminently suitable for traction purposes. Its efficiency remains practically constant at all loads, and for d.c. pressure of 500 V may be taken as about 95 per cent. At 1 500 V this is increased to 98·4 per cent. A number of test results on rectifiers installed at Berne and on the Midi Railway were given in support of these figures. The latter installation has a capacity of 1 200 kW at 1 575 V and a difference in the losses in the rectifiers and in rotary converters for the same work is represented by 237 000 kW per annum, which, capitalised, amounts to a large sum.

The floor space usually occupied by rectifier plant is comparable with that required for rotary converters for d.c. pressures up to about 600 V, but where higher pressures are concerned it is less. No foundations are required in the ordinary way, and the plant, being stationary, has all the advantages accruing from such a condition. Replacements are only occasionally necessary, and in the matter of attendance the rectifier scores heavily and, as has been done at Birmingham, can easily be adapted for automatic control.

Present Position.

The number of plants equipped with rectifiers up to the end of June, 1923, is 192, comprising 396 cylinders with an aggregate capacity of 104 500 kW.

Among the chief installations working in this country are one 1 400 kW at Glasgow, two of 900 kW at St. Pancras, two of 415 kW at Battersea, while there are others at Birmingham, Liverpool, Wolverhampton, Hertford and St. Albans. The London, Midland and Scottish Railway have recently ordered two 500 kW sets to operate at 2 300 V d.c., and these will be the first high tension rectifiers to be installed in this country.

In the future it will probably be to such plant as these that we shall look for the solution of our conversion problems. Though rotating machinery used for the same purpose has been brought to a very high state of perfection, it is admitted by those concerned that something simpler is desirable and something which will materially reduce attendance and maintenance charges. This need can only be fulfilled by a stationary plant, and it can without hesitation be said that we have the solution in the high power mercury arc rectifier.

* Abstract of a Paper read before Section G of the British Association.

Automatic Re-closing Circuit Breakers.

Experience in American Steelworks.

Three automatic re-closing circuit breakers have been in service for three years at a sub-station of a steel company in Pennsylvania without requiring any repair expense. During this period, states the "Engineer," the only trouble has been a slight corrosion on the contacts of the re-closing solenoid, which was very easily remedied. These 250 V breakers are installed in a motor generator sub-station and provide protection to various feeder circuits. Two of the breakers, rated at 5 000 A, are used on a generator circuit and a feeder circuit belonging to a 400 ft. double trolley gantry crane in the coal storage plant. The other breaker, having a capacity of 2 000 A, is placed on a feeder circuit belonging to another part of the plant. The switch duty has not been severe, since under the worst conditions the breakers have not opened more than three to four times a week.

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Electricity Supply at Aylesbury.

Complete Test Figures for New Turbo-Alternator.

Aylesbury, like Peterborough, is an example of a place where electricity supply is going ahead. Supply was only started in 1915 from two 100 kW Diesel oil engines, but this plant soon had to be augmented by a 200 kW suction gas engine which was set to work in 1918. By the time it was in operation, however, the demand was such that the station was fully loaded, and although the Armistice removed the demand for energy from the munitions factories this was more

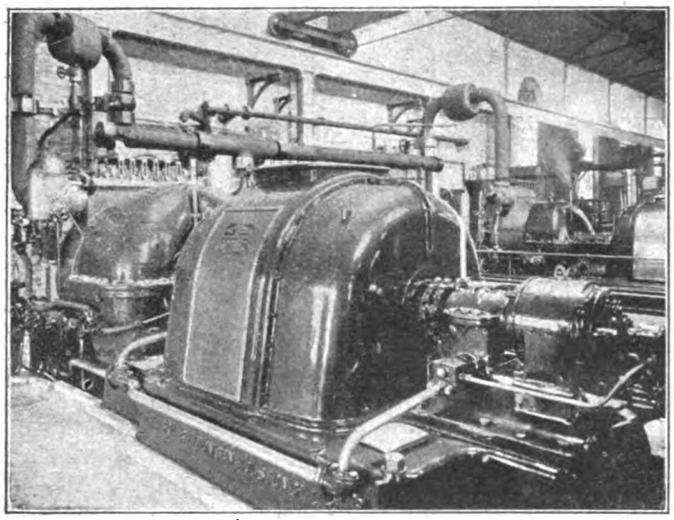

FIG. 1.—VIEW OF NEW 1 500 KW TURBO-ALTERNATOR AT AYLESBURY.

than compensated for by Cubitt's Engineering Co., who required 600 kW, or more than the capacity of the station at the time. A 1 000 kW turbo-alternator, with the necessary converting plant for supplying the direct current network, was therefore started in August, 1920. This, however, is not the end of the story. A further large consumer was secured in Hazell, Watson and Viney, and this led up to the purchase of a 1 500 kW turbo-alternator, which was formally inaugurated

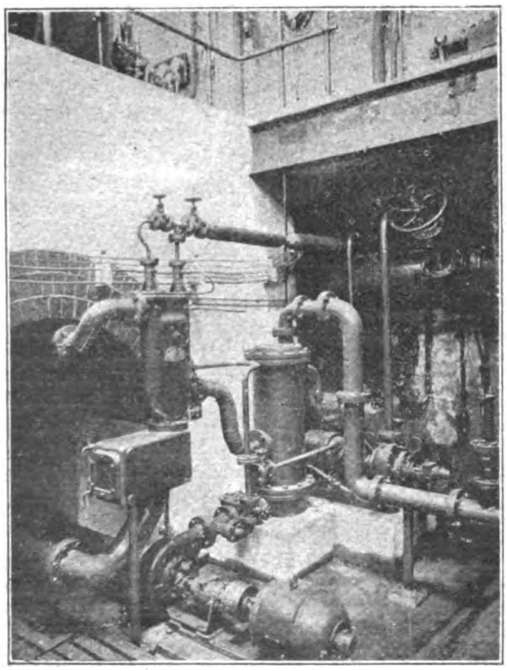

FIG. 2.—VIEW OF THE AIR EXTRACTOR, SHOWING NEW TYPE OF SEALING VALVE.

on September 11th. The progress thus summarised is of a kind on which Ald. James Robinson, the chairman of the Electricity Committee, and Mr. W. A. Turnbull, borough electrical engineer, can heartily be congratulated. But as Aylesbury is in a very interesting position electro-geographically, we shall not be surprised to learn before long of developments which will put even those we have recounted in the shade.

Technical Details of New Plant.

Striking as the commercial development has been, we propose to refer more particularly in this article to certain technical details in the new plant, and especially to the very complete test on the turbo-alternator which has been conducted by Mr. W. M. Selvey. Statistics, we all know, are unreliable, and the same adjective may be justly applied to many a string of test figures. The Aylesbury figures, however, fall into another category, and indicate not only that the makers have successfully fulfilled their promises, but that they have succeeded in producing an efficient machine of comparatively small output. This is a fact of importance; for there is going to be a large demand for sets of this output for a long time to come; and improvements in their design and manufacture are matters to which it is worth while to pay attention.

The turbo-alternator, which we illustrate in Fig. 1, was made by the British Thomson-Houston Co. It has an output of 1 500 kW at 6 600 V with a frequency of 50 when running at 3 000 revs. per min. It is of the Curtis impulse type, the steam passing through one compound impulse stage and six single stages.

The condensing plant, which was manufactured by Cole, Marchant and Morley, is of the surface type, with a cooling surface of 2 200 sq. ft., and is capable of dealing with 18 300 lb. of steam per hour. The capacity of the circulating water

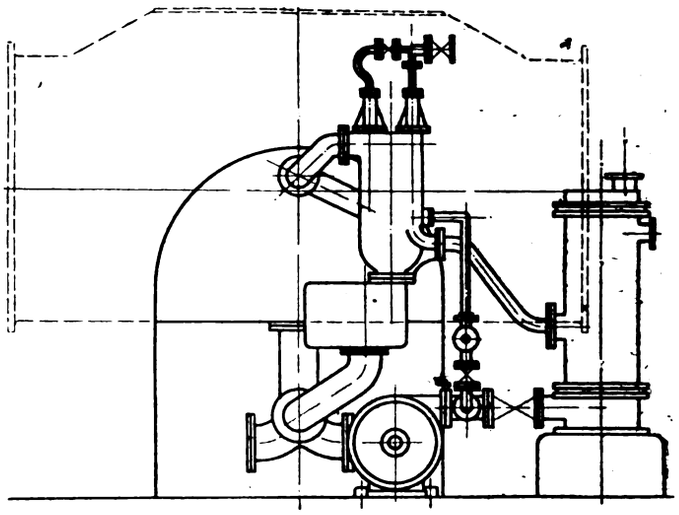

FIG. 3.—DIAGRAM OF AIR EXTRACTOR.

pump is 114 000 galls. per hour. Vacuum is produced by a "Delas" air extractor of a new pattern with a patent vacuum sealing valve bolted in position. This is shown in Fig. 2.

The New Air Extractor.

Fig. 3 shows the arrangement of the air extractor, which is of the intermediate condenser type, in relation to the patent vacuum sealing float valve (contained in the box immediately below the extractor). This valve is necessary to compensate for the difference in vacuum between the main condenser and the intermediate condenser jets. It takes the place of the usual "U" tube, and therefore dispenses with a considerable length of piping. The extraction pump and feed water heater and the inter-connecting pipework are also visible in the illustration. It will be noted that the cooling water for the extractors is taken from the condensate pump discharge, two valves in the pipe line allowing an independent supply to be used when starting up.

Fig. 4 illustrates the air extractor in section, and shows not only the arrangement of the primary and secondary nozzles, but the cooling water system. The connection between the chambers round the secondary and primary diffusers is formed by a pocket cast on the outside of the extractor casing. After the water has passed through these two chambers it is used by the intermediate jet condenser to condense the steam from the primary nozzle, and from here falls into the float box containing the patent vacuum sealing valve, and from there to condensate suction.

Float Box.

The sealing device (Fig. 5) consists of a float box, which is fitted to the intermediate steam jet air extractor. No U tube is required, and thus the expense of this is

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eliminated, the float box being obviously a very much cheaper article.

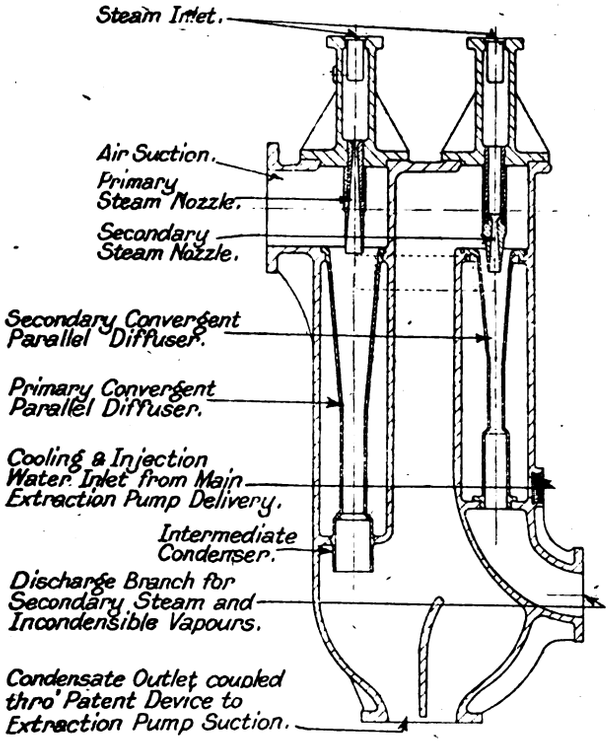


FIG. 4. SECTION OF THE AIR EXTRACTOR.

The water seal in the float box is kept quite steady, and another advantage is that the heat in the steam used by the primary jet can be recovered. This heat is almost entirely lost with most other types of jet, as it is taken back to the condenser through the U tube and cooled down over the surface of the condenser. Including radiation losses, etc., it is estimated that in the hot-well tank 85 per cent. of the heat value in the steam used by the steam jets is recovered, whether of the intermediate condenser type or the straight through type without intermediate condenser, providing the former is used with a surface plant. If the former is used with a jet plant this amount of steam cannot be recovered, but with a jet plant 85 per cent. of the steam used in the jet where an air extractor without intermediate condenser is used can be recovered.

The Official Tests in Full.

Turning now to the tests on this plant conducted by Mr. W. M. Selvey. These were made to see how the plant complied with the terms of specification, and the results are given in the accompanying table. The specified steam conditions for which the guarantees on the turbine were given, and to which test results obtained were corrected, were :—Steam pressure at stop valve, 195 lb. per sq. in. gauge ; superheat, 264 deg. F. ; vacuum, 28·5 in. Hg. (with barometer equal to 30 in. Hg.). Under the specified steam conditions the makers guaranteed that the turbo-alternator would give the following steam consumption results :—

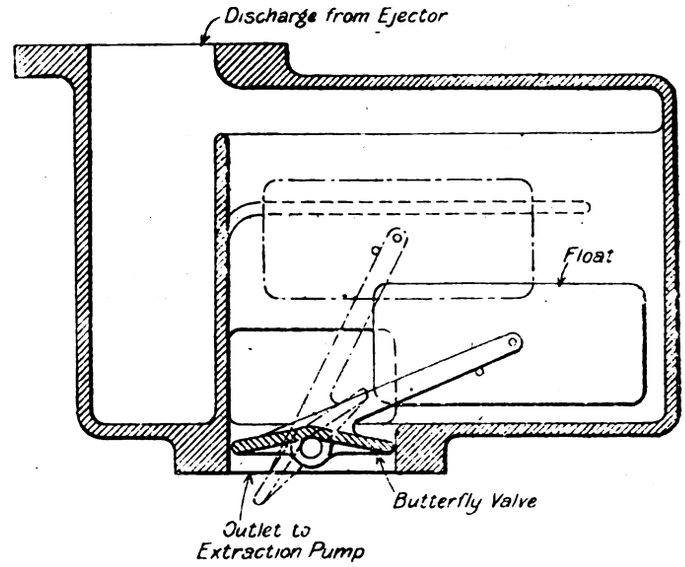
Load.	kW	Steam Consumption. lb. per kWh.
5/4	1 875 ..	11·9
Full	1 500 ..	11·96
3/4	1 125 ..	12·43
2/4	750 ..	13·375

Summary of Test Results.

Particulars.	Load. ½	¾	1/1	5/4
Actual output, kW	805	1 159	1 512	1 877
CONDITIONS—				
Steam pressure (G) lb. per sq. in.	191·1	190·5	189·6	185·3
Superheat, deg. F... ..	275·2	281·3	295·6	283·4
Vacuum (T.F.) (30 in. bar) in. Hg.	27·90	27·70	28·05	27·34
STEAM CONSUMPTION—				
Total steam per hr., lb. ..	11 290	15 295	18 444	23 864
Steam, lb. per kWh ..	14·02	13·20	12·20	12·71

SUMMARY OF TEST RESULTS (*continued*).

Particulars.	Load. ½	¾	1/1	5/4
CORRECTIONS TO STANDARD CONDITIONS, 195 lb./ 261·4 deg., sup./28·5 in.—				
Total correction factor multiplied by..	0·9619	0·9517	0·9854	0·9266
Corrected steam consumption, lb. per kWh ..	13·49	12·56	12·02	11·78
Guaranteed consumption ..	13·375	12·43	11·96	11·90
EFFICIENCY (AS RUN) excluding Auxiliaries—				
Turbine (S.V.), per cent. ..	68·02	70·49	72·82	73·05
Alternator, per cent. ..	89·0	92·05	93·53	94·4
Overall, per cent.	60·54	64·88	68·10	68·96
Steam condensed, lb. per hr.	11 290	15 295	18 444	23 864
Surface, sq. ft.	2 200	2 200	2 200	2 200
AVERAGE TEMPERATURES—				
Inlet water, deg. F. ..	89·43	88·68	78·69	84·59
Outlet water, deg. F. ..	98·89	101·43	94·14	104·80
Rise, deg. F.	9·46	12·75	15·45	20·21



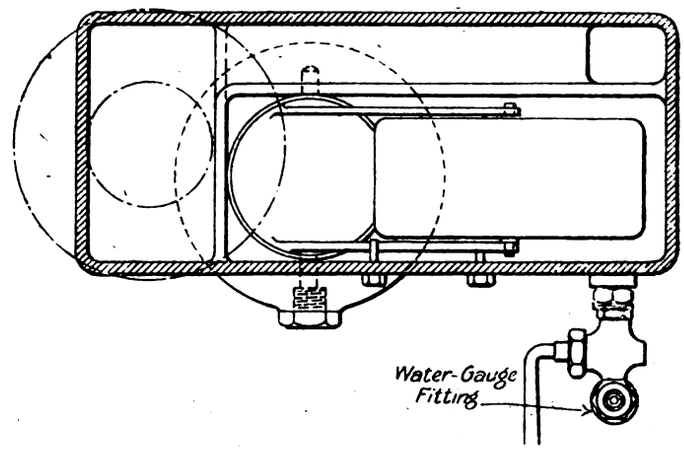


FIG. 5. VIEW OF THE SEALING FLOAT BOX.

Temperature of exhaust steam, deg. F.	102·04	105·5	99·33	109·95
Temperature of vacuum absolute, in Hg. ..	2·056	2·278	1·896	2·608
Temperature of vacuum (30 in. bar), in. Hg. ..	27·94	27·72	28·10	27·39
Condensate temperature, deg. F.	102·3	105·2	98·1	105·8
Quantity of water, gall. per hr.	119 740	119 820	118 980	117 840
HEAT TRANSMISSION CO-EFFICIENT—				
K. (logarithmic) B.Th.U's extracted per sq. ft. per 1 deg. F. per hr, ..	754	772	746	854
GUARANTEE (K)—				
Water at 60 deg. F., 114 000 gall. per hr., 28·5 in. vacuum, 18 300 lb. of steam per hr.	—	—	378	—

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Test Conditions.

We understand that these tests were carried out with the fullest possible precautions to ensure the accuracy such as we are accustomed to associate with tests carried out by Mr. Selvey. The contractors and the sub-contractors cordially co-operated in the provision of elaborate testing apparatus. In addition to this the Corporation staff, under the direction of Mr. Turnbull, constructed a very interesting form of water resistance (Figs. 6 and 7) from particulars supplied by Mr. Selvey.

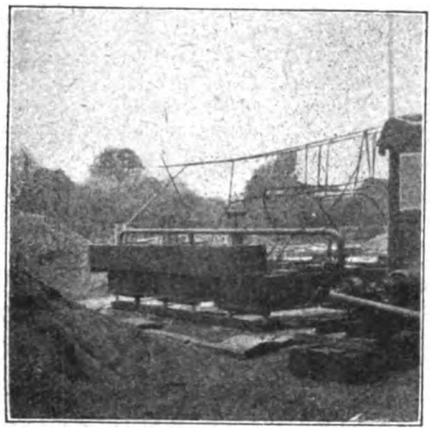

FIG. 6.—VIEW OF SPECIAL WATER RESISTANCE.

While running the test a spare turbine was kept just floating on the bars and the whole of the service load was taken up by the turbine under test. Such balance of load as was necessary to make up the required amount was furnished by the water resistance, which was capable of very delicate and easy regulation. The water resistance was connected through a spare feeder panel and was fully protected. The load was not only thus capable of fine adjustment, but proved to be susceptible of great steadiness. We may therefore take it that these figures are reliable.

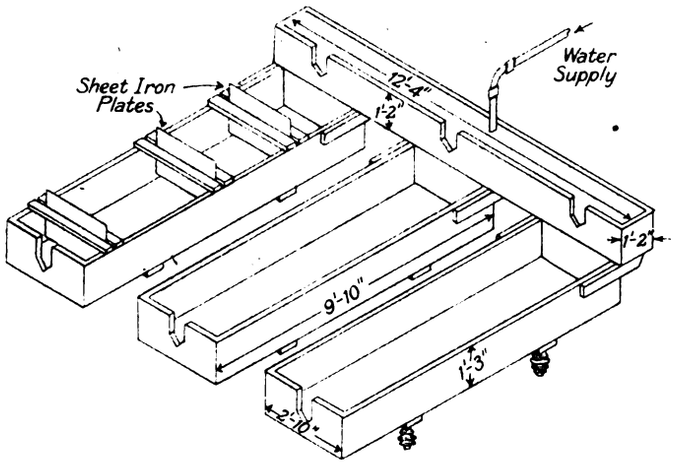

FIG. 7.—DIAGRAM OF THE WATER RESISTANCE.

Some Comments.

The interest in this test lies in the fact that when the order was placed there was some very close tendering, and it is satisfactory to note that the actual results are extremely close to the tendered figures. Although such efficiencies as are contained in these results have been heard of before, we do not recollect ever seeing any published test where such figures have been obtained. No doubt we shall hear that equal results have been obtained elsewhere, but if so we shall have served a useful purpose in forcing the publication of information which has previously been withheld. We have heard of rumours of similar results with regard to heat transmission in the condenser, but with regard to authentic published results there is a singular absence of such figures. We are not referring, of course, to results which have been obtained with poor vacua as were formerly used in reciprocating engines, but to modern turbine condensers.

Results were given in a recent publication relating to a condenser installed by Mr. Yeaman at Stoke giving a figure of 600. We believe it to be correct that some of the figures obtained at Gennevilliers approach 700. The results on the small condenser at Aylesbury are even still better, and it would appear that even to-day the final word has not yet been said in condenser engineering, even in spite of the enormous advance that has been made since the days when an Edwards' air pump was commonly used. It is a most interesting reflection to consider how, in the wake, so to speak, of large plant, small plant has steadily crept up in efficiency, a point the importance of which we stress above.

The Water Resistance.

The use of water resistances for testing turbo-alternators gives rise to a number of well-known difficulties, such as boiling and irregularity in the load, which have been overcome in the resistance used at Aylesbury. It consists, as shown in the illustrations, of an inlet tank, which is fitted with adjustable V notches for regulating the flow of water into the three "load" tanks. The latter are each with a central electrode connected to one of the three-phases and two earth electrodes which are connected together and to a common earth. Adjustable V notches are provided at the outlet of each load tank. Before starting, the flow is adjusted by the "V" notches, so that a convenient depth of water is kept in the tanks, and thereafter can be regulated in accordance with the load conditions. We understand that the arrangement works most satisfactorily, and, as will be seen, it is compact and can be adjusted without approaching to any live parts.

We have to thank Mr. W. M. Selvey and Mr. W. A. Turnbull for permission to publish these interesting tests and the correlated information.

Review.

Steam Turbine Theory and Practice. By WILLIAM J. KEARTON. (London: Sir Isaac Pitman and Sons.) Pp. xvi. + 456. 15s. net.

The author of this new work on turbines states that it is written primarily for the student. We think this is too modest a description, and no student could well be expected to absorb anything like all the matter presented unless he were to devote a whole course to this subject alone. In fact one begins to realise with a little regret that the now very extensive literature on this subject, when so largely drawn on as in the present case, is beginning to give an air of complication, and even heaviness to the subject. The author has made himself well acquainted with most of this literature, and on the whole the volume has rather an "engineering" than "scholastic" tone. Occasionally an engineer reading this work would be a little inclined to discuss and deprecate certain rather dogmatic views laid down.

On the academic side we hardly see the value of introducing the new term "Enthalpy." The distinction between the total Heat "H" and that function which adds to this value the heat equivalent of the work done in pumping the feed water into the boiler, has been carefully dealt with by Callendar ("Properties of Steam," p. 29), who, however, did not think it necessary to invent a new name for it. We have been unable to follow Article 33, giving a theorem relating to expansion. The chapters on nozzles and blading give much information.

An interesting statement by the author is that "it is very difficult to obtain reliable test results, since their publication is a rare event, but the circles (i.e., in a given curve) indicate one or two results for large Parsons' turbines." We seem to have heard something like this before in the discussion on Mr. Baumann's recent paper, but we hardly think the author gives sufficient credit to the careful compilation by Martin, which has been set out in curve form in a more detailed way than by the author. We are inclined to agree with him on the general absence of fully-accredited results on large impulse turbines.

The chapter on marine turbines is of great interest, some valuable information being given on the results of the new turbo-electric ship, the s.s. "Mjolner." There is also a very interesting description of a land turbine 15 000 kW, 3 000 revs. per min., by Messrs. Brown Boveri, which has novel features.

On the whole we congratulate the author on a good book, with regrets for little blemishes here and there which can easily be removed in a later edition. The price is exceedingly reasonable for such a comprehensive treatise.

W. M. SELVEY.

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The New Electric Steel Furnaces at the Fiat Works in Turin.

By G. VITALI.

In recent years electric furnaces have attained an important place in the high-grade steel industry. Between 1913 and 1920 the total number of electric furnaces in all countries increased sevenfold, America and Canada having 363, England 160 (including 70 in Sheffield), and Germany 100. Over 90 per cent. of these are arc furnaces, which are cheaper to instal and maintain and are more reliable and durable than others. Even after the war the number of furnaces increased considerably, despite the fact that war material was no longer needed.

The scarcity of pig iron and coal during the war led the Fiat works to construct an electric steel furnace for turning out ordinary grades of steel in large quantities. For some years six electric steel furnaces of 5 to 6 tons capacity gave such good results in the Fiat steel foundry that it was decided when rebuilding their Turin works to replace the projected Martin

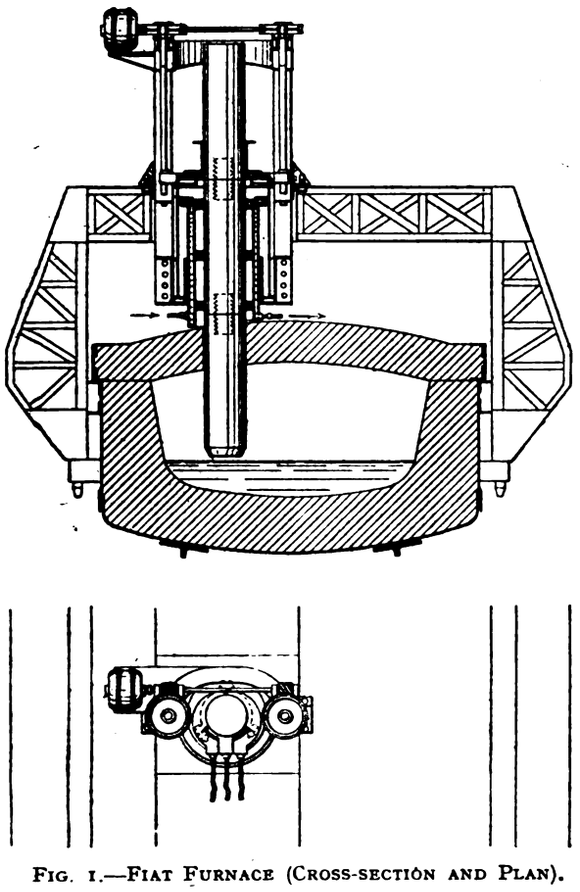

FIG. 1.—FIAT FURNACE (CROSS-SECTION AND PLAN).

furnaces by four electric furnaces of 15 to 20 tons capacity, and two of 3 and 6 tons capacity. Four to eight new furnaces will be added when the old foundry is shut down.

The Fiat furnaces were designed to fulfil the following conditions :—

1. Production and maintenance of a neutral hearth throughout the whole operation.
2. Use of a continuous electrode to obviate interruptions.
3. Starting with a cold charge, the time taken for melting and refining not to exceed 2½ hours.
4. Reduction of energy and electrode consumption, compared with other types.
5. Increase of life of roof and lining.
6. Ease in erection and dismantling for repairs, and the possibility of replacing a damaged electrode carrier without shutting down.

The three-phase type of furnace was chosen as being best suited for the available supply—namely the 21 kV network of the Società Elettricità Alta Italia.

The Fiat Furnace.

The Fiat furnace—see Fig. 1—consists of a cylindrical vessel which can be tipped in either direction by means of a hydraulic or an electrical device—the latter being now used as better and cheaper. There are only two openings, the larger one for charging and drawing off slag, and the top hole on the other side for drawing off the molten metal.

The removal of slag is very important in steel manufacture. By slightly tipping the furnace forwards the slag can be drawn into a container under the charging floor and so away from the furnace—a much simpler process than in furnaces with side doors. The opening for the charging door has a water-

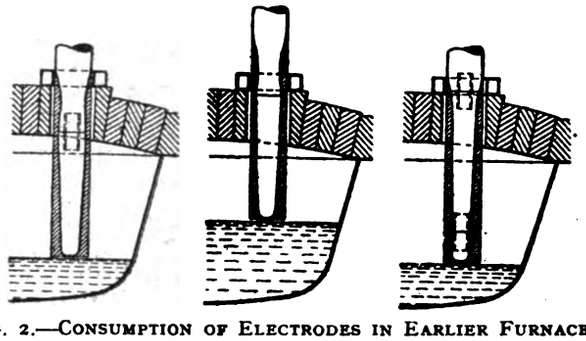

FIG. 2.—CONSUMPTION OF ELECTRODES IN EARLIER FURNACES.

cooled frame on the outside which protects the cover during charging by the automatic machine.

The construction of the electrodes of this three-phase furnace is specially noteworthy. The three graphite electrodes of 350 mm. in diameter are supported by a special bridge to stand vertically over the bath. Each electrode with its armature and controlling device and motor can be bodily removed during working if necessary and replaced in half an hour. Similarly the whole bridge with all three electrodes can be easily removed.

After detaching the bridge, the covering with the roof can be lifted off, so that re-lining can be undertaken without difficulty. This arrangement and the water-cooled frame round the charging opening makes it possible to run 150 charges through the furnace without shutting down.

Results Due to Good Design.

The excellent results obtained from this type of furnace are mainly due to the careful and novel design of the electrodes and cooling. In the roof there is a water-cooled jacket round the electrode (Fig. 1). To the electrode terminal, which is moved up and down by a motor, a second cylinder is fixed, capable of moving telescopically over the water-cooled jacket. The close fit between the two cylinders shuts out the air and so prevents the electrodes becoming oxidised and thereby

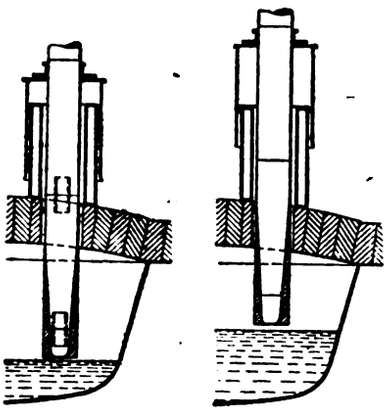

FIG. 3.—CONSUMPTION OF ELECTRODES IN FIAT FURNACES.

increases the life considerably. Fig. 2 shows how the electrodes are consumed in the earlier furnaces and Fig. 3 in the Fiat furnace.

The energy supplied to the furnace is thus utilised entirely in melting the charge, and not largely in heating great quantities of air passing through the furnace. This leads to lower energy consumption. Experience shows that in ordinary furnaces the electrodes are not used up mostly by melting the

* Abstract of an article in the "Elektrotechnische Zeitschrift."

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charge but by the flames and oxidising gases. The electrode consumption in the Fiat furnace is reduced to 2·8 kg. per ton of melted steel, while for other types it varies from 8 to 15 kg.

Preventing the flames coming out round the electrodes by the sealed joint between the cylinders means that there is no circulation of air through the furnace, even when the charging door is opened, with the result that the space over the bath remains neutral.

The secondary windings are connected in star and for each electrode there are 12 flexible leads with a total cross-section of 4 800 mm². The star point is connected to the shell of the furnace—see connections in Fig. 4. Thus unbalancing is reduced as much as possible, while it is possible even to use one electrode only. The furnace case is also earthed. In the secondary circuit there are only the current transformers for the ammeters and the automatic regulators.

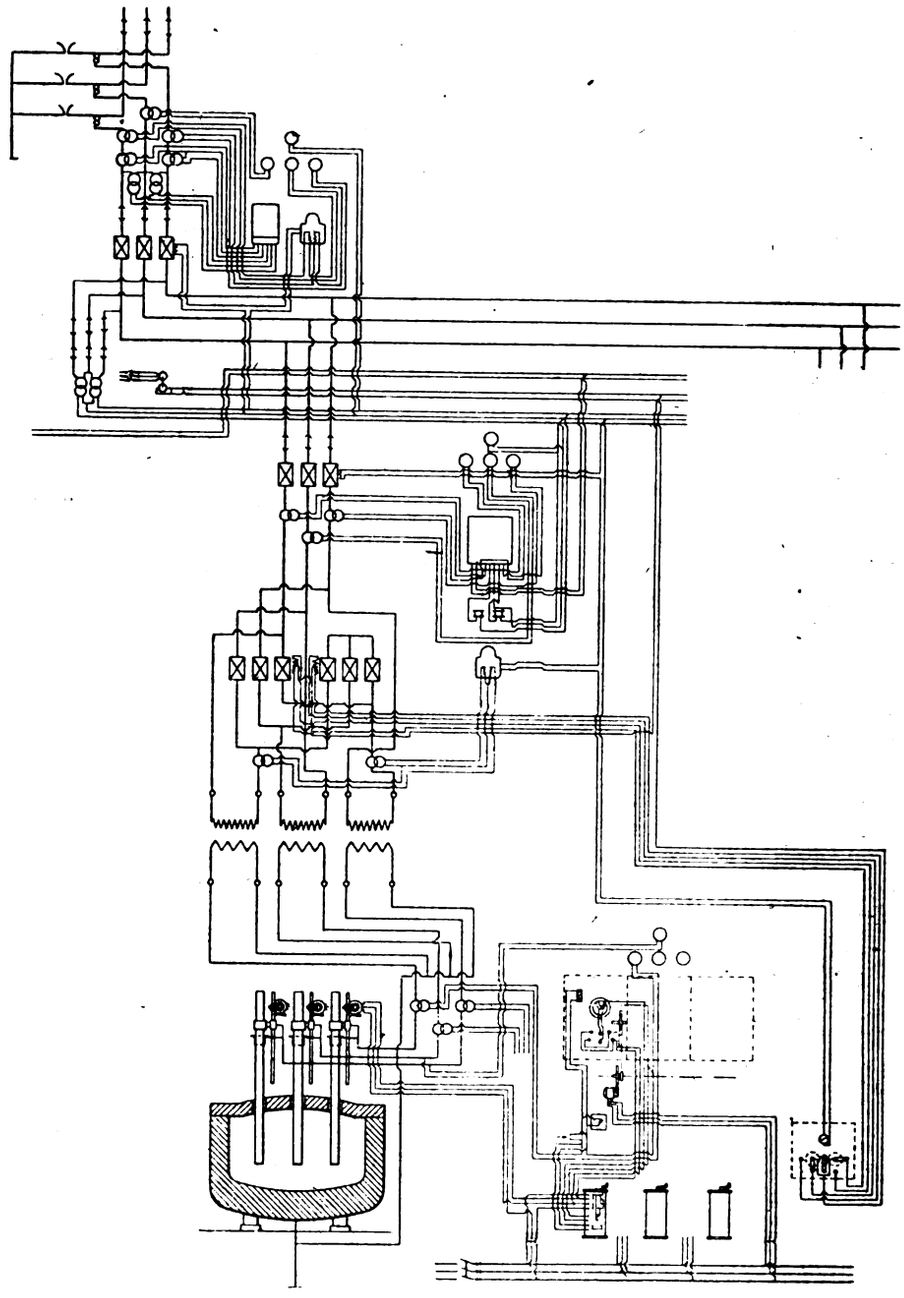

FIG. 4.—DIAGRAM OF CONNECTIONS FOR FIAT FURNACE.

Consequently it is unnecessary to use cast iron or any other substance with carbon, because the carbon in the metal is not oxidised. Small extra amounts only are necessary to obtain the requisite carbon percentage.

When working, two voltages are generally used. During the first and longer period when the solid charge is being melted the higher pressure of 130 V is used to send the largest possible current. For the refining period, 75 V are used to bring the bath to the pouring temperature of 1 750 deg. C.

With the 5 to 6 ton furnace, a 2 000 kVA oil-cooled transformer with delta-connected primary is used to give 130 V. For 75 V, the primary is star-connected and the output is 1 150 kVA.

Some of the results obtained are given below for charges of 4 675 kg :—

Charge 1.—First period :	125 min.	2 550 kWh.
Second period :	43 min.	650 kWh.
Charge 2.—First period :	127 min.	2 450 kWh.
Second period :	48 min.	670 kWh.
Charge 3.—First period :	122 min.	2 500 kWh.
Second period :	33 min.	500 kWh.

The average consumption of the above is 0·66 kWh per kg.—the meters were on the primary side and measured all losses.

Over a month, with an output of 1 341 160 kg., the average consumption was 0·7 kWh kg. This included holidays when steel was not made but the furnaces were kept warm.

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Variable Speed A.C. Motors.

Some Details of the Latest B.T.-H. Design.

For a considerable time past every endeavour has been made to obtain a satisfactory system of speed variation for a.c. motors, and, of recent years, due to the rapidly increasing use of alternating current, the question has become more acute. In many industries constant speed machines are suitable for most of the drives, but there are a number of manufacturing processes in which variable speed is essential, and if a direct current supply is not available, the additional cost, space requirements, and losses incurred with converting plant, become a formidable factor.

Slip-ring motors have been used to a limited extent, but these have an inherently poor efficiency when operating at low speed, and are subject to a great variation of speed under variation of load, both of these characteristics being very serious drawbacks. As an improvement on the slip-ring motor, various types of change-pole motor have been introduced, but even these have serious limitations, insomuch that only a certain number of definite speeds are available, and also, the power factor at the lowest speed is sometimes very low. The a.c. commutator motor, on the other hand, overcomes all these disadvantages and has the additional great advantage that the control gear required is much more simple and consequently less costly than that for any of the foregoing systems in the majority of cases, it being necessary only to instal an oil switch in the main circuit.

The variable speed machines described below have been developed by the BRITISH THOMSON-HOUSTON CO. for all industrial applications requiring variable speed motors, and while possessing the speed characteristics of a d.c. shunt

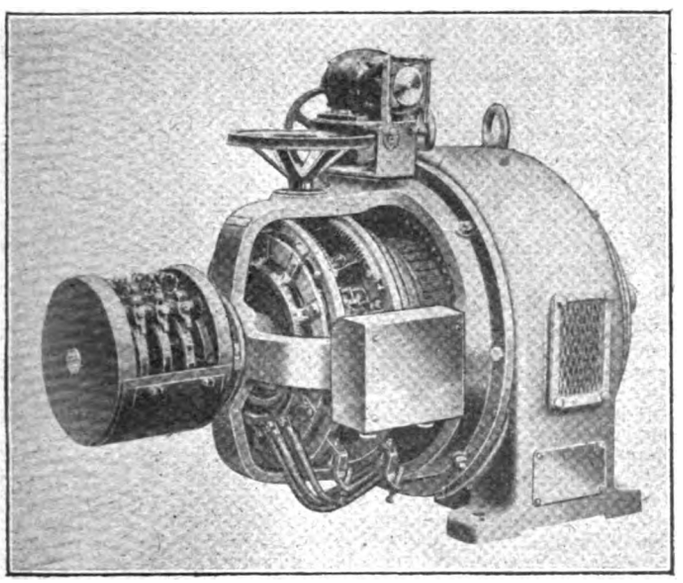

FIG. 1.

wound motor, are also suitable for operation on polyphase circuits.

Winding Arrangements.

These motors—which are known as Type CH—are provided with the following windings, the primary and secondary being arranged inversely to those of the ordinary induction motor :—

1. Primary winding—located on the rotor, and by means of slip-rings connected to the supply mains.
2. Secondary winding—located on the stator.
3. Regulating winding—placed in the same slots as the primary winding. The regulating winding is connected to the commutator and thence, by means of brushes thereon, in series with the secondary winding on the stator.

Same Characteristics as D.C. Motors.

Within its normal range this motor has practically the same characteristics as a direct current shunt wound motor with speed variation by field control, with the exception that the speed of the former does not vary with the temperature to the same extent as does that of the latter. Furthermore, for normal speed regulation, no external resistance is required in order to effect speed variation, and hence the motor operates with high efficiency at all speeds. Normal speed variation is obtained by simply turning the hand wheel provided, which, through rack and pinion gear, changes the position of the brushes on the commutator. The movement of the brushes can also be effected very conveniently from a distance either mechanically, by means of wire rope and pulleys, or by spindle and bevel gear wheels, or electrically by means of a small pilot motor coupled to the brush shifting spindle, as shown in Fig. 1, and controlled by push buttons. The latter system has the advantage, among others, that when the main motor is switched off, the pilot motor automatically returns the brush gear to the correct position for re-starting.

The Type CH motor—unlike the d.c. variable speed shunt wound motor, where the maximum torque is developed at the lowest speed and decreases as the speed increases—exerts a constant torque throughout the whole speed range, i.e., the output is directly proportional to the speed.

Speed Range.

The normal speed range of the standard motor is 3 : 1, but other speed ranges can be evolved. The motor operates at speeds above or below the synchronous speed and at any speed between the maximum and minimum values. When running at synchronous speed the motor operates exactly as an ordinary induction motor. Under this condition no part of the regulating winding is in circuit, the secondary winding being short-circuited through the brushes across one or more commutator segments. According to the amount that the two sets of brushes—with which the motor is provided—are displaced in one direction or the other, so the speed will vary either above or below synchronous speed. It is usual, therefore, to select a synchronous speed about midway between the maximum and minimum speeds desired.

The difference between the no-load speed and the full-load speed for any brush setting is approximately 5 to 10 per cent. of the maximum speed of the motor, the exact percentage depending on the size of the motor. In some cases a creeping speed is required, and this can be obtained by inserting a small resistance in each phase or the stator winding.

The Type CH motor is more stable than the ordinary induction motor when running at creeping speeds and hence lower creeping speeds can be obtained. The stability of an induction or a synchronous motor, i.e., liability to drop out of step with fluctuations of load, when running at creeping speeds, depends upon the ratio of the creeping speed to the normal operating speed—the smaller this ratio, the greater the stability. The Type CH motor has normal operating speeds much below the synchronous speed, hence this ratio is smaller than would obtain in the case of a slip-ring induction motor, where the normal operating speed is only slightly less than the synchronous speed.

Starting.

When neither creeping speeds nor automatic control are desired, a plain circuit breaker only is required to start the standard motor. A switch is provided on the brushgear so that an electrical interlock can be arranged with a suitable main circuit breaker in such a manner that the latter cannot be enclosed unless the brushes of the motor are set in the minimum speed position, i.e., the correct position for starting. Under this condition the motor will exert a starting torque of not less than 1½ times full load torque with a line current of approximately 1½ times full load current. Motors with a greater starting torque can be supplied, if desired, but these must be made the subject of a special enquiry.

Commutation.

In the matter of commutation, the Type CH motor operates with great advantage as compared with other brush shifting motors. For a motor of given H.P. the power dealt with by the commutator is only a fraction of the total, as, therefore, the commutator voltages and currents are small, liberal design limits can be used and hence any sparking which may occur is negligible. In practice, it is almost impossible to obtain a flash-over on the commutator.

Power Factor and Efficiency.

Characteristic curves obtained on test from a 400V 25 cycle three-phase 50-17 H.P. running at 540-180 revs. per min. are shown

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in Figs. 2 and 3, and are typical of all these motors. The curves are plotted for conditions at maximum, mean and minimum speeds; power factor and efficiency at intermediate speeds can be deduced with reasonable accuracy.

Throughout a considerable portion of the speed range the power factor of the Type CH motor is higher than that of an induction motor. It will be observed from Fig. 2 that the

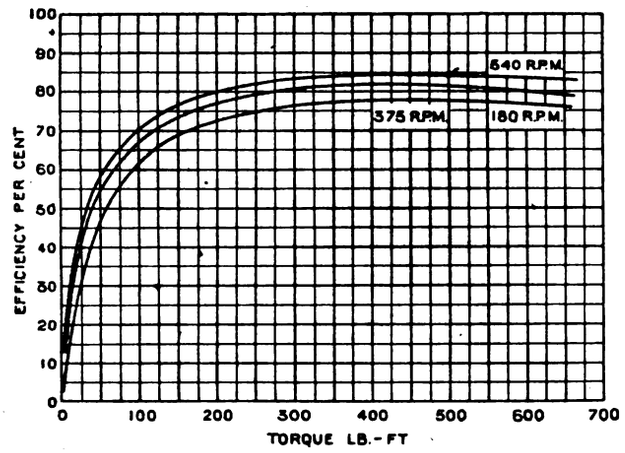

FIG. 2.—EFFICIENCY CURVE B.T.H. VARIABLE SPEED A.C. MOTOR.

efficiency over the whole speed range is fairly constant and still has a high value at the minimum speed, also that the power factor at the maximum speed is high, approaching unity over a considerable range of load.

Applications.

The Type CH motor is, the makers claim, admirably suited for any duty demanding a variable speed polyphase alternating current motor. This is particularly the case where the operating conditions necessitate uniform and gradual accelera-

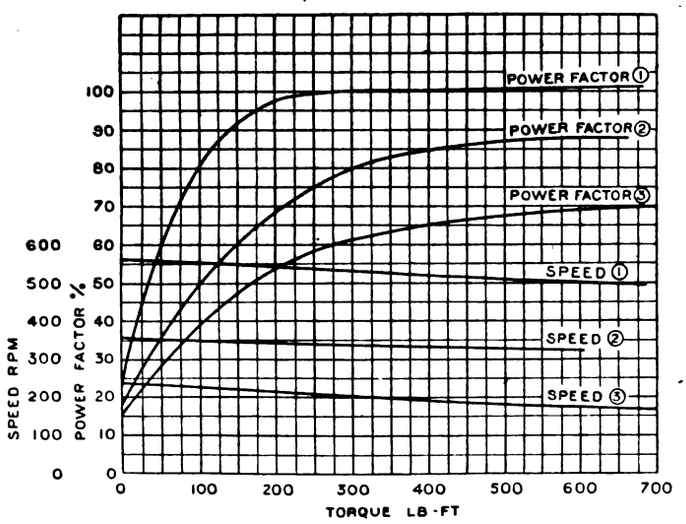

FIG. 3.—SPEED AND POWER FACTOR CURVES OF SAME MOTOR.

tion. The speed of the motor passes under control, through every revolution of the normal speed range, the commutator and brushes acting as a controller with an infinite number of points. It is this feature that has made the motor so successful in paper manufacture, paper and calico printing, and in the production of textile materials. The numerous processes in paper manufacture requiring a variable speed motor include paper making, reeling, cutting, calendering, drying, and the machines involved in all these processes can be successfully driven by means of the Type CH motor which gives high efficiency at all speeds, uniform acceleration and ideal operating characteristics.

Many other applications to which the motor is well adapted include machine tool drive, pumping, exhausters, chain grate stokers, rubber manufacturing machinery, and, in fact, any duty where efficient speed variation is required.

Correspondence.

SHOULD BRITISH ORDERS BE PLACED ABROAD?

To the Editor of THE ELECTRICIAN

SIR,—The recent and present campaign in the daily and technical Press in favour of British orders being placed with British firms contains many elements with which even we, as importers of Swiss electrical machinery, can sympathise, especially if we take account of the spectacular factors and the points of human weakness governing the controversy.

On January 29th this year the writer had occasion to deal with this subject at some length in the daily and technical Press, and we take the liberty of referring you to the enclosed reprint from your valued journal dated February 2nd, 1923. The writer sees no reason why he should modify any of the statements made in this letter; they are equally applicable to-day and they will always be applicable as they contain fundamental truths. We might add the following:—

(*a*) Whilst booking *orders* in Great Britain we would, as in the past, purchase quantities of raw materials from producers in this country.

(*b*) We daresay a similar undertaking might be obtained from British electrical manufacturers, though we know that in the past important pieces have sometimes been ordered from German, Austrian and American houses.

(*c*) Those big electrical manufacturing concerns, who alone come under consideration in connection with the construction of big turbo plant, are straining the cry of unemployment unduly in their favour, in so far as most of them are quite busy. We do not, of course, deny by this that unemployment in connection with many industries is rampant and that it merits careful and sympathetic treatment.

(*d*) It is an open question as to whether the placing of British orders for electrical machinery exclusively with British manufacturing concerns is economically a wise policy if it is adopted even under present-day conditions. The writer has already shown in his letter of January 29th to the Press the evils which are bound to arise from such a course. If we, for instance, declare that we can book an order at a price, by, say, 25 per cent. lower than the British price and that this our price is a keen one, but no loss-price, it stands to reason that other terms must be applied to the British price, especially when considering that we have to take the raw materials and semi-manufactured parts all the way to Switzerland, and the finished plant again all the way from Switzerland, and that we pay as high wages as British electrical manufacturers.

(*e*) We admit, of course, that it is no business of ours when British public bodies insist on paying to British manufacturers prices which should secure them more than handsome profits, but we cannot quietly accept their explanation of our market prices to the effect that the exchange (when the Swiss franc is at par with the British pound sterling) and low wages, and all sorts of innuendos equally off the mark, are responsible.

(*f*) The hard fact remains that, taking one example at random, well over £10 000 in good money might have been saved by placing the order with us, a Swiss firm, at the same time ensuring that a goodish portion of the contract sum would have been spent in this country. The saving of well over £10 000 could have been allocated to all sorts of work of municipal and national importance—*e.g.*, making roads, canals and other improvements, money therefore mostly spent in wages, consequently directly reducing *local* unemployment. As it is, the sum of well over £10 000, which would have been saved, is now allocated to quarters who can either not produce a competitive article or who direct it into the pockets of some shareholders (we have no particular firm in mind, but speak on quite general terms). The rate-and-tax-payer has to find a sum quite 25 per cent. higher than necessary and he has to find also the doles or unemployment moneys to the tune of something like £10 000 on top of it. Can that be denied? and, if not, where is the sense of it? The writer cannot, for the life of him, see where his economics, as viewed from the British standpoint, go astray.

The writer does not expect for a moment that such arguments are sufficient to immediately reverse the present preconceived straight-line policy between two points. "The man in the street" is too immediately affected by slogans such as "Out with the foreigners," "Dumping," "Let us spend our money in the country," "Help British Trade," and in a time of crisis and of acute unemployment he is very liable to forget:

(*a*) That Free Trade has made this country the greatest manufacturing and trading country, indeed the clearing house, of the world, and

(*b*) that nearly all Britain, but especially Lancashire and many other districts, are largely manufacturing for export themselves.

The writer does not believe that salvation lies in the local spending of big money for a specific machine when it can be purchased at a lower price in a country whose currency is at par with British currency.—We are, etc.,

OERLIKON LTD.,
G. WUTHRICH,
General Manager and Chief Engineer.

London,
September 17th.

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Shipping, Engineering and Machinery Exhibition.

(*Concluded from page 279.*)

Projection Micrometer.

A new instrument known as the Lewbeck projection micrometer (Fig. 11), which has been designed for the measurement of fine wires and fibres, is being exhibited by the LONDON ELECTRIC WIRE CO. AND SMITHS. Briefly the advantages claimed for the instrument are that there are no parts to cause inaccuracy through wear, the wire is not compressed or deformed during the measuring process, the accuracy for fine wire is 1/50 000 in., the micrometer is easily checked, and it is also portable and can be worked on any firm bench. This new projection micrometer consists of a rigid piece of apparatus, comprising an illuminating arrangement, a holder for the wire or fibre, a microscope with a Beck apochromatic object glass, a compensating eyepiece and a translucent screen. No error, it is said, can be introduced by the alteration in position of the various parts. An image, which is as far as possible perfect, is thrown upon a ground-glass screen which is covered in to preclude all extraneous light and is viewed through an aperture. The image is exactly one-thousand times the size of the object, so that 1/10 000 in. on the object is 1/10 in. on the screen.

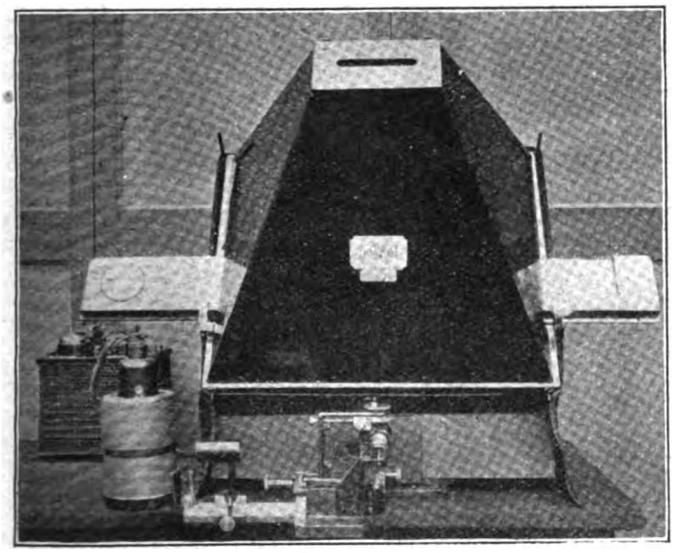

FIG. 11.—THE LEWBECK PROJECTION MICROMETER (LONDON ELECTRIC WIRE AND SMITHS).

On the surface of the screen there is a transparent scale with divisions of one-tenth of an inch, and it can be moved about across the image by means of a rack and pinion. The zero mark on the scale is set to one side of the object, and the division that corresponds to the other side gives the diameter. As a fifth of a division can easily be estimated, the readings are accurate to within about 1/50 000 in. Fine wires and fibres can be measured with the greatest of ease. By means of a pair of V-shaped grooves the wire is immediately brought into exact focus, and by the use of a micrometer screw the wire can be moved in the direction necessary. The wire holder is designed so that the wire may be revolved through an angle of approximately 90 degrees whilst it is under observation, and the diameter of its sections at right angles can be taken. The instrument is manipulated by a single operator who sits or stands in front of the instrument. By removing one of the lens systems the magnifying power of the microscope is reduced from 1 000 to 100 so that larger objects can be measured. The wire holder has an arrangement for carrying a glass slide with lines ruled at a definite distance apart, and which can be placed in the position normally occupied by the wire. These lines are thrown upon the screen and the scale is checked for accuracy.

A Submerged Log.

The electric submerged log exhibited by the ELECTRIC SUBMERGED LOG CO. is claimed to be the most precise instrument of its kind. An accuracy of a fraction of a foot per mile is maintained at any speed of the ship, and the separate speed indicator, which registers from 0 up to 36 knots with half-knot readings, operates with the same degree of accuracy. At any time the accuracy can be checked on board the ship, so that the navigating officer may test the reliability of the device. Moreover, as the extreme sensitiveness of the log permits the slowest motion of the ship to be distinctly and accurately recorded, when the ship is lying at anchor both tides and currents can be recorded and their speed measured.

Wireless Apparatus.

A very compact ½ kW portable wireless telegraph set is being exhibited by WM. HAMILTON WILSON. Although it is primarily intended for military and similar purposes, it will also serve as a permanent installation on small ships, yachts, large motor boats, etc. The complete instrument is mounted in a teak case measuring approximately 21 in. by 14 in. by 10 in., and it can be carried by a single man. With the exception of the aerial, earth gear and battery, the set is absolutely self-contained. Standard sets are made to work with a 50 V battery and to transmit on wave lengths of from 300 to 600 m., but alterations can be made to suit purchasers' requirements. A ½ kW set can be relied upon for communication over distances of 150 to 200 miles, but under favourable conditions these distances can be more than doubled. If desired a switch for reducing the power input can be fitted for short-distance transmission. Standard sets operate with a spark frequency of 650 per second, the transmitter being of the well-known Wilson type.

Electric Trucks.

Probably no other exhibition has contained a better display of electric trucks and cranes, but most of the types shown are familiar to readers of "THE ELECTRICIAN." RANSOMES, SIMS AND JEFFERIES, are exhibiting a 15 cwt. electric runabout crane and two of their "Orwell" industrial electric trucks. Examples of the firm's electric motors are also in evidence. Another well-known firm that is represented is BRITISH ELECTRIC VEHICLES, LTD., who are exhibiting two electric trucks and an electric locomotive. These locomotives, we understand, are now being used on important contracts, including the reconstruction of the City and South London Railway. HESKO, LTD., of Kingsway House, Kingsway, W.C. 2, are also exhibitors of electric tractors and trucks. One of the most novel exhibits on the firm's stand is a trailer crane which derives its power from an electric truck or similar self-propelled vehicle (Fig. 12). The crane is mounted on two wheels, the third point of support being the truck which can occupy any position relative to the crane. The attachment of the crane to the truck only occupies a few seconds. There is only one motor on the crane which has derricking and hoisting motions. Standard cranes of this type have a lifting capacity of 1 ton, but cranes capable of lifting two and three tons are also built.

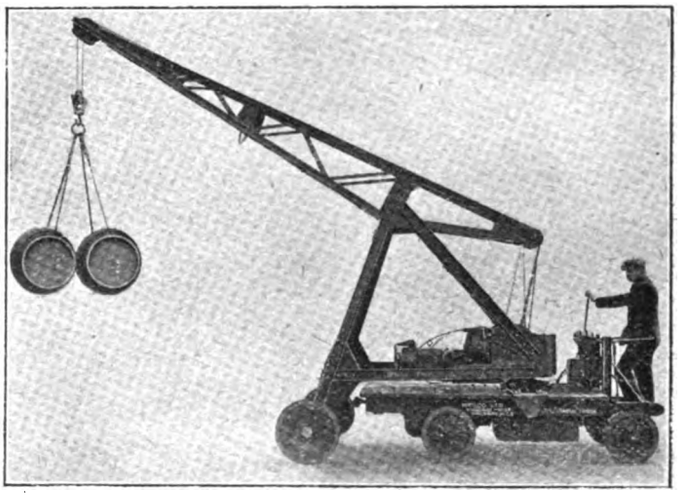

FIG. 12.—THE "LONDON" TRUCK (HESKO, LTD.).

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Merchandise to Sell and Profit By.

***In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of* THE ELECTRICIAN.**

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

The "Tangent" Contact Pillar.

GENT AND CO. are determined to keep the place which they hold in the front rank of manufacturers with a reputation for service and

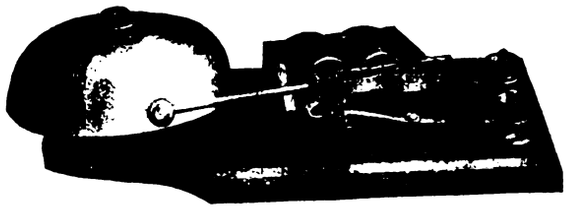


FIG. 1.—THE LATEST GENT BELL.

quality for bells and bell accessories. This is proved by the new "Tangent" contact pillar which we illustrate.

More electric bells go out of commission through the contact breaker twisting on its axis than from any other cause. In the "Tangent" patent contact pillar, the same screw which locks the contact screw in position after adjustment, also locks the contact pillar itself in the adjusted position, so as effectively to prevent it from turning on its axis, or being forced out of position by the vibration of the bell, even if its axial or central fixing screw becomes loose, as such screws often do.

The illustration (Fig. 2) shows (*a*) the contact screw; (*b*) the fixing screw; (*c*) the all important locking screw serving the double purpose; and (*d*) the slotted brass plate of strip by which the

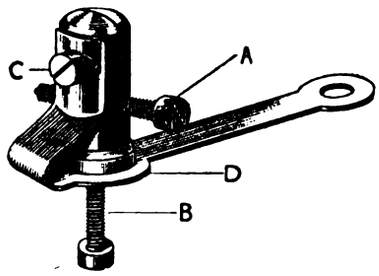


FIG. 2.—THE "TANGENT" CONTACT PILLAR.

"locking" result is obtained. Note the slot in this plate in which the screw "C" passes. The strip also acts as a terminal as is usual. Contractors who guarantee reliable work will welcome this new device, as it gives full security against failure in electric bells.

The "Ever-Ready" Radios Bicycle Lamp.

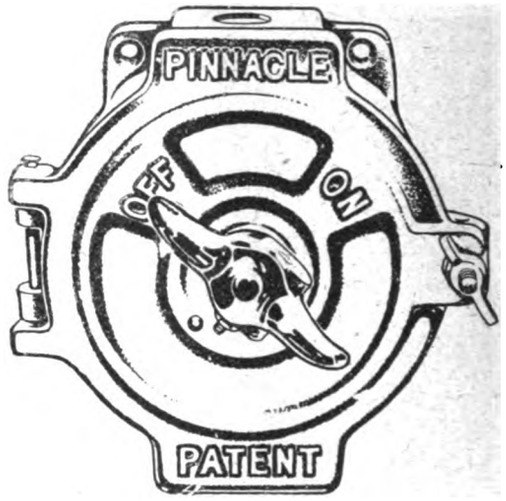
It is the conviction of many that the possibilities of generator sets for bicycle lighting have been ruined by the rubbish that has been passed on to the public for the sake of making a set down to a price. Many makers have made the mistake of assuming that

AN ITEM FOR KEEN CYCLISTS.

the cycling public has no interest in the efficiency and reliability of the lighting set so long as the price is kept low. Time has proved, however, that the fundamental basis on which these sets are bought is reliability. The Radios set which we illustrate is marketed by the EVER-READY CO., and will do much to restore confidence with both retailers and the buying public. Price is no index to the quality, but it is of interest to mention that the set is listed at 30s.

The "Pinnacle" Switchfuse.

We illustrate the "Pinnacle" quick make and break switch, which is manufactured by the WHOLESALE ELECTRICAL CO. (1922). It is a good sound switch, and should prove a "bread-and-butter" line for many jobs. The construction is on quite new lines. Of robust construction, the switch is foolproof, being definitely locked



THE NEW PINNACLE SWITCH.

when in the "on" position. The moving mechanism is mounted in the cover, whilst the rubbing contacts are embedded in separate compartments of the fireproof base. The fuse blows in a fireproof chamber. Both "make" and "break" are positive and instantaneous—a partial movement either way being impossible. The switch is at present made in two sizes 15A and 30A, both for double pole operation. Larger sizes are, we understand, being developed.

A Higher Standard in "Mill" Fittings.

Among the several classes of apparatus which have sunk to a very low level of quality and design is the line of cast-iron fittings which are popularly known as "watertight mill fittings." The level of quality has sunk so low, however, that they have ceased to be

A SIMPLEX MILL FITTING.

regarded as watertight fittings, and are in reality a mere cast-iron attachment to hold a cheap well-glass over a lamp. SIMPLEX CONDUITS, Ltd., have interpreted correctly the wishes of the trade for a higher standard of quality and design. We illustrate the pattern given in Simplex Catalogue No. 871A, which is typical of a most comprehensive range. The fittings can be supplied with or without guards, with or without reflectors, and a still further variation can be had of fittings with bracket and pendant drops.

"Ballsok Beads."

Users of bare wire insulation will be interested to know that a British patent No. 198 137 has been granted to LIONEL ROBINSON AND CO. for their "Ballsok" method of insulation for bare conductors. The beads were placed on the market a year ago and we understand have proved in every way satisfactory for cover-

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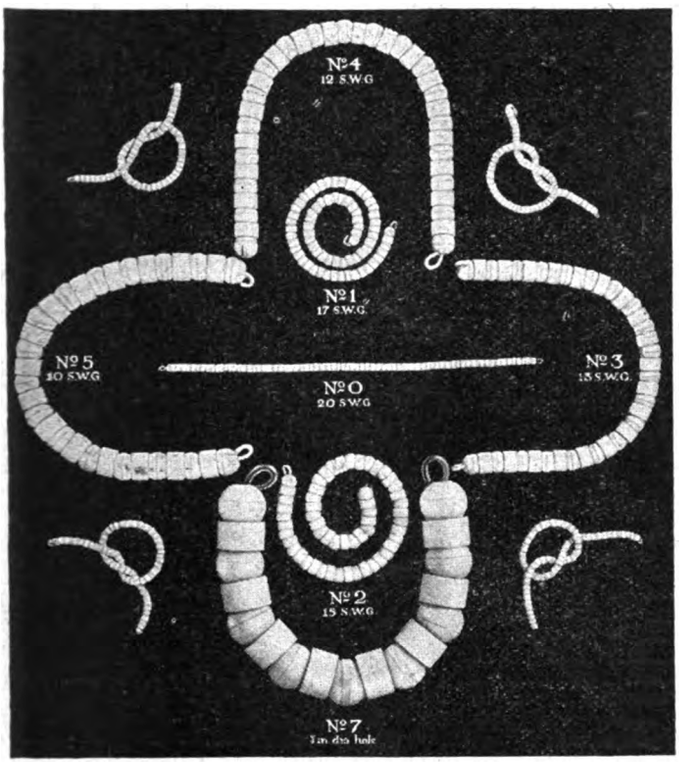
ing bare connecting wires, such as must be used in electric cooking and heating apparatus, electric furnaces, electric geysers, table utensils and, in certain cases, motor starters, regulating resistances, controllers, tramcar and railway resistances, etc.

The beads are of British manufacture and are made in non-hygroscopic material. We are informed that they can be raised to a red heat and plunged into cold water without cracking—a very severe test. The range of sizes is most extensive, as is shown



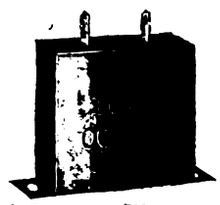
SOME EXAMPLES OF "BALLSOK" BEADS.

by the illustration, and this also indicates the complete enclosure of the wire when it is bent at quite acute angles. The largest "Ballsok" beads are suitable for covering a wire of an external diameter of ¼in. and the smallest size is suitable for No. 20 gauge wire and downwards. The latter size is in demand for thermo-couples and electrical instruments in which a water and insect proof insulated covering is necessary for all internal connections. The "Ballsok" method of insulation has an advantage in threading in that both the ball and socket are double sided and it is not necessary to examine which end is being threaded. Should it be found that a surplus ball or socket has been threaded on, the extra member can be pinched off with a pair of pincers, and the need for threading and re-threading, which is necessary with a single ended method of insulation, is obviated.

We understand that the British Admiralty has approved of the method of insulation and that it is becoming increasingly popular with electrical manufacturers.

T.C.C. Wireless Condensers.

We illustrate a wireless condenser manufactured by the TELEGRAPH CONDENSER CO. This is a typical illustration of a large range of sizes. These condensers are all of the same proportions as the illustration, and are provided with feet—excepting in two large high-tension sizes. The range is in addition to the regular T.C.C. sizes for telephone and telegraph work.



A TYPICAL WIRELESS CONDENSER.

"Material to Use and Profit By."

An interesting booklet on joint box compounds and jointing accessories has just been issued by W. T. HENLEY'S TELEGRAPH WORKS CO., Engineering Department, and we recommend it to engineers chiefly because of the valuable data given relating to the physical properties of the various Henley compounds.

In order to facilitate comparison, particulars are set out in tabular form of a wide range of box compounds to cover conditions met with in any climate and for all voltages. The fusing and pouring temperatures, shrinkage and puncture voltage, etc., have been carefully ascertained at Henley's Research Laboratories. The fusing temperatures were measured by the Kraemer and Sarnow methods. The pouring temperature given is of vital interest to the successful working of compounds.

Amongst the accessories a description is given of a new type of compound bucket of specially stout construction made from sheet-iron with folded joints and welded bottom. The lid of the bucket has an external flange to prevent the entry of rain.

Electrical engineers in charge of colliery installations will find the 7010 bucket interesting. It has been specially designed for use in collieries where it is impossible to heat the compound at the required point because of fire-damp, etc. Details are also given of portable oil-blast furnaces, blow-lamps, bonding clamps, lead sleeves, jointing sleeves, and sundry connectors for simplifying cable joints. Interested engineers should write for a copy of list U.M. 1.

Artistry in Kettles.

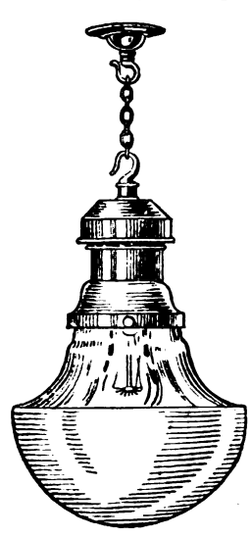
Reviewing the various designs of electric kettles which have been placed on the market in the last few years, one particular fact stands out. That fact is the formality of design, and it would seem that it has been impossible for designers to strike a new line of thought. Obviously kettles for use as table-ware must be distinctive and "fresh" in their design, otherwise there is but little with which to

THE NEW SOUTTERWARE OVAL KETTLE.

appeal to the domestic buyer other than price. The range of kettles in the "Soutterware" line offered by the TELEPHONE MANUFACTURING CO. to the trade is outstanding for the number of really appealing designs which it comprises. Particularly is this so with their No. 20/31EE kettle, which we illustrate. The body is of oval shape, and the decoration and the style of legs make the kettle a line which should be prominently displayed in showrooms. The kettle has a capacity of 2 pints with a consumption of 450 W, and prices range from £3 2s. 6d. in polished brass.

Siemens and the "New Vogue."

The monthly trade price list issued by SIEMENS AND ENGLISH ELECTRIC LAMP CO. is a galaxy of good "merchandise to sell and profit by." From time to time we shall comment on items taken from this list, and this week we illustrate a unit which Siemens market. It is typical of the trend of thought, or the "new vogue in lighting equipment," to use an expression which is becoming popular. The unit consists of two parts, viz., the fitting body or housing with ceiling plate and chain, and a glass globe. Only a simple description of the fitting is necessary because the illustration will reveal its characteristics. It should be remarked, however, that while the design takes a severe note it is obviously the fitting to instal where a strong "commercial" type of unit is required. The glass globe is of particular interest because it is a "one piece" glass with a clear top. In effect, therefore, we have a semi-indirect bowl with a clear glass top, but without the drawbacks inherent with fittings where two separate pieces of glass have to be used.



A TWO-PART LIGHTING UNIT.

A new price list has just been issued by the BORDESLEY ACCESSORIES CO. The list is comprehensive, and contains prices of practically every class of small supplies.

The BRITISH THOMSON-HOUSTON CO. have published a price supplement No. 5112A, which quotes prices of oil-immersed Y-delta starting switches, and a descriptive list No. 5112B, describing the same apparatus with full technical details. The B.T.-H. also ask us to announce the issue of price supplement No. 2143, quoting prices on induction motors.

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Electricity in Mines.

Testimony to Advantages of Electric Signalling.

The comparatively small number of mines in which electric signalling is adopted was attributed by M. MAURICE LE BAS, in a paper read before the recent Engineers' Congress at Liège, to the aloofness of many mine owners, conservatism, and the desire to avoid new troubles.

Only 78 replies were received to a questionnaire on the subject sent recently to 300 collieries and metal mines in France, Belgium, the Sarre and Dutch Limburg. The statistics obtained show that 65 pits in France and 21 in Belgium are equipped with mechanical signalling only, and 40 in both countries have mechanical signalling supplemented by telephones and electric bells. Seventeen have complete electrical systems in normal service, eight have been recently, or are being, equipped with electrical apparatus, and six had their electrical equipment destroyed during the war. Twelve mines have not yet adopted electric signalling, and the owners of seven are opposed to such a system. Four collieries in Limburg are using electric signals with success, and two have been equipped too recently to enable an opinion to be formed. Some concerns, though generally satisfied with their electrical systems, recommend greater simplification and endeavours to secure increased robustness of apparatus, which it is important should be watertight. All users agree that electric signalling is quicker and safer than mechanical signalling.

In many mines in this country electricity is playing an increasingly important part. Near Edwinstowe the Bolsover Colliery Co. is contemplating the construction of a colliery to be worked entirely by electricity, and free use will be made of electricity in a new extension of the Arniston Coal Co.'s operations in East Lothian.

Economical Generation of Electricity.

Proposed Pit-head Stations in Ireland.

The suggestion made by Mr. C. A. M'CURDY, M.P., in a newspaper article, that electricity should be generated at the pit mouth was reiterated before the Commission appointed to inquire into the natural and industrial resources of Northern Ireland last week, when Mr. T. S. DURHAM gave evidence regarding the coal prospects at Coalisland and in the Lough Neagh district. The obvious site for a turbo-generating station was, he said, at the pit-head, whence high tension transmission could be carried to Cookstown, Portadown, and Lurgan and, possibly, later linked up to the Belfast station. The transmission would be effected by means of overhead cables, similar to those employed at present in Cumberland, Clyde, and Tyne Valleys, parts of Norway and Germany, and elsewhere. It was estimated that power in the Coalisland district could be supplied economically at a cost of a 1d. per kWh.

After Business Hours.

D.P. Battery Co.'s Outing.

The annual works' outing of the D.P. BATTERY CO., took place recently, the party travelling from Bakewell to Blackpool and back by special train.

Ediswan Ladies at Windsor.

A party of ladies from the staff of the EDISON SWAN ELECTRIC CO., paid a thoroughly enjoyable visit to Windsor and Eton on Saturday last. The journey from Ponder's End was made by motor *charsà-bancs*, and during the evening a launch trip on the river was arranged. Despite the somewhat unfavourable weather the proceedings were voted a complete success, and the thanks of all were extended to the Committee and to the the firm's publicity manager, Mr. H. V. Richards, who acted as master of the ceremonies.

Elliott's Social Association's Sports and Fete.

The annual sports meeting and garden fête of the ELLIOTT SOCIAL ASSOCIATION (Elliott Brothers (London), Ltd., Century Works, Lewisham) was held recently at Colfe's Grammar School Ground at Eltham Green, about 630 members and friends being present. The representatives of the company included Mr. W. O. Smith (President, E.S.A.), Sir Keith Elphinstone, and Mr. L. W. Smith, with their wives and friends.

The sports programme included a variety of events. Competition in the inter-departmental tug-of-war this year was very keen, and the silver challenge cup presented by Mr. W. O. Smith went to the Tool Room team; the Indicator Shop team were runners-up after an exciting struggle. A silver challenge cup was also given by Sir Keith Elphinstone for the inter-departmental relay race, which was finally won by the Staff team. The invitation relay race of one mile was won by the team from Siemens Brothers and Co., Ltd., of Woolwich.

Side shows and competitions, all in charge of members of the E.S.A., together with the band of the 91st (T.F.) Brigade, R.A.F., contributed to the success of the meeting. The prizes were, with a few exceptions, given by the directors of Elliott Brothers, and were presented by Lady Elphinstone.

American Electrical Exports.

Increased Trade in Small Appliances.

According to preliminary figures given in "Commerce Reports," exports of electrical apparatus and supplies from the United States during the first six months of 1923 were valued at $34 514 924, a gain of $2 894 412 over the figures for the corresponding period last year. It is interesting to note that the increase is accounted for mainly by increased business in small appliance and supply lines rather than in heavy equipment.

The total value of electrical generating apparatus exported was $2 025 171 during the first six months of 1923—a 6.8 per cent. increase over the same period of 1922. Shipments of mechanical-drive turbines taken alone, however, were less this year than last year. In value the export shipments of self-contained lighting plants during the first half of 1923 were nearly double those of the same period of 1922. Over 1 200 lighting sets were shipped between January and July of this year.

Dry-battery exports increased about 36 per cent. in number and 15 per cent. in value during the six months of 1923 over the corresponding period of 1922. Storage-battery shipments also showed a heavy increase, $1 224 572 worth being the amount exported in the first half of 1923, while the total was only $653 539 for the same period of 1922. Shipments of transformers, converters, switchboards, circuit breakers, and lightning arresters aggregated $4 384 619 in value during the 1923 period. This is somewhat less than the exports during the same period of last year, which were swelled by large individual shipments of power-plant equipments.

Proposals for the Economic Conference.

Financial Assistance for Electricity Undertakings.

That financial assistance should be given to electricity undertakings, railways and tramways, and that immediate steps should be taken to put in hand, in the Dominions and Colonies, the erection of wireless receiving and transmitting stations, either under the control of the Dominion and Colonial Governments, or in conjunction with private enterprise, are among the recommendations put forward by the Association of British Chambers of Commerce for the consideration of the Imperial Economic Conference.

It is also recommended that all questions affecting trade between Great Britain and the Dominions and other parts of the Empire, especially with respect to tariff and kindred questions, should be dealt with by a permanent standing committee in London, with a view to improving trade relations. The codification of the laws relating to patents and trade marks is suggested, and the Association also favours the assimilation of the commercial laws of the Empire and the improvement and unification of certificates of origin. It is also urged that a further attempt should be made to secure the adoption by each of the Dominions and each part of the Empire of the forms of invoice and certificates of origin recommended by the Imperial Customs' Conference, 1921.

Electrical Exhibition at Aylesbury.

Educating the Consumer to Use Modern Appliances.

Following the inauguration of the new turbo-alternator set at Aylesbury electricity works last week (described elsewhere in this issue) consumers of electricity were afforded the opportunity of visiting an interesting exhibition of modern electrical appliances organised by Mr. W. A. TURNBULL, the borough electrical engineer, in the Town Hall. Cookers of various types were shown, and demonstrations were given by the British Electric Transformer Co. on their "Tricity" cookers. Among the smaller appliances on show were fans, irons, kettles, coffee percolators, immersion heaters, fires, shaving mugs, toasters, soldering irons, a lamp socket oven and a hair dryer by L. G. Hawkins and Co., boiling rings, ovenettes, toasters, fires, irons and a boudoir utility set by the Hotpoint Co. All types of pipelighters and shaving water-heaters by Victor Ashby and Son, and egg-boilers, plate warmers, fires and irons by Metropolitan-Vickers Co. The "Calora" electrically-heated foot-muff, stool, bed-warmer, heating pad and carpet by Du Bois and Co., was an interesting exhibit. Among the fires shown was a hot-water radiator by Benham and Sons, and air-heaters by Metropolitan-Vickers Co. Walter D. Fair and Co. gave demonstrations with a "Sunnysuds" washer and wringer, and with an electrically-driven sewing machine. The "Blighty" washer and wringer, and the floodlights with which the hall was illuminated, were shown by the G.E.C. Co., and various types of lighting fittings were exhibited by the B.T.-H. Co. The Electricity Department demonstrated the vacuum cleaner which they hire out together with a range of hire irons.

Electricity in the Home.

A Popular Exhibition at South Shields.

To demonstrate the variety of uses to which electricity can be applied in the home an exhibition of domestic electrical appliances is being held at South Shields during this week and next week. Arranged jointly by the South Shields municipal electricity undertaking and the General Electric Co., the opening of the exhibition coincided with the Corporation's decision to effect substantial reductions in the electricity charges, particularly for domestic purposes.

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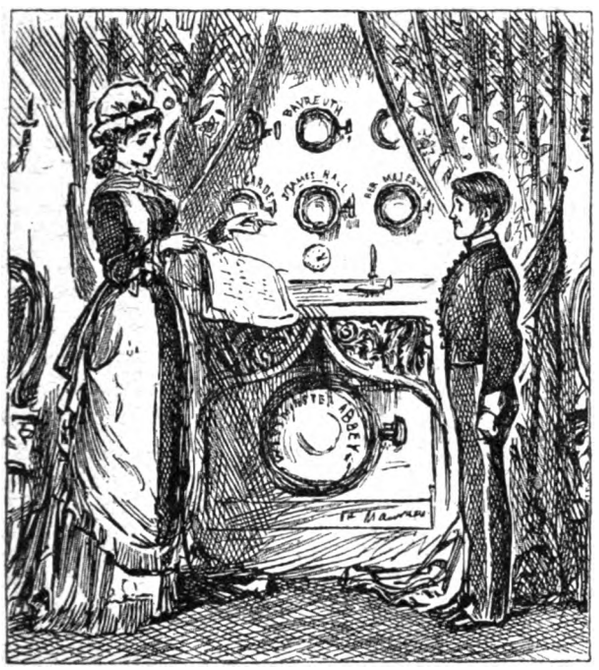
A Broadcasting Prophecy by George du Maurier.



Musical Mistress of House ("*on hospitable thoughts intent*"). "NOW, RECOLLECT, ROBERT, AT A QUARTER TO NINE TURN ON 'VOI CHE SAPETE' FROM COVENT GARDEN; AT TEN LET IN THE STRINGED QUARTETTE FROM ST. JAMES'S HALL; AND AT ELEVEN TURN THE LAST QUARTETTE FROM 'RIGOLETTO' FULL ON. BUT MIND YOU CLOSE ONE TAP BEFORE OPENING THE OTHER."

Buttons. "YES, MUM!"

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BY THE TELEPHONE SOUND IS CONVERTED INTO ELECTRICITY, AND THEN, BY COMPLETING THE CIRCUIT, BACK INTO SOUND AGAIN. JONES CONVERTS ALL THE PRETTY MUSIC HE HEARS DURING THE SEASON INTO ELECTRICITY, BOTTLES IT, AND PUTS IT AWAY INTO BINS FOR HIS WINTER PARTIES. ALL HE HAS TO DO, WHEN HIS GUESTS ARRIVE, IS TO SELECT, UNCORK, AND THEN COMPLETE THE CIRCUIT. AND THERE YOU ARE!

From "Punch," December 14th, 1877.

Electrical Imports and Exports.

Nearly Eight Million Pounds' worth of Exports this Year.

IMPORTS.—The following are official values of electrical machinery, apparatus, and material imported into this country (*a*) during August 1923, and (*b*) the aggregate figures from January 1st to August 31st, with increase or decrease compared with corresponding periods of 1922:—

Electrical machinery, (*a*) £72 926 (decrease £102 008), (*b*) £678 791 (decrease £232 985); telegraph and telephone cables, submarine, nil; other than submarine, (*a*) £5 500 (decrease £4 553), (*b*) £61 267 (increase £42 115); telegraph and telephone apparatus, (*a*) £27 218 (decrease £21 729), (*b*) £335 126 (increase £167 952); other electrical wires and cables, rubber insulated, (*a*) £8 155 (decrease £643), (*b*) £73 866 (increase £6 861); with other insulations, (*a*) £16 691 (increase £9 906) (*b*) £87 403 (increase £40 489); carbons, (*a*) £11 174 (increase £9 217), (*b*) £48 387 (increase £24 702); glow lamps, (*a*) £13 766 (increase £3 173), (*b*) £117 324 (increase £8 280); arc lamps and electric searchlights, (*a*) £461 (increase £456), (*b*) £2 689 (increase £2 400); parts of arc lamps and searchlights (other than carbons), (*a*) £516 (decrease £50), (*b*) £9 639 (increase £1 590); batteries, (*a*) £12 478 (decrease £7 732), (*b*) £85 144 (increase £26 656); electrical instruments (commercial and scientific), and electricity meters, (*a*) £6 132 (increase £288), (*b*) £63 708 (increase £18 854); switchboards, (*a*) nil (decrease £428), (*b*) £1 927 (decrease £499); other electrical goods and apparatus, (*a*) £66 039 (increase £32 081), (*b*) £536 400 (increase £214 505). Total of electrical machinery, apparatus and material (other than uninsulated wire), (*a*) £241 056 (decrease £77 376), (*b*) £2 101 671 (increase £320 880).

EXPORTS.—The exports of electrical machinery, apparatus and material, produced or manufactured in the United Kingdom, (*a*) during August, 1923, and (*b*) from January 1st to August 31st, with increase or decrease compared with corresponding periods of 1922, were as follows:—

Electrical machinery, (*a*) £236 104 (decrease £12 784), (*b*) £2 492 750 (decrease £475 694); including railway and tramway motors, (*a*) £31 832 (increase £20 166), (*b*) £208 954 (increase £91 648); other generators and motors, (*a*) £111 050 (decrease £2 584), (*b*) £1 288 235 (decrease £261 516); and other electrical machinery, (*a*) £93 222 (decrease £30 366), (*b*) £995 561 (decrease £305 826); telegraph and telephone cables, submarine, (*a*) £220 557 (increase £173 775), (*b*) £537 458 (increase £290 709); other than submarine, (*a*) £40 913 (decrease £9 846), (*b*) £572 788 (increase £182 577); telegraph and telephone apparatus, (*a*) £104 888 (decrease £44 504), (*b*) £1 216 946 (decrease £80 429); other electrical wires and cables, rubber insultated (*a*) £68 289 (decrease £789), (*b*) £659 484 (increase £231 339); with other insulations, (*a*) £43 380 (decrease £41 133), (*b*) £592 874 (decrease £116 321); carbons (*a*) £3 468 (decrease £3 104), (*b*) £42 658 (increase £9 739); glow lamps, (*a*) £20 706 (decrease £17 102), £209 036 (decrease £45 759); arc lamps and searchlights, (*a*) £46 (increase £16), (*b*) £5 155 (increase £915); parts of arc lamps and searchlights (other than carbons), (*a*) £45 (decrease £144), (*b*) £1 674 (decrease £3 910); batteries, (*a*) £31 969 (increase £6 760), (*b*) £344 585 (increase £37 939); electrical instruments (commercial and scientific) and electricity meters, (*a*) £24 221 (decrease £9 517), (*b*) £216 823 (decrease £8 231); switchboards, (*a*) 2 273 (decrease £3 020), (*b*) £75 338 (decrease £96 112); other electrical goods and apparatus, (*a*) £62 798 (decrease £42 588), (*b*) £882 453 (increase £96 618). Total of electrical machinery, material and apparatus, other than uninsulated wire, (*a*) £859 657 (decrease £3 980), (*b*) £7 850 022 (increase £23 380).

Latest B.E.D.A. Literature.

Electricity of the Past, Present and Future.

The BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION'S latest effort for the British Empire Exhibition is arrestingly entitled, "Think to Scale." It contains an aerial photograph of Trafalgar Square and the adjacent streets and houses; and a plan of the same district on which is superimposed an outline of the halls of Industry and Machinery at Wembley. This pictorial example rubs in the lesson that the Exhibition will be the largest enterprise of its kind yet seen, and the corollary that the electrical industry should see it is worthily represented there.

Two leaflets from the same source deal with the coming of the electric age. When Westminster Abbey was built its stone was bright and clean. Years of smoke have not only destroyed that condition, but necessitated that historic fabric should undergo constant repair and recasing. The expense thus incurred could be saved, according to the London County Council, by the greater use of electricity and gas. But Mr. E. E. LOFTUS, assistant surveyor of the Abbey, points out that gas is just as injurious as coal. "The only final solution," he says—and he speaks from experience—" is electricity." And so say all of us.

A third leaflet reproduces Dr. Steinmetz's prophesy that the Anglo-Saxon race is passing as a world force and that its place will be taken by the Slav. Whether we agree with this or not, we can heartily endorse his further statement that many of the problems which trouble the human race to-day will soon be solved by electricity. Smoke and soot will go and leave the spotless town. There will be no more drudgery, for electricity will become the world's slave. *O fortunata domus!*

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Foreign Notes.

EUROPE.

Light Railway Electrification in France.

It is reported that a scheme is being prepared for the electrification of the Chambery light railways, now steam operated, in the Savoy district of France at an estimated cost of 2 860 000 fr. It is also stated that the Compagnie des Omnibus et Tramways of Lyons, intends to electrify the tramways from Lyons to Saint Priest and from Lyons to Neuville and Trevoux, the latter to be widened to metre gauge. The line from Lyons to Bellecour and Trois Renards is also to be extended and electrified to Charbonnières.

State Subsidised Electrification in Prussia.

Three laws authorising the State to subsidise the electrification of the district along the middle and lower Weser and to acquire an interest in two industrial enterprises operating electric power stations were passed by the Prussian Diet recently, according to the American Consul-General at Berlin, who in a report to the Department of Commerce says that the State is authorised to spend 26 000 000 000 marks to electrify the region along the middle and lower Weser, to guarantee to the extent of 26 000 000 000 marks any loans issued by a corporation operating this enterprise, and to disburse 11 400 000 000 marks towards laying State-owned cables and constructing plants which will connect the high-power station at Hanover with the State-owned cables in the region of the upper Weser.

The State is authorised to acquire an interest in the Ostpreussenwerk A. G., an electric power station, by the purchase of shares to the extent of 200 000 000 marks, on the understanding that the capital stock shall be increased to 600 000 000 marks; in addition, to grant the enterprise a non-recallable loan of 750 000 000 marks, to hold at its disposal another 4 250 000 000 marks, and to guarantee, in conjunction with the Reich and the Province of East Prussia, a further issue of 30 000 000 000 marks in bonds.

The State is authorised to acquire, to the extent of 250 000 000 marks, an interest in the A. G. Ueberlandwerk Oberschlesien, an electric power station the establishment of which is under consideration, and to undertake to guarantee to the extent of 1 000 000 000 marks any loans issued by the undertaking.

THE FAR EAST.

Electricity Supply Developments in China.

The Wuching Electric Power Co., formerly the Cheng Sun Electric Light Co., has increased its capital by $200 000 and is installing new plant.

An electricity supply company has been formed with a capital of $20 000, at Poynanchen, Tunghsiang, Chekiang. The Ministry of Communications has approved the application for registration submitted by the promoters.

Electric Fans for South China.

Annual sales of electric fans in South China, where the long hot summers make them a necessity for home and office use, are estimated at about 7 000 oscillating fans and 1 000 ceiling fans, all of which are imported and sold through Hong Kong. According to "Eastern Engineering," the United States supplied approximately 70 per cent of the imports, followed by Great Britain with 20 per cent., the balance coming from Italy, Germany and other European countries. It is expected that these trade proportions will show a distinct variation in the future, as European makers are reducing their prices between 20 and 60 per cent., and accordingly should receive many more orders. The standard voltage for fans is 220 for Hong Kong and 100 for all the near-by markets, such as Kowloon, Canton, and Swatow.

Continuous Passenger Transportation.

Practical Demonstration at Southend.

The Adkins-Lewis system of passenger transportation was first referred to at the British Association meeting in 1911 (see THE ELECTRICIAN, vol. lxvii., p. 903); but with the exception of a small experimental railway erected at Ipswich there has hitherto been no opportunity of observing how the system would operate under practical conditions. Mr. YORATH LEWIS, and his associates in "Never-Stop" Transit, Ltd., have now erected a large railway at the Kursaal Gardens, Southend-on-Sea. At a demonstration last Saturday, inaugurated by SIR JOHN FRANCIS, we were able to see the railway in operation.

As is well known, the system comprises the provision on a circuitous route of a series of independent cars, positively controlled and driven by a spirally-threaded shaft laid between the rails, each car engaging one of the spirals by a pair of rollers, one on each side of the thread. The shaft extends throughout the route, and is rotated at constant speed. Consequently, the speed imparted to the cars is proportional to the pitch of the spiral engaged; to give slow speed at station places the pitch is, therefore, close, and to give high speed *en route* the pitch is six or eight times greater; the intermediate pitches, to give the necessary acceleration and deceleration are graduated.

Power is supplied by two 40 H.P. d.c. motors, situated one at each end of the line, both being governed by an electrically-operated contactor controller worked automatically by press-buttons at the stations. Owing to the small size of the present railway kinetic braking of the motors is not attempted, but each motor is fitted with a solenoid brake capable of bringing the entire system to rest in a few seconds. No brake or signal apparatus is required on the railway.

"Garcke."

Twenty-six Years of Electrical Development.

Electrical engineers ought to be impressed, even if they are not, with the progress the industry is making. Statistics, speeches, and articles which are published from time to time all go to show that though we are not getting on quite so fast as everyone would like, yet we are getting on.

The latest proof of this great truth is to be found in the twenty-sixth issue of the "Manual of Electrical Undertakings and Directory of Officials," more conveniently and generally known as "Garcke." In 1896 the capital invested in municipal and privately-owned electricity supply undertakings was £61 109 525; in 1922-23 it was £650 440 552, not far short of eleven times as much and covering 1 467 undertakings. This is not a bad record for less than thirty years' existence, and makes us wonder what it might be under more enlightened conditions. This capital has not been invested without return, and an interesting table shows that the dividends have been risen slightly throughout that period. For instance, in the supply section of the industry the average rate of dividend in 1901-02 was 4·79 per cent, and in 1922-23 5·8 per cent., the highest figure yet recorded. The average overall rate of 493 electrical companies is 5·11 per cent, or very slightly less, ¼ of 1 per cent., than it was last year.

Bigger Revenue and Smaller Costs.

A useful section of the manual is the tables analysing the accounts of 217 municipal and 130 privately-owned electricity supply undertakings. The average revenue in the case of the companies was 2·91d. per kWh sold, and in the case of the municipalities 2·53d., the average working costs being 1·79d. and 1·67d. respectively. The revenue in both cases has risen, and the working costs have fallen slightly in both cases during the past year, and we therefore hope that it will be found possible to do something more than has been done in the reduction of price. The technical statistics indicate that the slump has had its effect on the electrical industry—an effect which we hope will soon pass.

It is, however, a work of supererogation to continue to talk about "Garcke" and its contents. Both are, of course, known to all readers of THE ELECTRICIAN, and we do not anticipate that the latest edition with all its information will prove less useful or be less frequently consulted than its predecessors have been. It is, of course, published by the Electrical Press, and its price is 30s. net.

Forthcoming Books.

Comprehensive Wireless Publications.

Two important books on the ever-popular subject of wireless are announced for publication this month by ERNEST BENN, LTD. The first is a treatise on "The Poulsen Arc Generator," by the well-known authority, Mr. C. F. ELWELL, to whom chiefly is the credit due for its practical development. Hitherto, scientists and practical men alike have had to rely on isolated articles in the technical Press for information as to the progressive and far-reaching developments in design which have marked every successive installation. Mr. Elwell's book is plentifully illustrated, provided with an exhaustive bibliography, records all the forms which different designing engineers have given to the generator, and analyses their respective advantages.

Mr. PARR'S work on the "Principles and Practice of Wireless Transmission"—from the same publishers—is, like Mr. Elwell's book, the first to be devoted exclusively to its subject. The theory of the production and control of wireless waves is treated from first principles, and set out in plain, concise language. The different systems of transmission are critically examined, and a special section of the book is devoted to the practice of transmission and to the rules and regulations governing it at the present time. Every experimenter in wireless reception is a would-be experimenter in transmission, and this book should thus be assured a wide and immediate welcome.

Among the forthcoming books announced by the Old Westminster Press is the 3rd edition of "Popular Fallacies," by A. S. E. ACKERMANN. The 2nd edition appeared in 1909. The new edition will contain 696 pages of new matter and deal with 1 350 fallacies, including the 460 dealt with in the earlier edition.

Books Received.

"Friction." By T. E. Stanton. (London: Longmans, Green and Co.) Pp. 183. 12s. 6d. net.

"Alloys Resistant to Corrosion." A General Discussion. (London: The Faraday Society.) 5s. 6d. net.

"Small Electric Motors." By E. T. Painton. (London: Sir Isaac Pitman and Sons.) Pp. 120. 2s. 6d. net.

"Recent Developments in Atomic Theory." By Leo Graetz. (London: Methuen and Co.) Pp. xi+174. 9s. net.

"Garcke's Manual of Electrical Undertakings." Volume XXVI. 1922-23 Edition. (London: Electrical Press, Ltd.) Pp. 1 670. 30s. net.

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Electricity Supply.

Extensions and Developments.

SKIPTON was lighted electrically for the first time last week.

It is stated that work on the WOODBURY electric lighting scheme will be commenced shortly.

BACUP Town Council proposes to lay a power cable from Market Street to Weir Mile.

AMBLE Urban Council has decided to proceed with the erection of a new sub-station in Scott Street.

A public meeting of WORMIT residents has decided to form a company to supply electric light to the town.

FULHAM Electricity Committee recommends the expenditure of £400 on the extension of mains in Chancellors Road.

A scheme for supply of electricity to the Cefn Forest district by the BEDWELLTY Urban Council is estimated to cost £4 090

CLACTON Electricity Committee intends to relay a section of the distributing main between Station Road and the Anglefield.

PAISLEY Town Council is applying to the Electricity Commissioners for sanction to borrow an additional amount of £7 000 for capital expenditure.

BARNSLEY Town Council has applied to the Electricity Commissioners for a loan of £34 250 for the purchase of additional plant for the electricity works.

CREWE Town Council has decided to canvass the residents in Bedford Street and Chetwode Street as to taking supplies of electricity with a view to the extension of the cables at a cost of £640.

BLACKPOOL Town Council is applying for sanction to borrow £10 000 for duplicate feeders and pilot cables between the electricity works and the southerly boundary of the borough at Squire's Gate.

WARRINGTON Electricity Committee is applying to the Electricity Commissioners for sanction to a loan of £25 000 to cover the cost of an electricity supply scheme. Steps are being taken with a view to providing a sub-station at Newton-le-Willows.

NELSON Corporation is applying to the Electricity Commissioners for permission to instal a 250 kW rotary converter at an estimated cost of £2 209 and for permission to instal a turbo-generator set of 6 000 kW capacity at an estimated cost of £24 000.

The extension at BLACKPOOL Electricity Works is being formally opened on Monday next. The Mayor, Councillor H. Brooks, as chairman of the Electricity Committee, is inviting members of the Council to the opening ceremony. Afterwards the guests will be entertained to tea, and to a special wireless concert.

Alterations in Charges, Proposed and Actual.

PONTYPRIDD Urban Council is recommended to reduce electricity charges by a halfpenny per kWh from next quarter.

TURTON Council has decided to reduce the price of electricity for lighting to 6d. per kWh; for domestic purposes to 2d. and for power to 3d. per kWh for the first 500 kWh and 2d. per kWh afterwards, the new charges to come into force on October 1st.

That the cooker hire charges be reduced from 10s. to 5s. per quarter for small cookers and from 15s. to 7s. 6d. for large cookers is recommended by HACKNEY Electricity Committee. A reduced scale of charges for lighting, heating, power, etc., is also recommended as from the meter readings for the September quarter.

FULHAM Electricity Committee recommends that as from the September meter readings the charges for electrical energy be further reduced as follows:—For private lighting, from 5½d. to 5d. per kWh; slot meters, from 6d. to 5½d.; for power and heating, from 1½d. to 1⅜d. per kWh; and public lighting, from 1⅜d. to 1·65d. per kWh.

ST. PANCRAS (London) Electricity Committee recommends the following reductions in charges from the September meter readings:—Lighting, from 5d. to 4½d. per kWh; factory lighting and cinema theatre supplies, from 5d. to 3d.; and the kilowatt demand system charge from £1 440 per annum plus 1d. per kWh to £720 per annum plus 1d. per kWh.

SUNDERLAND Town Council has decided that during two winter months in each year a rebate of 50 per cent. shall be made in the charge for electricity used for shop window lighting and advertisement signs (excluding licensed premises) observable from the public streets after 6.30 p.m., conditional upon the full shop window or sign lighting being continued to 9.30 p.m., or later, at the option of the consumer.

Tapping New Areas.

QUEENSBURY District Council is applying to the Halifax and Bradford Corporations inquiring their terms for a supply of electricity to the parts of Queensbury already covered by the trams of these authorities.

SHEPTON MALLET Urban Council has received an offer from a commercial electricity undertaking to light the town electrically. It is understood that the company is submitting similar proposals to various other towns of similar size.

Inquiries and Orders.

The Ministry of Transport has granted an order enabling the Whitstable Electricity Co. to charge 9d. per kWh for lighting and 4½d. for power, the Urban Council having the privilege of applying for a revision after three years.

A draft Order, having for its object the co-ordination of electricity supplies in the WEST RIDING, has been submitted to the local authorities and other interested parties in the area concerned, and their replies are expected during the present month.

The Cambrian Electricity Supply Corporation has applied to the Electricity Commissioners for a Special Order to generate and distribute electricity in the DOLGELLY urban district. Any objections must be sent to the Secretary, Electricity Commission, Whitehall, London, by October 1st.

The Ministry of Transport has issued an order fixing the maximum charge for electricity at AYLESBURY at 9d. per kWh, with minimum payments of 11s. 3d. for each winter quarter and 7s. 6d. for each summer quarter. The Town Council has decided to charge 9d. per kWh instead of 10d. as from July 1st last.

LEICESTER Corporation has applied to the Electricity Commissioners for a Special Order extending the Corporation's area for electricity supply to Thurmaston urban district, parts of Billesdon, Barrow-upon-Soar and Blaby rural districts. Any objections to the Secretary, Electricity Commission, Whitehall, London, by October 1st.

In connection with the LONDON ELECTRIC SUPPLY CORPORATION'S application for a special Order to supply power for the Southern Railway's electrified lines announced in THE ELECTRICIAN several weeks ago, it is understood that a number of objections are likely to be received on the ground that the order would infringe the existing rights of supply of undertakings on the route of the Southern Railway.

MELKSHAM Urban Council is the only one of the local authorities concerned in the West Wilts electricity scheme, which is not satisfied with the proposals of the promoters. At a meeting of the Council last week the Clerk stated that Mr. Edwards, the principal promoter, could not see his way clear to meet the Council any more, and if the Council was not prepared to accept the terms he was afraid that the company would have to apply for an order, and then the Council's objections would be overruled by the Electricity Commissioners.

RUGELEY Urban Council has informed the Electricity Commissioners of its opposition to the inclusion of the urban district in the Cannock Electricity Extension Order, on the grounds that the Council is of opinion that the distribution of electricity should be in its own hands, and that in view of there being a probability of the erection of a power station in or near Rugeley, the Council would be in a position to distribute electricity at a cheaper rate, or failing that, a bulk supply could be obtained from the Cannock Urban Council.

Personal Items.

FLIGHT-LIEUT. E. T. CARPENTER, Royal Air Force, has joined the Electrical and Wireless School, Flowerdown, for a course of instruction.

CAPTAIN J. ARTHUR SPENCER states that he has ceased to have any connection with the business of A. C. Alexandra and Co., of Westminster, London.

SIR CHARLES AND LADY BRIGHT and family are leaving Leigh Grange on or about September 27th for Little Brewers, Hatfield Heath, Harlow, Essex, which will be their permanent address in future.

Mr. HARRY BAKER, who has been for 21 years accountant and commercial assistant of the Bournemouth Corporation tramways' department, has been presented with a cheque upon his resignation from that position to become manager of the Westcliff Motor Services.

MR. H. S. BINNS informs us that he has relinquished his appointment with Ferranti Ltd., and has started in business as an agent. He has taken over the representation of the Hackbridge Electric Construction Co. (for transformers) and the Hackbridge Cable Co. (for cables), for the Manchester and Birmingham districts. For the present his address will be 10, Parkfield Road, New Moston, Manchester, the telephone number being "Failsworth 13."

OBITUARY.—For many years sales manager to Edison and Swan, and until recently connected with Conolly Brothers, of Manchester, MR. OLIVER H. BISHOP has died, aged 65 years. The death has occurred under painful circumstances of Mr. FRANK L. GARSTANG, station superintendent on the staff of Bolton Electricity Department. Mr. Garstang, who was taking a trip to the Canary Islands for the good of his health, had only been four days at sea when his illness became acute, and he died last Saturday, almost within sight of Liverpool.

WILL.—MR. REGINALD LAURENCE, of Felthorpe Hall, Norwich, of Laurence, Scott and Co., electrical engineers, of Norwich, who died in London on July 22nd last, aged 66, left £148 918. In addition to various bequests to charities he left £200 to the recreation fund of Laurence, Scott and Co.; £200 to William Harding Scott, his colleague at Gothic Works, Norwich; £100 to James William Bransby, works manager at Gothic Works; £50 to his clerk, Charles Nelson Beales; £25 to Alexander James Sutherland if in the service of Laurence, Scott and Co., to each member of the staff, foreman, and workman who shall have been continuously in the service of the company since January 1st, 1900, £10, a further £10 to those in such service since January 1st, 1895, and a further £20 to those in such service since January 1st, 1890.

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Tenders Invited and Accepted.

GREAT BRITAIN.

NORTHAMPTON CORPORATION.—Relaying 1 624 yards of permanent way of tramway in Kettering Road and Gold Street. Specifications from the Borough Engineer, Guildhall, Southampton.

LEICESTER CORPORATION.—Four water-tube boilers, with superheaters, economisers, etc., for duty of 45 000 lb. an hour each at 285 lb. pressure. Specification from the City Electrical Engineer.

ORKNEY HARBOUR COMMISSIONERS, September 22nd.—Electric lighting of Kirkwall Pier. Specification from Mr. J. A. Liddle, Pentland Engineering Works, Gorgie, Edinburgh.

HADDINGTON CO-OPERATIVE SOCIETY, September 24th.—Electric light and power installation work in connection with alterations to buildings at Market Place, North Berwick. Schedules, etc., from Mr. Thos. Deans, General Manager, Lodge Street, Haddington.

MANCHESTER BOARD OF GUARDIANS, September 26th.—Twelve months' supply of electric lamps. Forms of tender from the Clerk, Union Offices, All Saints, Manchester.

ORMSKIRK GUARDIANS, September 26th.—One 40 kW steam-driven generating set. Specification, etc. (£2 2s., returnable), from Mr. G. J. Gibbs, 7, Lune Street, Preston.

MANCHESTER CORPORATION, September 29th.—Motors, with speed reduction gear, transformer and converting plant, cable, etc., required in connection with the conversion of two sets of reciprocating hydraulic pumps to electric working. Specifications from the Secretary, Waterworks Offices, Town Hall, Manchester.

MIDLOTHIAN AND PEEBLES DISTRICT ASYLUM, ROSSLYNLEE, September 29th.—Six months' supply of electrical fittings, oils and paints, etc. Forms of tender from the Clerk and Treasurer, 19, Heriot Row, Edinburgh.

EDINBURGH CORPORATION, October 1st.—Electricians' work in connection with the erection of two blocks of buildings (nine two-storey houses) at Clark Avenue, Bangholm. Specifications from Mr. J. D. Gibson, 60, Frederick Street, Edinburgh.

WARRINGTON CORPORATION, October 1st.—Motor-driven air compressor for the Electricity and Tramways Department. Specification from the Borough Electrical and Tramways Engineer.

CENTRAL LONDON DISTRICT SCHOOL, October 5th.—Extension of electric lighting installation. Specification, etc. (10s., returnable), from the Clerk to the Managers.

LONDON COUNTY COUNCIL, October 8th.—Repair and relaying, etc., of l.t. cables. Specification from the General Manager of Tramways, Embankment, W.C.2.

NEWCASTLE-ON-TYNE CORPORATION, October 15th.—Remodelling heating and lighting installation at the City Hospital, Walker. Plans, etc., from Mr. Ernest Hatton, Transport and Electricity Undertaking, Manors, Newcastle-on-Tyne.

PRESTON CORPORATION, October 15th.—(1) Two 1 500 kW rotary equipments (Spec. R.P.S.6); (2) h.t. and l.t. switchgear (Spec. R.P.S.7); (3) h.t. cables (Spec. R.P.S.8.). Specifications, etc., from the Town Clerk, Town Hall, Preston.

AUSTRALASIA.

CITY ELECTRIC LIGHT CO., BRISBANE, October 31st.*—One 12 500 kW turbo-alternator.

DENMARK.

COPENHAGEN MUNICIPALITY, October 11th.*—Electric crane for unloading coal from ships at the quay side.

IRELAND.

ST. COLUMBA'S CHURCH, DRUMCONDRA, September 22nd.—Electric wiring and fitting. Specification from J. P. Tierney and Co., 44, Kildare Street, Dublin.

DUBLIN CORPORATION, September 24th.—Coal-meters for use in conjunction with the mechanical stokers at the Pigeon House Electricity Works.

PURDYSBURN ASYLUM, BELFAST, September 24th.—Six months' supply of electrical fittings, oils, etc. Forms of tender from the Secretary.

DUBLIN CORPORATION, September 29th.—One 38 H.P. three-phase motor. Specification, etc. (£1 1s., returnable), from the City Electrical Engineer, Fleet Street, Dublin.

NEW ZEALAND.

HOROWHENUA ELECTRIC POWER BOARD, October 3rd.*—Lightning arresters, switches, etc.

WELLINGTON PUBLIC WORKS DEPARTMENT, November 27th.*—Two recording instrument panels.

SOUTH AFRICA.

JOHANNESBURG MUNICIPAL COUNCIL, November 1st.*—Joint box compound, cutouts and insulating tape.

URUGUAY.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO.*—24 750 fuse fittings, including bipolar or tripolar fuses for Edison screw plugs.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO, November 5th.*—White varnished porcelain insulators, etc.

THE PREMIER ARMATURE CO., has carried out the electric light installation work in Oswaldtwistle town hall.

The tender of G. T. Walker for electric wiring and fitting of the DUDLEY GUARDIANS' Institution, at £1 255, has been accepted.

BRIERFIELD DISTRICT COUNCIL, has accepted the tender of H. Ashworth for electric light wiring and fitting on the Market Ground, £66 15s.

STAFFORD CORPORATION has accepted the tender of Ferguson Pailin, Ltd., for two sets of switchgear for sub-stations at £397 per set, exclusive of transformers and l.t. panels.

MANCHESTER CORPORATION has accepted the tender of T. A. Livesey for two electric fans for the Gas Committee, and that of the Vaughan Crane Co. and Higginbottom & Mannock for cranes for three sub-stations for the Electricity Committee.

A message from VICTORIA, B.C., states that a contract involving an expenditure of approximately $350 000, for electrical pumping machinery with a capacity of 180 000 gals. per min., and other equipment, has been awarded by the Federal Department of Public Works for the electrical work in conjunction with the new dry dock at Esquimalt.

A contract for electrical propelling apparatus and switchgear for a barge built for the STANDARD OIL COMPANY, of New Jersey, by the Newport News Shipbuilding Co., has been secured by the Westinghouse Electric and Manufacturing Co. The vessel will be self-propelling, two McIntosh and Seymour Diesel engines driving two 185 kW Westinghouse generators, which supply current to the main motor of 455 H.P.

* Particulars from the Department of Overseas Trade.

Institution Notes.

At LIVERPOOL UNIVERSITY on Monday the honorary degree of Doctor of Science was conferred *inter alia* upon Sir Ernest Rutherford and Prof. Niels Bohr.

The NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS has granted Mr. W. Heighway, of Manchester, a scholarship, value £6, and Mr. R. W. J. Stark, of Edinburgh, a scholarship, value £7, both payable in annual instalments, for three years.

The opening meeting of the INSTITUTION OF ELECTRICAL ENGINEERS will take place on Thursday, October 18th, when Dr. Alexander Russell will deliver his inaugural address as president. The premiums awarded for last Session's papers will be presented on this occasion.

A lecture on "Development in Powdered Fuel Firing on Steam Boilers and Metallurgical Furnaces," by Mr. J. S. Atkinson, will be delivered before the ELECTRICAL POWER ENGINEERS' ASSOCIATION (SOUTHERN DIVISION) at the Institution of Electrical Engineers, Embankment, London, W.C.2, on October 5th, at 7 p.m.

THE NATIONAL UNION OF SCIENTIFIC WORKERS announces the formation of a new branch at Siemens Brothers and Co., Woolwich. The chairman of the Siemens Branch is Mr. J. J. Ferguson; the treasurer, Mr. H. S. Double; and the secretary, Mr. S. G. Warren. This makes the second purely industrial branch in the Union.

Premiums awarded by the Council of the INSTITUTE OF TRANSPORT in respect of the session, 1922–23, include: Railway (Operating) Gold Medal to Sir Philip Dawson, M.P., for paper on "The Financial Investigation of the Prospects of Railway Electrification." Railway (Engineering) Gold Medal to Sir Robert Hadfield, for paper on "Modern Trackwork and its Importance"; Institute Silver (Graduate) Medal to Mr. E. W. Bayliss for paper on "Tramways: Their Scope and Object, etc." These and other papers will be presented at the meeting of the Institute to be held in the lecture theatre of the Institution of Electrical Engineers on October 1st.

Forty Years Ago.

"The Electrician," September 22nd, 1883.

INTERRUPTION OF TELEGRAPHIC COMMUNICATION.—On Saturday night last, telegraphic communication between Paris and London was interrupted for several hours by a storm affecting the wires.

* * *

THE ELECTRIC LIGHT FOR NIGHT WORK.—The contractor for the rebuilding of the Alhambra Theatre, Mr. Brass, uses eight Fyfe-Main arc lamps to enable his workmen to proceed with their work at night, in order to complete his contract within the specified time.

* * *

LIGHTNING IN AMERICA.—The idea that lightning is not so destructive as it used to be in the United States, because the network of railroads and telegraph wires lessens the number of accidents, is met by the record of the summer. Fatal thunderbolts have never been more common.—"Scientific American."

* * *

ELECTRICITY IN PARIS.—The Compagnie Electrique Métropolitaine gave a banquet at the Grand Hotel, Paris, on Tuesday, to inaugurate the lighting of the large dining-room by electric lamps. The room was lighted by gas until the first toast, "Electricity," was proposed, when the electric lights were switched on. Subsequently, the omnibus which has been fitted up for electric propulsion, as mentioned in our last week's "Notes," was inspected by the guests.

* * *

UNIVERSITY COLLEGE, DUNDEE.—From the syllabus of this college we notice that a special course of lectures will be delivered by Prof. Ewing during the winter session on Electrical Engineering. Students who enter for this course must satisfy the professor that they possess a sufficient previous knowledge of electricity. A special laboratory has been fitted up at the college, where students can put into practice what they have learnt in the lecture room. A dynamo, gas engine, forge, and wood and metal working tools are all to be found there.

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Electric Traction.

Tramway Extensions and Developments.

HACKNEY Finance Committee recommends the expenditure of £5 580 in connection with the proposed tramway in Amhurst Park.

Reconstruction of the Portobello tramway depot, at a cost of £4 000, and the erection of new offices in Leith, to cost £3 000, are recommended by the EDINBURGH Tramways Committee.

SUNDERLAND Corporation is to lay down a single track siding at Roker, at a cost of £650, to facilitate the loading of passengers there during rush hours and to avoid delay to through cars from Sea Lane to the town.

Nearly a mile in length, another extension of the GLASGOW tramway system was opened last Sunday. The extension connects the existing lines at Govan to Craigton Road, but it is intended that the line ultimately will link up with the Paisley Road tramway. A new route from Battlefield to Carlton Place was opened last week.

In conjunction with the arterial road scheme at BIRMINGHAM, a new electric tramway is to be made from the existing terminus at Selly Oak to Rednal and Rubery. Built on a concrete foundation, the new tramway is being constructed upon the wood sleeper track principle. The metals will be ballasted with slag, and it is eventually proposed to surface this with soil, sown with grass seed.

Fares, Receipts and Passengers.

PONTYPRIDD Urban Council is to experiment for three months with penny car fare stages.

SUNDERLAND Town Council has adopted a proposal to reduce fares on all routes up to 8 a.m. by a halfpenny, the maximum fare to be twopence.

During the week ended September 8th traffic receipts on LONDON tramways controlled by the Underground Group totalled £41 306, a decrease of £7 050 on the corresponding week last year.

CARDIFF Tramways Committee has decided to co-operate in the city's shopping week and run a decorated and illuminated car. When the cost was discussed, the manager (Mr. R. L. HORSFIELD) said that a £700 increase in tramway receipts resulted from last year's shopping week.

The Ministry of Transport has sanctioned the borrowing by NEWPORT (MON.) Corporation of £10 185 for the reconstruction of tramways in Malpas and Corporation Roads. Sanction to the expenditure of a further £1 155 for tramway reconstruction between Cromwell Road and Milner Street, is to be applied for.

Official returns of 34 of the principal tramway undertakings in the United Kingdom, as published by "The Tramway and Railway World" for the week ended September 1st, give total receipts of £340 711, or £20 452 less than in the corresponding week of last year. The total length of track included in the returns was 1 948 miles. Receipts this year were at the rate of £174 18s. per mile of single track, and last year at the rate of £185 8s., thus showing a decrease for the week of £10 10s. per mile open.

EDINBURGH Tramways Committee recommends a revision of fares which will increase the penny stage by an average distance of 50 per cent., the 2d. by 35 per cent., the 3d. by 42 per cent., and the 4d. by 16 per cent. The average 1d. stage, which is now 1 358 yards, would be increased to 2 032 yards. If approved by the Council, the new fares should be in operation by November. Consideration of the question of season tickets has been delayed pending a report on the experiment at present being carried out at Bradford.

Electric Railway Items.

Traffic receipts on the MERSEY RAILWAY for the week ended September 8th, totalled £4 439, bringing the aggregate total for the year to £162 559.

The laying of conductor rails in connection with the electrification of the South-Eastern section of the SOUTHERN RAILWAY is now proceeding, and 10 miles have already been laid on the Bexley Heath section.

New electric train sheds erected by the LONDON AND NORTH-EASTERN RAILWAY, at Gosforth, which are to be opened shortly, have accommodation for about 150 carriages. A 30-ton overhead travelling crane is installed in the repair shop, where two trains can be dealt with simultaneously.

It is hoped to open the Hendon Central and Brent stations on the new Edgware extension line of the HAMPSTEAD AND HIGHGATE TUBE RAILWAY about the end of October. The two new stations are practically completed, and workmen are now pressing forward with the electrical equipment and permanent way work. It is less than fifteen months since operations on this extension were begun.

Miscellaneous Traction News.

Reuter reports two tramcar collisions at Melbourne on two successive days. The total number of injured is given as 110.

The board of Calcutta Tramways Co. has ascertained that no damage of any kind was done to the property of the company by the recent earthquake disturbance in Calcutta.

Mr. J. Ferguson, chief engineer of the GLASGOW tramways, together with members of the Tramways Committee, attended the demonstration of the "Never-Stop" railway at Southend last Saturday.

The Stamford Hill branch of the Transport and General Workers' Union has passed a resolution stating that the speed of tramcars in London under the new schedules issued by the L.C.C. are considered to be excessive and to entail danger.

Wireless News.

A Franco-Russian Wireless Contract.

The first contract of note concluded between French industry and the Soviet Government has recently been announced by the Compagnie Générale de Télégraphie sans Fil, states the "Manchester Guardian" Paris correspondent. He states that by an agreement which has already been ratified by Moscow the wireless monopoly in Paris—for it is an actual if not a legal monopoly—undertakes to assist the Radio-Electric Trust of Russia to establish stations and other plant throughout the Soviet dominions, receiving in return 40 per cent. of the receipts of the Trust. Beyond that and the fact that the agreement is to last for five years no details are available of this deal.

Broadcasting Developments in the U.S.A.

New York's latest broadcasting station, which is known as "Broadcast Central," and operates under the call letters WJY and WJZ, can be heard by listeners-in on eastern side of the United States. The first mentioned channel operates on a wave-length of 405 m. and the latter on 455 m., separate types of programme being broadcast from each.

The antennæ are strung from two 120-ft. towers situated on the roof at a distance of 175 ft. apart and form two separate four-wire horizontal systems separated by ropes and insulators. The length of the wires forming one system is 45 ft., and the length of the other system is 55 ft. As the output of a high-quality microphone seldom exceeds a few millivolts, considerable amplification is necessary. A three-unit motor generator set is used. One of the generators has a 1 000 V commutator at each end, thus giving 1 000 V for the amplifier plate filter and 2 000 V for the transmitter. The equipment is all duplicated, one set being in reserve, so as to reduce the risk of a breakdown to a minimum.

Wireless Messages from the Arctic Regions.

A long message has been received by the Central News from Mr. F. G. Binney, leader of the Merton College Arctic Expedition, and this has relieved the anxiety which had been felt with regard to the safety of the voyagers in consequence of the breakdown of wireless communication with their little vessel, the "Teringen." The party are in the North East Land, and the message states that the ice will prevent them from circumnavigating the North East Land this year. They recently listened in to a British broadcasting station and heard the items with reasonable clearness. They can claim to be the first Arctic explorers who have had that experience. Mr. Binney adds that his party's messages may be picked up by listeners-in between 9 and 10 p.m. (Greenwich time). The call signal is RRR and the wave-length 440 metres.

Wireless News in Brief.

A new wireless station is to be erected at Vardoe, Norway.

South African listeners-in will pay an annual licence fee of 5s.

A wireless exhibition will be held at Bournemouth Town Hall in November.

Rochford Guardians have rejected a proposal to instal a wireless receiving set at the local workhouse.

According to the Rome correspondent of the "Morning Post" Senatore Marconi has joined the Fascist party.

October 17th is the probable date of the opening of the broadcasting station which is now being erected at Bournemouth.

It is announced that the proposal to erect a Marconi wireless station at Avebury, in Wiltshire, will probably be relinquished.

Wireless receiving sets have been installed upon the "Admirals'" vessels and fish carriers running between Billingsgate and the North Sea fleets.

The experimental use of the carrier circuit system in connection with interchange of broadcasting between London and provincial stations is believed to be responsible for some amusing effects. It is stated that private conversations have been heard in Newcastle-on-Tyne by listeners-in, and, on the other hand, a business man in that city, talking on the telephone, has been heard to remark "Where's this —— music coming from?"

Business Items.

HEMBER AND MALBY, electrical engineers and dealers in wireless and electrical fittings, will shortly open new premises in High Street, Clacton-on-Sea.

Mr. FRED G. ALDEN, electrical engineer, has removed his business from Lloyd's Bank Chambers, Oxford, to more commodious premises at 7, New Road, Oxford.

C. E. HEATH AND CO., insurance brokers, announce that after to-morrow (Saturday) their address will be 36–38, Cornhill, London, E.C.3, and their telephone number, Avenue 2236 (7 lines).

The AUSTIN-RATCLIFFE TRADING CO., of Palace Cinema Chambers, Slough, Bucks, inform us that they are doing an extensive postal business in wireless receiving apparatus, and would be glad to hear from manufacturers through their buying agents, Alexander and Co., 32, Rosebery Avenue, London, E.C.

HOLLINGS AND GUEST, LTD., Thimble Mill Lane, Birmingham, inform us that they are experiencing a big demand for their various hydraulic presses and pumps for foreign and colonial use. At the present time they have machines on order for various parts of the world, including China, India, East Africa, Australia, Gold Coast, etc.

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Companies' Reports, Dividends, etc.

BRUCE, PEEBLES AND CO.—Announcement is made of a dividend at the rate of 7½ per cent. per annum on the cumulative participating preference shares for the half-year ended June 30th.

BRITISH ELECTRIC TRANSFORMER CO.—It is now announced that consideration of the question of the payment of a dividend on the 7 per cent. cumulative preference shares has been deferred until the accounts for the current year can be produced, probably about May, 1924.

SHANGHAI ELECTRIC CONSTRUCTION CO.—Holders of share warrants to bearer are notified that a first interim dividend at the rate of 6 per cent. actual, less income tax at 4s. 7½d. in the £, in respect of the year 1923 has been declared, and will be payable against presentation of Coupon No. 23 on and after October 1st, at the Eastern Bank, Ltd., 4, Crosby Square, London, E.C.3.

Stock Exchange Quotations.

The STOCK EXCHANGE COMMITTEE has granted official quotations to 212 500 £1 fully paid 7 per cent. cumulative participating preference shares of the Lancashire Electric Light and Power Co., scrip, fully and partly paid, for £2 000 000 4½ per cent. A and scrip for £2 000 000 5½ per cent. B mortgage debenture stock of the Newfoundland Power and Paper Co., and $2 772 400 common stock, in £1 shares, of the Consolidated Gas, Electric Light and Power Co. of Baltimore.

Cable, Telegraph and Telephone Companies.

WESTERN UNION TELEGRAPH CO.—The directors announce a quarterly dividend of $1¾ per share.

EASTERN EXTENSION AUSTRALASIA AND CHINA TELEGRAPH CO.—The directors have declared an interim dividend for the three months ended June 30th, 1923, of 5s. per share, free of income tax.

Supply and Lighting.

ELECTRIC SUPPLY CORPORATION.—The directors announce an interim dividend at the rate of 7 per cent. per annum, less tax, on the ordinary shares for the half-year ended June 30th, payable on September 26th. The dividend paid for the corresponding period of 1922 was at the rate of 6 per cent. per annum.

KALGOORLIE ELECTRIC POWER AND LIGHTING CORPORATION.—Holders of the non-cumulative income debenture stock have been notified that the company has a sum of £2 000 available for redemption of this stock at a price not exceeding 7s. in the £. Yesterday (Thursday) was the last day for the receipt of tenders. Notice to those whose tenders are accepted will be posted on or before September 24th, and the company will thereupon make payment against certificates for preference shares duly endorsed. The company does not bind itself to accept the lowest or any offer.

EAST ANGLIAN ELECTRICITY, LTD.—In their report for the year ended March 31st last the directors state that the profit, after making allowance for a dividend on the cumulative preference shares, amounts to £4 196, which they propose to allocate as follows:—Depreciation of freehold and leasehold land and buildings, plant, meters, mains, etc., £2 275; writing off agreement relating to Felixstowe Council Provisional Order £359; carrying forward the balance of £1 562. The directors have utilised the amounts standing to capital reserve account and general reserve account respectively at March 31st, 1922, in writing off assets as follows:—Goodwill, £5 000; costs relating to increase of capital, £4 998; preliminary expenses, etc., £2 333; depreciation, £725. The directors recommend that the dividend accrued to March 31st on the amounts paid up on the cumulative preference shares at the rate of 7 per cent. per annum (less income tax) be declared.

New Issue.

ASCOT DISTRICT GAS AND ELECTRICITY CO.—Details are published of an offer, by tender, of £15 000 of £10 6 per cent. irredeemable preference shares with par as the minimum price of issue. The issue is being made to meet the cost of extensions in order to fill increasing demands for the illuminants manufactured. The Company's Sales of electrical energy last year totalled 277 000 kWh.

New Companies.

HARRY PEET, LTD.—Private. Cap., £5 000 in £1 shares. Electricians, etc. Reg. office: 275, Fulwood Road, Sheffield.

ARGEN CAR HEATER, LTD.—Private. Cap. £700 in 2s. shares. Electrical engineers, etc. Reg. office: 290a, St. Paul's Road, Highbury, London, N.1.

WELDING AND ENGINEERING CO. (SHEFFIELD), LTD.—Private. Cap., £5 000 in £1 shares. Electrical engineers, etc. Solrs.: Smith, Smith and Fielding, Sheffield.

PREMIER TELEPHONE AND WIRELESS CO., LTD.—Private. Cap., £1 000 in £1 shares. Business indicated by title. Reg. office: Evelyn House, 62, Oxford Street, London, W.1.

GRAY ELECTRICAL CO., LTD.—Private. Cap., £5 000 in £1 shares. Electrical, mechanical and radio engineers, wireless specialists, etc. Reg. office: 110, Charing Cross Road, London, W.C.

HARLES, LTD.—Private. Cap., £100 in 1s. shares. Manufacturers of and dealers in electric lamps and electrical apparatus and appliances. Reg. office: 462, Claremont Road, Rusholme, Manchester.

SMEDLEY GARAGE AND ENGINEERING CO., LTD.—Private. Cap., £300 in £1 shares. Manufacturers, letters and hirers of electrical and other vehicles, electrical engineers, etc. Reg. office: 288A, Cheetham Hill Road, Manchester.

AEROZON AIR CONDITIONING CO., LTD.—Private. Cap., £2 625 in 2 500 cumulative preference shares of £1 and 2 500 ordinary shares of 1s. Importers, manufacturers and repairers of and dealers in dynamos, magnetos, accumulators, coils, etc. Reg. office: 195, Strand, London, W.C.2.

J. A. GROOME, LTD. Private. Cap., £400 in £1 shares. To acquire the business of an electrical engineer now carried on by J. A. Groome at 17, Windsor Road and 81, High Road, Willesden Green, N.W., and to carry on the same and the business of dealers in wireless apparatus and electrical products, etc.

ECLAT ELECTRICAL ACCESSORIES (PADDINGTON) CO., LTD.—Private. Cap. £1 000 in £1 shares. To acquire the business of making and selling electric lamps, electrical accessories and apparatus now carried on at 2, Woodchester Street, Harrow Road, London. Solicitors: Bruce Millar and Co., 28a, Basinghall Street, London, E.C.2.

CLAYTON-MURDOCH GAS APPLIANCES, LTD.—Cap., £75 000 in 60 000 preference shares of £1 each and 150 000 ordinary shares of 2s. each. To acquire from Todman, Ryall and Co., Ltd., *inter alia*, all or any of the British rights of manufacture of the "L.W." dynamo, and to carry on the business of gas and electrical engineers, etc. Reg. office: Capel House, New Broad Street, London, E.C.

FUMASIL CO., LTD. Private. Cap., £3 000 in £1 shares. To obtain concessions from foreign governments and others, to acquire, build, manage or control works and conveniences of all kinds, including railways, tramways, iron, steel, ordnance, engineering and improvement works, gas and electrical works, cables, etc. Solicitors: Linklaters and Paines, 2, Bond Court, Walbrook, London, E.C.4.

FEUERHEERDS ROTORS (CONSOLIDATED), LTD.—Cap., £20 000 in 100 000 8 per cent. non-cumulative preference shares of 2s. each and 200 000 ordinary shares of 1s. each. To acquire the business of Feuerheerds Rotors, Ltd., and Feuerheerds Rotors (British Empire), Ltd., and to carry on the business of manufacturers of and dealers in hydraulic pumps, motors, transmissions, etc. Solrs.: E. H. Riches, 4, London Wall Buildings, London, E.C.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"The Labour-Saving Movement"; "The New British Gramophone."

THE CHEMICAL AGE.—"British Association Meetings: Dr. E. F. Armstrong on 'Enzymes'"; "The Photo-Sensitising Dyestuffs—II.," by S. E. Ellingworth.

THE EUROPEAN COMMERCIAL.—"Monthly Review of the Coal, Iron and Steel Industries of Europe and America"; "Stainless Metals: The Results of Sheffield Research"; "Hungary's Foreign Trade in 1923."

THE FRUIT GROWER.—"Science of Apple Storage"; "Red Plant in Strawberries"; "Varieties of Apples."

THE GAS WORLD (Exhibition Number).—"National Gas Exhibition at Birmingham"; "Co-operative Control of Gas and Electric Undertakings"; "Centrifugal Pipe Making."

THE HARDWARE TRADE JOURNAL.—"The Story of Italy's Iron and Steel Trade"; "International Foundry Congress in Paris"; "The Gas Exhibition" (illustrated.)

Prices of Metals, Chemicals, etc.

TUESDAY, September 18.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£66 0 0	—	£1 0 0
Electro Wirebars	„	£68 10 0	—	£1 5 0
H.C. Wire, basis	per lb.	9 13/16 d.	—	¼d.
Sheet	„	10 5/16 d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 1 13/16 d.	—	¼d.
Brass 60/40—				
Rod, basis	„	7½d.	—	—
Sheet, basis	„	10d.	—	—
Wire, basis	„	10½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 2 6	—	1s.
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
Lead Pig—				
English	„	£27 0 0	—	—
Foreign or Colonial	„	£25 12 6	—	—
Tin—				
Ingot	„	£103 15 0	—	£5 10 0
Wire, basis	per lb.	2s. 7d.	—	½d.
Aluminium Ingots	per ton	£120 0 0	—	—
Spelter	„	£32 17 6	5s. 0d.	—
Mercury	per bottle	£8 5 0	—	10s.

Sulphur (Flowers)—Ton £8 10s. *Sodium Chlorate*—Per lb. 2¾d.
„ (Roll-Brimstone)—„ £8 10s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. „ £25 10s. per ton, £7 10s.
Boric Acid (Crystals). „ £48 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2¾d.; plantation 1st latex, 1s. 3½d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Company.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

ALEXANDER, A. C., 10, Iddlesleigh Terrace, Caxton Street, electrical engineer. £17 16s. July 18th.

CREIGHTON, Harold H., 10, Legh Street, Warrington, electrical supplier. £14 1s. 7d. August 9th.

FEESEY, FRANK AND CO., 4A, Bird Street, W., electric machine dealers. £64 5s. 2d., July 27th; and £15 5s. 6d., July 27th.

HAYWOOD, Mr. W. G. (trading as HEYWOOD AND CO.), 30, Seaton Street, N.W., electrical engineer. £15 17s. 10d. August 14th.

MAWER, Mr. W. A., 29, Station Road, West Croydon, electrical engineer. £33 6s. 1d. August 1st.

WALTON SPORTS ELECTRIC DEPOT, 300, High Street, Felixstowe, electrical engineer. £13 12s. 9d. June 22nd.

WILLESDEN ELECTRIC, LTD., registered offices, 843, Harrow Road, N.W., manufacturers. £11 15s. 1d. July 27th.

WIRELESS INSTRUMENT MANUFACTURING CO., Avenue Road, Willesden Junction. £11 18s. August 1st.

Satisfaction.

EVANS ELECTRICAL, LTD., 10, Bush Lane, Cannon Street, E.C., engineers. £25 19s. 9d. July 12th. (Satisfied September 10th, 1923.)

Deeds of Arrangement.

BERRY, James Harry, trading as BILL AND BERRY, 18 to 26, Constitution Hill, Birmingham, electrical engineers. Filed September 17th. Trustees, G. R. Griffin, 43, Cannon Street, Birmingham, I.A., and another. Secured creditors, £582; liabilities unsecured, £5 217; assets, less secured claims, £4 804.

HALL, William Henry, and CASHNELLA, Joseph Ewart, trading as HALLS, dealers in radio parts, 71, Beak Street, Regent Street, W., the said W. H. Hall trading as W. HALL AND CO., electricians, at 71, Beak Street. Deed of arrangement and inspectorship, with licence to debtors to carry on business with a view to payment of debts in full, by instalments of not less than 5s. in the £ payable by December 31st, 1923, 10s. in the £ payable by March 31st, 1924, and 5s. in the £ payable by June 30th, 1924; debtors to pay trustee weekly payments of not less than £10 during September, £25 during October, £50 during November, £70 during December, 1923, £70 during January, 1924, £60 during February, £50 during March, and thereafter sum of £40 per week until the necessary sum has been provided, secured by an assignment upon trust, etc. Filed September 12th. Trustee, C. Latham, 15, Eastcheap, E.C., accountant. Liabilities unsecured, £1 283; assets, less secured claims, £2 855. The following are creditors: Cort Arthur and Co., £42; Castle, T. L., £288; Day Bertram and Co., Ltd., £30; Greenshade and Brown, £21; Micanite and Insulator Co., Ltd., £21; Pettigrew and Merriman, Ltd., £112; Power Equipment Co., Ltd., £155; Shirley, Owen, £23; Hunt, A. H., Ltd., £103; Smith, H. W. and Co., Ltd., Lydbrook, £42; Oldham and Son, Ltd., Manchester, £60; Alpha Coil and Compound Co., Sheffield, £17; Crystalate Manufacturing Co., Ltd., Tonbridge, £27; Burton, O. F. and H., Walsall, £91.

Receivership.

ELECTRIX, LTD.—H. J. Ure, of 59–61, New Oxford Street, W.C., was appointed receiver and manager on August 28th, 1923, under powers contained in first debentures dated February 27th, 1923.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

CENTRAL SUPPLIES CO., LTD., 4, Cross Street, Finsbury Pavement, E.C., electrical and wireless factors. At a meeting of creditors held on September 17th at the offices of Trayton P. Child and Son, C.A., 36-37, Queen Street, E.C., a composition of 5s. in the £, payable on or before October 1st, 1923, was accepted. The statement of affairs showed liabilities £797, all due to unsecured creditors, and net assets £280, a deficiency of £517.

PALMER, RILEY AND CO., LTD., 90, Abbey Street, Accrington, electrical factors. A meeting of creditors was held in Manchester recently when a statement of affairs presented disclosed liabilities £6 732, all due to unsecured creditors, and net assets £4 836, or a deficiency of £1 896. An offer was made of 10s. in the £ in settlement of debts as at July 31st last, payable by four equal instalments over six months, and all indebtedness incurred since July 31st to be paid in full. The creditors decided to appoint a committee of inspection consisting of Messrs. British Thomson-Houston Co., Ltd., Ediswan Electrical Co., General Electric Co., Western Electric Co., and W. T. Henley's Telegraph Works, Ltd., to investigate the company's affairs and report to an adjourned meeting.

Edinburgh Gazette.

Winding-up Petition.

WELDING SPECIALISTS CO., LTD. (W.U.P., E.G., 21/9/23.) A winding-up petition has been presented.

Bankruptcy Proceedings.

ELLIOTT (J. E.) AND CO., 12, Broad Street, Oxford, electrical engineers. The statutory first meeting of creditors in this matter was held on Monday. The receiving order was made on a creditor's petition on proof of an execution levied by seizure and sale on June 4th last by the Sheriff. No statements of affairs have yet been lodged; in preliminary examination debtors state their joint assets as nil. The senior partner since 1922 has endeavoured to manage the business from London, and seems to have been engaged principally in endeavouring to raise money upon the business by negotiations for floating it as a private company. He appears, however, to have left most things in Oxford to the manager there and to have had no effective control of the business. The partnership unsecured liabilities are estimated at £2 000 to £3 000, but are probably considerably more. The Sheriff was allowed to seize the firm's stock, which was disposed of for £108. The Sheriff states the balance in his hands is about £10. The lessors have been allowed to enter into possession of the premises, and have taken steps with a view of reletting them. The firm (according to the observations of the Official Receiver) ought to have filed its petition when the negotiations to float a company failed.

MAULLIN, Horace John Albert, 206, Lozells Road, Hockley, Birmingham, trading as THE WILTON ENGINEERING CO., 124, Devonshire Street, Birmingham, electrical engineer. The application for discharge of this debtor was held on September 13th, at Birmingham. It was stated that the receiving order was made on September 8th, 1922, and a first and final dividend of 4s. 4d. in the £ was paid on proofs for £216. The discharge was granted subject to a suspension of two years.

METCALF, Charles Frederick Mason, trading as C. F. METCALF, 8, Cow Green, Halifax, Yorks, electrical engineer. Gross liabilities of £2 994, of which £2 778 is expected to rank for dividend, against assets of £2 248, or a deficiency of £530, are shown by this debtor's statement of affairs. He attributes his insolvency to the failure of a limited liability company to pay money due to him. At their first meeting the creditors decided to appoint Mr. C. H. Baker, of 1, Albion Street, Leeds, as trustee, with a committee of inspection.

STUART, Arthur Curtiss, and PERRIER, Cyril, trading as THE STUART WIRELESS TELEPHONY CO., 109, Kingsway, London. In this matter the following are creditors:—Adams, G., London, £74; Ashdown, H. E., Ltd., Birmingham, £63; British Radio Wireless Manufacturing Co., Ltd., £35; Fellows Magnetos, Ltd., £100; Gent and Co., Leicester, £101; Grimshaw Baxter and J. J. Elliott, Ltd., £26; London Electric Wire Co. and Smiths, Ltd., £33; Preen and Co., Ltd., £50; Semaphore, Ltd., £23; Day, Bertram, London, £100; Churchill, C., and Co., £83; Herve, L., Ltd., £50; Mullard Radio Valve, London, £30; Sterling Telephone, Ltd., London, £59; Telegraph Condensor Co., London, £53.

WRIGHT, Charles, and WRIGHT, Herbert Thomas, trading as WRIGHT BROS., electrical engineers, 251, Fulham Road, Chelsea, S.W. The joint statement of affairs shows liabilities £2 429 and estimated net assets £423. The business, established by the debtors in 1902, mainly consisted in wiring premises for electrical services and they also dealt with private customers in electrical accessories. It was a success until 1920 or 1921 but then began to show a serious loss. They had kept a full set of books of account and these were audited by a firm of accountants until 1921. They had, however, not since been written up or audited at all; that omission was due to their inability to afford it. The result was that since 1921 there had been no trading or profit and loss accounts. They first realised their insolvency in January, 1922, when they found that they did not possess enough money to pay their accounts. The result was that they borrowed £500. Their failure was due to depreciation of stock, machinery and fixtures, to law costs and sheriff's charges and to the slump in trade since 1920 with the consequent loss in trading and lack of profit to meet their household and personal expenses.

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Telegraph and Telephone Notes.

It is stated that MOST OF THE TENDERS for the manufacture of the new cable from Seattle to Alaska were received from United Kingdom firms.

An automatic telephone exchange recently put into operation at the LONDON COUNTY COUNCIL'S NEW COUNTY HALL comprises equipment for 700 extensions.

The cable ship "Faraday" has reported, at Halifax, Nova Scotia, the loss of the end of THE NEW TRANSATLANTIC CABLE when 500 miles out. Attempts are being made to recover the cable.

After having temporarily extended the use of the Libau radio-telegraphic station a year ago to postal telegram service with Danzig, whereby a saving of 1½ roubles per word was obtained, the Latvian Government, states the "European Commercial," decided to ERECT A LARGER TRANSMITTER at this station, capable of serving a radius of 3 000 kilometres, as against one of only 500 kilometres, in this way connecting up the country with the whole of Europe, the Eastern half of the Atlantic Ocean, and the Mediterranean. The old Libau station is used for both receiving and transmitting messages. In the case of more powerful stations, however, the transmitting and receiving stations must be separated from one another, in order to prevent the waves of the former impeding the action of the latter. It was accordingly decided to have the transmitting service at Libau and the receiving service at Riga. The plants at both stations are expected to be complete and ready for service by the middle of next month. Both stations are being provided with up-to-date installations, including Hughes apparatus, so that messages will be dispatched and received in typewritten form.

Payments by Results.

Mr. Ames on the Work of the Whitley Councils.

Following on the recent correspondence inaugurated in "The Times" by Mr. PYBUS on "Payment by Results," Mr. JOHN AMES, general secretary of the Industrial League and Council, states that the "Economic Production" Sub-Committee of the Industrial League and Council is shortly sending out a *questionnaire* on payment by results to a large number of employers in various industries. The information will be carefully collated and will ultimately be published. As it will be impossible for the Committee to get in touch with all employers, Mr. Ames will forward the *questionnaire* to any employer who desires one. The Whitley Councils, he adds, have had a most difficult work to do and have done it exceedingly well. They are really the only organisations in industry to-day which are dealing with industrial problems in a permanent and humane manner. Some are in suspense, but others are working very successfully. They need encouragement and support to become more successful, and just in so far as the principle of the Whitley Councils succeeds so will industry right itself.

Australia's Electrical Requirements.

Importation of Electrical Machinery and Appliances in 1923.

During the year ended June 30th, 1923, Australia imported electrical machinery and appliances valued at £3 380 424, compared with £3 098 925; the values of imported electric cable and wire were £1 205 706 and £888 184 respectively. These not inconsiderable increases are reflected in the statement of H.M. Senior Trade Commissioner in Australia that the total imports show an increase of nearly £29 000 000 on those of the preceding year. He adds that the accumulation of Australian funds in London, together with new loan money, has had a stimulating effect on imports, and that some reaction, temporarily unfavourable to British trade, must be expected.

Michael Faraday.

Lord Haldane's Anniversary Tribute.

To-morrow (Saturday) is the 132nd anniversary of the birth of the great electrical pioneer, MICHAEL FARADAY. In the course of a tribute which he has written for the "Yorkshire Evening News," Lord Haldane says: "As an experimental physicist, Faraday brought to bear scientific imagination, giving rise to verified insight of the highest order. The exact observer and the poet are not so far removed from each other as people are apt to think. Goethe told this to the world long ago. Faraday would have been a man after Goethe's own heart, had the latter lived long enough to study his work."

Miscellaneous.

The Corporation of NEWPORT (Mon.) is organising an ELECTRICAL EXHIBITION to be held in the Town Hall from October 13th to 20th.

Recent additional contributions to the Lord Mayor's JAPANESE RELIEF FUND include:—Siemens Brothers and Co., £262 10s.; Staff of the London Telephone Service, £155; and Barr and Stroud Ltd., £500.

We regret that in the description of the automatic coil winder which appeared on p. 282 of our issue of September 14th the name of the inventor was given as Maradic instead of Macadie. The machine shown in our second illustration is for winding two wires of the same thickness side by side.

Patent Record.

APPLICATIONS FOR PATENTS.

September 3rd.

22 109 F. E. and H. L. WOODHEAD. Variable electric condensers.
22 118 J. P. PRANGNELL. Wireless receiving apparatus.
22 135 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Composite metals.
22 143 SOC. DE PARIS ET DU RHONE. Current transformers. (31/1/23 France.)
22 151 C. E. FOSTER. Double pole electrical connectors.
22 153 J. AND C. ARRIGANI and F. W. COX. Crystal rectifier.
22 164 JOHNSON-WILLIAMSON LABORATORIES, INC. Radio-receiving apparatus (25/9/22 U.S.)
22 172 C. F. HALSALL. Lightning switch for wireless telegraph instruments, etc.

September 4th.

22 180 C. E. BATEMAN. Loud speaker for wireless broadcast reception.
22 206 FULLER'S UNITED ELECTRIC WORKS, LTD., and A. P. WELCH. Sound-amplifying horns.
22 207 A. P. WELCH. Holders for thermionic valves.
22 208 FULLER'S UNITED ELECTRIC WORKS, LTD., and A. P. WELCH. Electro-magnetic sound reproducers.
22 225 A. REYROLLE AND CO. and W. LULOFS. Relays fan.
22 229 W. CHARSTONE and A. PEARMAIN. Crystal detectors.
22 242 AUTOMATIC TELEPHONE MFG. CO. Telephone systems. (2/2/23 U.S.)
22 243 METROPOLITAN-VICKERS ELECTRICAL CO. Turbine blading. (13/9/22 U.S.)
22 247 IGRANIC ELECTRIC CO. and A. H. CURTIS. Variable inductance devices.
22 258 W. G. TURNER AND CO. and H. B. MOSELY. Crystal detectors.
22 262 S. CALAMATIANOS. Inductance coils for wireless telegraphy, etc. (16/5/23 Belgium).
22 289 RELAY AUTOMATIC TELEPHONE CO., F. W. DAVIS and B. B. JOHNSON. Automatic telephone systems.

September 5th.

22 292 A. M. TAYLOR. Electric power transmission systems.
22 305 J. A. CRABTREE. Electric switches.
22 306 H. F. VICKERY (NEVILLE). Electric lighting, heating or power circuit.
22 346 P. D. TYRES. Electric condensers.
22 347 E. J. L. DELFOSSE. Rheostat.
22 366 C. A. CARPENTER. Burglar and fire alarm systems.
22 372 AKT. GES. BROWN, BOVERI ET CIE. Protection of rectifier installations from short circuits. (16/9/22 Germany.)
22 376 C. M. PAGE. Electric lamps.
22 381 W. H. STOREY. Sound amplifier.
22 385 E. WATKINSON. Electric switches.
22 390 SIR H. F. HEATH and P. KAPITZA. Electric storage apparatus.
22 391 SIR H. F. HEATH and P. KAPITZA. Production of high-tension discharges.
22 392 SIR H. F. HEATH and P. KAPITZA. Flash illumination.

September 6th.

22 419 BRITISH ELECTRICAL AND ALLIED INDUSTRIES ASSOCIATION and E. B. WEDMORE. Poles for supporting overhead conductors, etc.
22 422 J. DUNN and M. MACGREGOR. Wireless aerial applicable as firescreen, etc.
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September 7th.

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Arrangements for the Week.

FRIDAY, SEPTEMBER 21st.

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION.

7.30 *p.m.* At Saint Bride Foundation, Bride Lane, Fleet Street, London, E.C.4. Paper by Mr. J. W. Beauchamp on (1) "The Scope and Object of E.D.A. Sales Lighting"; (2) "Some Notes on the Commercial Aspect of Electric Lighting."

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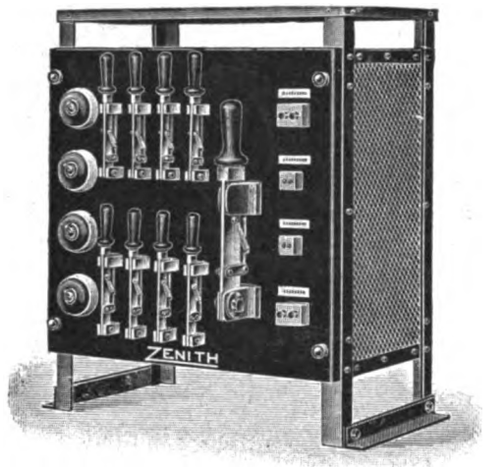

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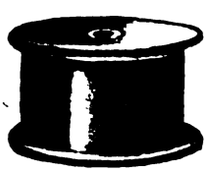

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Notes of the Week.

The Institution—The Hour of Meeting.

THE Institution of Electrical Engineers is to begin its session this year on the unusually early date of October 18th, when Dr. ALEXANDER RUSSELL, the new president, will deliver his inaugural address. The remainder of the programme, so far as it has yet been announced, is interesting. It comprises two joint meetings, one with the Société des Ingenieurs Civil de France (British Section) on "The Electrification of the Midi Railway," while there will also be a lecture from Dr. S. P. SMITH on the same subject. The other joint meeting is with the Physical Society, the subject for discussion being "Loud-Speaking Telephones." A matter of more immediate importance however is the time at which the meetings are to be held. Last year members were given the choice between 6 p.m. and 8 p.m., and came down heavily in favour of the former. This year they are asked to indicate their preferences for each half hour from 6 p.m. to 8 p.m. inclusive, and to use a sort of proportional representation vote in so doing. We have already voted for keeping the hour of meeting at 6 p.m., and we hope others will do the same, as we like to get home early. If, however, the hour must be changed we should like it to be changed to 8 p.m., as we prefer to leave our dinner hour undisturbed. These are both intimate personal reasons, but they are none the less weighty for that. On the whole we think it will be found that 6 p.m. suits the majority of those who regularly attend the meetings. It is, of course, theoretically inconvenient for those whose occupation is some distance from the Embankment, but we feel sure that on special occasions, to even these slaves of time, the earlier hour would present no real obstacles.

An Electric Hot Water Success.

IT is axiomatic that one of the disadvantages of electricity supply under modern conditions of generation is that it cannot be stored. Hence arise such sleep-banishing things as maximum demands, scientific tariffs, coal costs and *hoc genus omne*. It will also be agreed that could some method be found of storing the energy in electricity efficiently a good many of the problems relating to the development of the domestic load would be solved. One of the greatest of these problems is the hot water supply. If it were practicable to store heat in water at the users' end of the system during off peak hours a load factor of nearly 100 per cent. could be maintained at the station, and any load which did not alter the peak demand could be charged for on the basis of the average fuel cost. The more generally this could be done the lower would be the average cost, and the more all classes of consumer would benefit. In an article which we publish on another page of this issue, Mr. J. HORACE BOWDEN demonstrates this proposition by means of figures. In a particular case he shows that the coal per kilowatt hour generated would be reduced from 2·4 to 2·3 lb., the load factor of kilowatt hours sold would increase from 24·5 to 84 per cent. and the average charge per kWh would be reduced from 1·6d. to 0·65d. On such a basis it should be possible to supply hot water at 0·387d. per kWh and to reduce the charges for the other supplies.

An Electric Domestic Association.

BUT Mr. BOWDEN has gone further than simply to talk statistics. He has put this idea into practice. The Poplar public baths were supplied with hot water heated by gas at a cost of 3·63d. per bath. On the basis of 0·51d. per kWh this would have allowed up to 7 kWh per bath if the heating were done electrically. When such an idea was mooted, however, the Gas Company reduced their charge

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to 2·36d. per bath, or equivalent to 4·63 kWh. Nevertheless the installation was proceeded with and the result has been that it has been found possible to heat the water of a bath electrically at an expenditure of 3 kWh. These figures all apply to the summer months, but comparative figures for the winter months are likely to show the same margin of saving. This is satisfactory enough, but as Mr. BOWDEN points out, what we have got to do is to supersede, not gas, but coal and coke. This is a more difficult problem, especially in the small factory, but it will be solved in time. On the other hand the domestic hot water question can be tackled successfully right away. The essential is a hot water tank continuously in commission. In an average household this should have a loading of 130 W, and would consume 1 139 kWh per annum at a 100 per cent. load factor. In addition, the average requirements for lighting, heating and cooking would be 3 000 kWh per annum, a consumption and a type of load which it is worth while doing some striving to attain. Mr. BOWDEN suggests that such an attainment might be assisted by the formation of an Electric Heating Association. But as, in spite of Shakespeare, there is a great deal in a name, we suggest that the title should be the Electric Domestic Association. We hope it will soon be formed to deal with the points which Mr. BOWDEN describes as its first duty.

Buying Electric Fires.

THIS is not the place to speak of what are usually called the advantages of electric fires. That task is performed enthusiastically by more than one of the contributors in this issue; and we leave our readers to study what they say and so acquire that pleasing glow which comes when praise is given with no ulterior motive. For our part, we wish to draw attention first to the illustrated paragraphs which we publish on another page, giving details of some of the latest electrical heating appliances that have been put on the market, and, second, to the article by "Spectator" which deals with the important question of selling this apparatus. The first of these articles indicates clearly that any one who wishes to buy an electric fire has plenty of choice, a choice that is made more difficult by the similarity of design, construction and performance, all of which have reached a high standard. The article is informative and therefore useful, but it undoubtedly creates a problem: What to buy? And, as "Spectator" truly remarks, a sound knowledge on the subject of buying is worth many selling campaigns, essential as those are. There is a large market for electric fires which has not been explored as it ought to have been, but it can be developed by increased energy on the part of contractor and retailer and by getting to work earlier in the season if the heating business is to be planned on a seasonal basis. Such planning means the acquirement of large stocks and the buying of such equipment as will increase the turnover. In other words the task is to examine and test every piece of apparatus and reject everything which cannot be offered to the public with confidence. In many branches of the electrical industry this has already been done. There is no reason why it should not be done with fires; it is the only way in which the really efficient apparatus can be discovered.

Domestic Electric Pioneering.

WE cast no slur on the contributors to this week's issue when we say that though all of them have been inoculated with the domestic electric idea, in most of them that inoculation has not had its full effect. Many electrical engineers are in the same position; and some have not even got themselves inoculated. The reason for this is that the domestic electric idea is new; and that the first enthusiasm is still exercising its influence. We expect with confidence to see the idea triumph, but we have no illusions as to the difficulties that will have to be experienced before that comes to pass. We hope that all our contributors will keep their enthusiasm or, if that is impossible, that at least they will strive to attain the ideal they had before. That task should be made easier by a study of Mrs. HOWELL'S article on the "Electric Home." Mrs. HOWELL is a pioneer. Hard experience, if it has not dulled her enthusiasm, has sharpened her critical faculties; yet she still believes in the electrical idea, and though she sees the need for improvement in details, as we all do, realises that the advantages obtainable far outweigh the weakness of youth. We would commend to electrical engineers what she says about technical matters; the advice of the user is not to be despised. But we would commend to the general reader what she says about cost. Cost in connection with electric cooking is a bogy that must be laid. Mrs. HOWELL'S clear statement will help to lay it

More Talk About Amalgamation.

THE gas industry, as we have pointed out before, is an interesting psychological study. At one time its members were quite determined that gas was the best agent to use for lighting, heating, cooking and power, but that conviction has undergone a sea change. Electricity is now admitted by so great an authority as Mr. GOODENOUGH to be more efficient for lighting, and electric motors are familiar objects in gas works. But the end is not yet. For we have Mr. J. R. BRADSHAW wondering, in a Paper read before the Institution of Gas Engineers last week, whether the strong position of the gas industry has not been the cause of its undoing, and admitting that in some particulars electricity has advantages over gas. This looks uncommonly like a case of what is vulgarly known as "wind-up"; and this opinion is confirmed by Mr. BRADSHAW'S further remarks. Gas installations, he says, are cheap, and cheapness means a lot, but are the consumers' requirements fulfilled when the gas industry gives them something cheap? Mr. Bradshaw thinks not; the gas industry should therefore give the consumer electricity if he wants it, and this is to be done at Retford, where Mr. BRADSHAW comes from, by installing generating sets in the gas works. In this way money will be saved, especially because there will be only one chief needed instead of two. This suggestion, it is interesting to learn, is not made with the idea of stifling competition, but because to run an electricity undertaking in conjunction with an established successful gas undertaking is the only way in which it is possible for the town to receive a supply of electricity on a commercial basis. (This is good!) Retford is a town of 14 000 inhabitants.

An Ally, not a Competitor.

Mr. BRADSHAW further considers this idea of a combined gas and electricity undertaking is the right one for all small towns and that the message undoubtedly is to recognise electricity not as a competitor but as an ally, and to enter the electrical field with vigour, and develop it for all it is worth. There is, he points out, a real need for electricity in the interests of modern development, and whether "we like it or not we must recognise it." We are a little at a loss to understand whether Mr. BRADSHAW is an *ingenué* or the other thing. We think the latter, for we notice that the gas engineer is always to control the electricity undertaking and not the other way about. We would remind him of what happened to the young lady of Riga. The electrical industry has no inclination to accept that *rôle*. More seriously, the objection to this suggestion, which is not new, is that it attempts to reconcile two opposites. If a gas undertaking starts an electricity supply in a small town the result is only that a few of the larger householders and shops will avail themselves of it automatically. No effort will be made to secure the smaller consumers and the pitch will be queered for any one else to do so. Any development of the domestic load is unthinkable, so long as a gas engineer remains at the head of affairs. This is only human nature. But human nature being what it is, we oppose the idea, and prefer that the electricity and gas undertakings should remain separate. The combination has never yet been a success for both parties and never will.

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Women and Electrical Development.

In the special Trade Promotion numbers which we publish every six months—in the spring and in the autumn—we attempt to concentrate the attention of our readers on the problem of increasing the " other uses " of electricity. What is meant by this term " other uses " is by now generally understood; but, like many other terms in common circulation, it is not easy of definition. For our present purpose it may best be said to cover those applications of electricity which are still in a preliminary stage of development as distinct from those others, such as power, lighting, telegraphy, telephony and traction, which, though still increasing in amount or importance, have reached a certain degree of saturation. This definition is not exact. For, taking lighting as an example, though it is generally recognised that technically and commercially electricity has established a pre-eminent position, yet development is taking place and indeed is demanded in dealing with such matters as glare, the use of sky signs, theatre illumination, long-hour shop window lighting, and, of course, tariffs. The same is true of conditions in the other branches we have enumerated where, as in lighting, there remain a great many interesting problems to solve and an ever increasing chance of developing the use of electricity in both new and old ways.

The Employment of Electricity in the Home.

In these issues, however, our principal concern is to deal with what is taking place in the employment of electricity for heating and cooking and small power purposes, especially in the home, to indicate how experience is modifying designs of equipment and method, and to lay down the lines upon which our efforts can best be conducted to achieve the maximum result. We have a great belief, which is being increasingly shared by others, in the future of domestic electricity; and we see no reason why that future should not speedily become the present. The contents of this issue show that our optimism is not unjustified.

A Peculiar Factor.

The progress of domestic electricity is, however, influenced by a factor which it is not too much to say is peculiar to itself. In the other branches of electrical progres the apparatus is either supervised by a skilled personnel or is of such a kind that it can generally be left to unskilled attendance without danger or fear of breakdown. A lift, a printing machine, a crane, may all be driven by a man who knows nothing about electrical equipment or about machinery except as much as is involved in simple duties connected with cleaning and lubrication. Modern electrical apparatus is so reliable and so fool-proof that it can safely be operated under these conditions, as statistics of breakdown and accident amply show. Moreover, every male human being has a certain instinctive mechanical sense which, without any technical training, makes it possible for him to be left with safety in charge of simple machinery.

Woman and the Mechanical Sense.

In the domestic field the conditions are different. Domestic apparatus, whether it be a broom or an electric cooker, is committed to the care of a class of human beings who lack that instinctive mechanical sense to which we have just referred. This is a factor which must be reckoned with and counteracted. Instruction in the simple practice of lubrication as applied to vacuum cleaners is necessary, while the deleterious effect of dust in such equipment as cookers and heaters must be insisted upon. It is a curious fact that while woman in the abstract tries to attain the absolute cleanliness of walls, floors and furniture, she, also in the abstract, will cheerfully disregard the presence of dust and grease where they can do harm without being unsightly.

Conservatism as an Obstacle.

This is one point that must be taken into consideration in designing domestic electrical apparatus; for the rest it is a matter of education. A more important question is woman's innate conservatism. Except in clothes, the fashion in which moves in curious cycles rather than changes, what was good enough for her mother and grandmother is good enough for her. In this statement we shall be supported by gas engineers. For though a great deal was done by propaganda and by the offer of very attractive terms (a bargain is always dear to the heart of a woman), the efforts made to induce a change from coal ranges to gas cookers were altogether out of proportion to the results obtained. The great progress that has taken place in recent years is due to that much-abused person the domestic servant—or rather to her absence. The enormous difficulty, often the impossibility, of obtaining servants has brought about a great reform in the conditions in the average home. The increasing cost and decreasing quality of coal has aided the change, while propaganda has done not a little to assist.

Electricity and the Smokeless House.

Though we cannot agree with the aims of the gas industry we can at least admire their methods and support their objects in so far as they relate to the introduction of the smokeless home. In striving for the same object the task of electrical engineers is at once easier and more difficult. We have a better proposition to offer. Both electric cooking and heating are more convenient than gas. The results are more certain and there are no fumes. Matches are not required. But (and it is a very big but) the use of electricity requires the use of new methods, especially in cooking, and to some extent in heating and cleaning as well. And to get a woman to change her methods is " an awfully big adventure."

There is, however, no need for despondency. For one thing, the force of circumstances is on our side. For other certain adventurous spirits have assumed the rôle of pioneers, have discovered that the electrical idea is good and are not unwilling to let their experiences be known for the benefit of others. This is a great advantage. For when it comes to such matters a woman is more likely not only to listen to, but to accept, the advice of another woman in preference to that of a man, and in due course to become imbued with the idea that electricity is in the fashion and is therefore worth a trial. For that reason we have thought it well to obtain articles from women who have had experience in these matters, and we hope our readers will find them instructive and useful in carrying on the great work of development.

How Women Can Help.

Woman can, however, help man in other fields than the purely domestic. In architecture especially there is much that she can do. It is not to be expected that old houses would be designed either for labour-saving or so that electricity could be used to the full advantage in them. But it is not too much to expect that the architects of the houses now being built should take both these matters into consideration and endeavour to realise the idea of a home rather than of a workhouse. There are many things in connection with housing, with factories, with streets and roadways, with hygiene and with social conditions generally, where the wider employment of electricity would mean an improvement. Woman can do much to bring about these improvements and electrical engineers would do well to enlist her assistance.

On the other hand, it should be part of our duty to see that every effort is made to educate woman in the advantages to her which will follow the greater use of electricity, both in the home and elsewhere. Our remarks on her conservatism are not made cynically, but as a statement of fact which must be realised and allowed for. It is worth woman's while to change her methods to gain great benefits. But she must be shown the necessity of change and the magnitude of the advantage. That is the duty of the electrical engineer.

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The Effect of Electricity on Domestic Architecture.

By ELEANOR K. D. HUGHES.

" Electric transport, electric industrial power, municipal electricity for public service and domestic use will," says Miss Hughes, " help to redress the evils of the industrial age." From the architectural point of view development must take place along two lines : the conversion of old houses to new domestic methods, and the design of a post-war house which is a compromise between tradition, experiment and economy. The effects of electricity on domestic architecture are apparent in the expression of a changed point of view, and in bringing about more simple planning, and the gain of valuable space for the same cubic contents. It enables the kitchen to be remodelled, and is solving the hot water problem. It is essential to the use of the vacuum cleaner and the service lift. Manufacturers have a tremendous opportunity to design good fittings, and contractors to carry out installations on the most modern lines.

The history of English domestic architecture is an illuminating study, not only from an antiquarian or sociological point of view, but in order to obtain a wider grasp of present problems, because it is the soil in which our own lives are inevitably rooted. There is no more faithful and intimate record of a people's history than that of its homes ; it is alive with associations and graphic in its simplicity, a chronicle in brick and stone, with all the freedom and unconsciousness of a personal diary, to supplement the written history of its public life. The house is a composite thing, a blending of new and old ; it reflects every national experience ; every national change is stamped upon it.

It is interesting to trace the relationship between the growth of modern science and the development of domestic architecture. The introduction of steam in industry and locomotion produced the Industrial Age, a more drastic change than any that had gone before, and one whose effects are still rampant in domestic architecture. It resulted in the covering of great tracts of coal-fields with the smoke of congested towns, huddled at the pit's mouth or under the factory chimneys. The jerry builder was turned loose in the country at large. The house of the long and narrow type, badly planned and badly lighted and with the smallest possible frontage, was duplicated by the thousand in the towns. This was not surprising when the people they housed were rated as " hands " only in the industrial world. It was in too many ways a triumph of matter over personality.

Electricity and Modern Town Planning.

It is against this state of things that modern town-planning has set its face—and turns to electricity to help it. Anyone coming into London along a high level railway line, such as that between Clapham Junction and Vauxhall, on a winter afternoon, must be struck with the prospect—square miles of chimney-stacks, their monotony broken by every conceivable device for emitting refractory smoke, the whole veiled by a thin haze—the smoke nuisance of the sanitary authority. It needs little imagination to conjure up an electrified city spread out under a clear sky, and only here and there the vertical shafts of chimneys sending out a line of smoke. It is hoped by the help of electricity to localise industries and to prevent the congestion of large towns closely surrounded by suburbs. Where electric power cannot be generated locally it can be carried easily over great distances. Thus the factory town may be redeemed. The pollution of the air which breeds disease, and encourages such things as tuberculosis, etc., will be exchanged for a clear sky, sunlight, wider streets, and other aids to health. Speedy intercommunication is of enormous value to the factory organisation for transport of workers and materials. It is hoped that local industries will revive, as they may reasonably do with power derived from some larger centre where it is not available in the neighbourhood.

Electricity as an Aid to Improvement.

Electric transport, electric industrial power, municipal electricity for public service and domestic use will, it is hoped, help to redress the evils of the industrial age. Under these conditions it is to be expected that domestic architecture will develop reasonably on modern lines, while losing nothing of its inherited charm and best traditions. Some of these developments were in sight before the war. Then the war came, and with it enormous strides in the use of electric power. House-building was at a standstill. After the war we awoke to find that the scientific world had gone forward by leaps and bounds. The war accelerated the revolution in the domestic world towards which we had been drifting. We were sufficiently detached to subject the whole system to critical analysis, with scientific thoroughness. The results of investigation in domestic science, in hygiene, in engineering, in building, and so on, were brought to bear upon the house.

Electricity in Domestic Service.

The problem was twofold : there were, on the one hand the pre-war houses of various dates, now mostly overcrowded, while the bigger mansions for the most part had perforce been abandoned and stood empty. These houses were generally arranged for the old domestic methods and were now subjected to uncomfortable strain. Much can be done by the use of electricity to adapt these to new conditions, especially as they are sound constructionally, and many of them from an architectural point of view of great value. Large tracts of eighteenth century London may be cited. Here the question of cost is a deterrent. The war taught us the possibilities of central service whether in factory canteens, hospitals, hostels, hotels and restaurants. These institutions were naturally the pioneers in introducing the use of electricity for domestic service and prepared the public mind for its use in smaller establishments. Restaurants such as the Tricity House and the B. &. K. Restaurant have done good service in this way. As regards new houses, on the other hand, the outlook seemed to provide endless possibilities—the Homes for Heroes of the statesman, the Ideal Home of the Newspaper Press. The Press did much in stimulating public interest by exhibitions, by prizes for house-designs, by ventilation of the subject in every way. The Government did much, both in providing grants and in controlling the schemes. The post-war house is a compromise between tradition, experiment and economy in varying proportions. As far as possible the results of up-to-date investigation are embodied—but economy must too often be the deciding factor. For this reason it is difficult at present to take proper advantage of electricity.

Effects of Electricity on Domestic Architecture.

Apart from its general effects on town planning, the effects of electricity on domestic architecture are apparent in the expression of a changed point of view, to which expression electricity has enormously contributed, and will contribute more in the future.

It has helped us to plan more simply and reasonably, and to gain valuable space for the same cubic contents.

Outwardly, the most noticeable difference will be in the reduced number of chimney-stacks. Inwardly there will be more spaciousness, and fewer chimney breasts, a healthy air of cleanliness and brightness.

An eminent architect has laid down the axiom that, in planning, the centre of the house is the kitchen-table. Electricity is enabling us to remodel the kitchen. As the main workshop of the house this should be as large as possible, well ventilated and well lighted. A scullery will

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not be necessary in most cases. The cooking should all be done on one side of the room. The counter-table arrangement is probably the most useful, fixed with all the attachments on the wall above it, and the various appliances, ovens, hot-plates, etc., placed upon it. A hot cupboard for plates could be placed under the counter, and there should be a shelf under. However, many households prefer the composite cooker, after the model of the gas stove. In any case cooking, whether baking in the oven or otherwise, should be effected at a reasonable height to avoid stooping, and to allow of sitting down during a long operation, such as stirring jam. The sink, hot water tank, and dish-washer should be arranged on the other side of the room, for reasons of traffic. On another wall a radiator with towel-airer should be placed ; this may either be electric or connected with the hot-water supply. The American pattern tool-table is excellent, with its motor for a hundred and one uses, boot-polishing, silver-polishing, mincing, coffee grinding, etc. It is run on castors, and tools and motor are packed up inside when not in use. An electric fan may be added to the kitchen equipment. A small extra room may lead out of the kitchen, or be placed close to it, for the washing-machine, an appliance which is reducing the household laundry bill to a surprising extent.

There is no need to emphasise the superiority of electric cooking—it has been amply proved. Light meals are increasingly cooked in the dining room. The trolley form of butler's tray, running on wheels, may have a heating surface for keeping food hot in transit, or the service lift may be so fitted.

The Hot Water Problem.

The problem of hot water supply is on its way to solution : in the meantime it will be found convenient in the ordinary household to provide hot water on a system fired by a coke or anthracite boiler. Such a fire is invaluable for burning household refuse. The hot water pipes are carried up in the usual way, and extra heat provided in a few minutes by electric means at the places required. This system heats the hot cupboard and warms the house generally, where there is no central heating system. On the other hand, if expense need not be considered, electric geysers provide hot water from the cold water supply in an incredibly short time.

The question of heating by electric radiators or other electric means has yet to be suitably applied to the middle-class house—always with the important exception of the electric fire—that invaluable successor to the gas-fire with its fumes and the coal-fire with its dust and ashes and subsequent cleaning, and the consumption of air by both.

As to cleaning, the suction cleaner is a valuable servant. The provision of a rubber pad on the nozzles and attachments of the cleaner would be a protection to the legs of furniture, picture-frames, etc. Some such instrument for polishing bare floors, and for household scrubbing and mopping, would be a great advantage, for occasions requiring honest soap and water.

A Plea for the Service Lift.

A plea may be put in for the service lift. The popularity of the bungalow is partly a protest against the use of stairs ; too much energy is spent in a house in carrying things up and down stairs, and this adds greatly to the burden of illness. It would be the greatest boon if the electric service lift could be brought into general use. It should be placed near the centre of service and be carried right through the house. It should be of a size to hold trays, medium-sized luggage, the suction cleaner, and so on, and there should be a detachable shelf. This obviates knocking against the staircase wall, with injury to decorations, which generally results from carrying luggage.

Lighting.

The use of electricity for lighting opens up possibilities. There is no injury to decorations, and these consequently last so much longer that renewal cost is saved, or may be put towards a better scheme in the first instance. There is a large field for experiment in lighting—its effects on colour schemes, on materials, and on shapes of rooms, to say nothing of its effects upon the human eye. Experience will produce simple and very beautiful effects suitable to ordinary domestic architecture. Generally speaking, decoration tends to light tints, as a background which keeps its cleanliness and acts as a foil to colour. The electric fire may be harmonised with a decorative scheme, either by its own colour or that of its metal surround, and it should always be well designed.

An Opportunity for Manufacturers.

Here a tremendous opportunity offers itself to manufacturers and to the trade. The importance of good design in electric fittings cannot be emphasised too strongly, and emphasised again and again. Electrical firms have realised this. There are numbers of men capable of producing designs which are in themselves works of art, however simple, and entirely fitted to their use. If the public are worthy of the best technical service they should be offered nothing less than the best design, and a glance at the metalwork on our great new buildings—such as the Port of London Authority, the County Hall, the Bush Building—will prove that a high level of design is appreciated. Because good design costs no more to reproduce, there is every reason why we should delight in it in our own homes, and it makes not only for delight, but for the moral and intellectual uplift of those who live with it.

As to general installation—economy in switches and plugs, etc., is false economy. Plugs should be protected, especially in the floor. They should be placed at a reasonable height, to prevent stooping, and to be out of reach of small children ; also the flexible cord will be easily seen, and will not become entangled on the ground. Guide lamps are useful in preventing waste of current, also clocks in connection with cooking, if the food has to be left.

There is no need to enumerate the hundred and one aids to comfort which electricity supplies. They increase daily and are of great service not only in a house, but in a flat or bachelor's quarters, from the geyser and the light cooker to the illuminated number over the door.

A Field for the Woman Electrician.

Electricity in the house affords a field for the woman electrician, who will add domestic science to her knowledge of electrical science, and a little practical knowledge of household economy.

The electrical press has been of great public service in the introduction of electricity in the house, and the expert, in co-operating with the domestic expert, is doing work of immense value. The great problem is that of supply, cost and voltage, and until these difficulties are overcome electricity cannot come into general use. The running cost must make up for the heavy initial cost. In new houses this can be put against economies in chimney stacks and space, in both new and old by the hiring system.

What is of more importance than cost is the saving in health, in efficiency, in labour, the giving of order and leisure, in the help that electricity lends towards making the home ideal in the sense that there ideals are born and fostered, because there life is lived at its best.

In an Italian village the peasants lay flowers and say a prayer at the grave of Volta—a simple expression of the gratitude which the civilised world owes to electrical science for public service rendered.

Books Received.

"Palmer's Technical Dictionary." English, Spanish and Portuguese. (London : E. Marlborough & Co.) Pp. 73. 7s. 6d. net.

"Matriculation Magnetism and Electricity." By R. H. Jude and John Satterly. (London : University Tutorial Press, Ltd.) Pp. 415. 6s. 6d. net.

"Radio-Activity." By Kasimir Fajans. (London : Methuen & Co.) Pp. 138. 8s. 6d. net.

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The History of an Electric Home.

By DOROTHY HOWELL.

Electrical apparatus in the home possesses the important quality that is essential in the manners of a gentleman, it is never noticeable. In recent years electrical equipment of all kinds has vastly improved. The lighting is useful and ornamental, but to maintain both qualities requires attention and care. All-electric heating means giving up the comfort of the coal fire, makes rubbish disposal difficult, and introduces the problem of obtaining sufficient hot water. The bowl fire is very useful indeed, but ordinary flex is a nuisance, and something ought to be done to provide a connector which a woman can wire as easily as she can learn to replace fuses. Cooking on the table is a delight, though the flex and connectors are again a nuisance which something should be done to remove. The cost question wants looking into, but electric cooking is well worth paying for.

When first faced with the question "Tell us about the use you find electricity in your home?" I found myself instinctively starting off with "I've got an iron, I've got a cooker," and so on, until I found that anyone reading it would gather that my idea of an electric home consisted in rattling off a list of various odds and ends worked by electricity, collected from a maker's catalogue.

It is only after thoroughly going into this question that I realise that I *have* got an electric home, because practically all my electrical apparatus possesses that important quality which is most essential in the manners of a gentleman, namely—that they should exist and be brought into daily use in such a manner that they are never noticeable. They have not arrived at this stage, however, without a fair amount of trial and trouble. I must admit that I started an electric home a long time ago, when I was first married, which is far more years ago than I care to contemplate.

Like all newly married girls I decided that my home should be different from everybody else's and more up to date than anybody's who had been married a week before I was. Consequently I arranged for some electric cooking apparatus, as well as, of course, for lighting and a radiator.

My Original Apparatus.

Perhaps I might just go back and tell you something about the apparatus I had then, and after that go through the home as I have it now, and show how far those invisible people called manufacturers have improved.

In the first place, gasfilled lamps were not thought of, or if they were, they were only in the experimental stage, and not on sale; I tried the "dim religious light" effect, obtained by wiring up a lot of old Dutch candle sticks dotted about the rooms, also the sconces on the piano. In the little den, far too small to be called a drawing room, this was an excellent idea for effect, until the man of the house wanted to sink into a comfortable armchair and read, which necessitated the introduction of a piece of flex with a lamp holder and a lamp on the end with a piece of green card tied over it, which was suspended over the back of the armchair mentioned above. This brought one fact home to me, namely, that if I was going to have effect in light, I must not forget that light was needed for useful things as well. Another point was that the piano lights looked charming as decorations, but the beautiful shades that made the effect had to be removed if anyone wanted to play anything from music.

The Lamp Radiator.

The radiator was one of the luminous type—that is, one of those with four lamps in it, and I must candidly admit that in spite of all the improvement and lecturettes I get from time to time on efficiency, I have not yet found anything so cheery and comfortable for the lounge or the bedroom as the old four-lamp radiator; which in those days could be rented for 2s. per quarter.

The Most Perfect Electric Appliance.

The iron, of course, even at that time was the most perfect appliance of all the electric series, and it is not many weeks ago that I disposed of the pre-war relic to a neighbour, for, I believe, very nearly as much as it cost all those years ago. The only objection to the iron was that it had to be used from the lamp holder, as the landlord when wiring the house seemed to have in mind the necessity of cutting the plugs and lights absolutely to the minimum. In those days the only contrivance we had for using the iron after dark in the kitchen was an ugly brass affair, in which the lamp was put between two pieces of brass which were bent round to another lamp holder at the bottom, so that the iron could be put in this and the lamp above it. I could never find a shade that was deep enough to cover this ugly contrivance and at the same time wide enough to take it.

Some Primitive Cooking Apparatus.

The cooking apparatus was what I should describe to-day as primitive; we had a grill, chiefly notable for its weight, the large amount of cast iron in its construction, and the length of time it took to cook. In addition to this, we had a solid hotplate which worked fairly satisfactorily, and another hotplate in the bottom of a sort of glorified biscuit tin, which had to be kept burnished like "fine gold" so that we should have no "radiation losses." What they were I have not the slightest idea, but as it did not seem to take any longer to cook whether it was cleaned by hours of "elbow grease" or was just rubbed over, I am afraid the story must have been a myth, or else we must have had a lot of "radiation losses." They cannot however have been very serious, as the bill was not extraordinarily high.

We could not afford a vacuum cleaner so we used to hire one; this was fairly effective, but extremely noisy.

The Home of To-day.

So much for my initial electric home. Now for my home of to-day.

The lighting, profiting by experience, is useful in the necessary places, and at the same time ornamental, and here are a few tips which may be useful to friends who are thinking of starting an electric home, or modernising their existing one.

If you have glass bowls which can be seen through, or bowls made of silk, it is necessary to take them down once a week and remove the dust and dead flies. Another thing that used to worry me, was the fact that through the nice painted shade on the ceiling fitting and on the standard lamp you could see the wires glowing red, a most ugly effect. This we have now got over by using a lamp of which I do not know the name, but the glass is like that on those flat white shades. The kitchen light, ours being quite a small kitchen, not too high and with light coloured walls, has been fixed up close to the ceiling without any cord. After having several shades and lamps broken by a vigorously applied towel after a morning cold tub, we have also had the bathroom light put up close to the ceiling, with a cut glass shade over it, called "Holophane," so now, unless you stare right up to the ceiling, you do not see the actual lamp, but get an even light all over the room. The bedrooms have ordinary pendants with silk shades, but in the bedroom where the children sleep there is another pendant also fairly close to the ceiling with a dim lamp in it. We have in the course of years tried all sorts of night lights, from the old fashioned ones that one used to put in a saucer of water to patent electric ones you pulled up or down by a piece of string (these by the way usually got fixed in one position in a few days), and at last we have an invention

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that seems to be quite the right sort. It is a small bulb with a thick piece of metal in it and it just glows red. Incidentally, I have had it whispered to me that it takes such little current, that if only one is burning by itself, it will not move the meter, so it remains alight all night.

All-Electric Heating not Necessary.

As regards heating I have not got all-electric heating, and I do not think I should like it if I had I stayed for a short time in a house where there was all-electric heating in conjunction with central heating, and I missed the coal fire. Once I was fortunate enough to stay for a few months in a flat where current was free; even then we purchased coal for the dining room. One disadvantage of the all-electric home from the hygienic point of view is the absence of anywhere to burn rubbish. Therefore I think I can say that for a small house our present arrangement, though not perhaps the best, is as good as any. In the dining room we have an ordinary dining room grate with boiler at the back and a pull out arrangement, so that the fire can be shut in. This insures that practically all the winter there is hot water at all hours of the day and night, and the shut up arrangement, when nobody is going to be in the room for half-an-hour or so, enables a lot of rubbish to be put on top of the coals, shut in and roar itself away, heating the water and disposing of a lot of household papers, etc. The bath water heating thus resolves itself into a summer problem.

Unfortunately we are situated in a district where electricity is not cheap, that is to say, it is nearly 3d. per kWh, so that bath water heating is out of the question, and in the summer we have to rely on the copper in the kitchen, which with a shovelful of coal, a few sticks and then fill it up with rubbish, will boil ten gallons of water in 15 minutes. The difficulty of getting it upstairs is now being overcome by having fixed an ordinary piece of water piping from the bathroom down to the copper (of course this only works where the bathroom is immediately over the kitchen or the place where the copper is) and using a little pump, which soon pumps the water up into the bath. Of course if electricity were cheaper we could get a big immersion heater placed in the bottom of the copper and another in the tank, for use in the summer, but this is something that will only come when the rates fall. For the other rooms we have ordinary fires with porcelain bars and wire wound on them, although perhaps it is rather a primitive way of expressing it, that is the way it is done. These are for the drawing-room and best bedroom, while we have a bowl fire that can be carried about anywhere for the other rooms.

Flex and Knots.

This little bowl fire is a very useful thing, indeed; of course, it is not much use if you want to heat a room, but when you want to bath the children, or if any of them have a cold, or on those biting east wind nights, if it is put in their bedroom just for an hour or so it takes the chill off the room and makes for healthy sleep. While on the subject of radiators that can be carried about I wish somebody could produce a flex that would not tie itself into knots and get twisted into all sorts of Chinese puzzles, and after a summer in the cupboard come out for the winter all dried and then wear out at the bend and have to be renewed. I did try one new thing, called cab tyre flex. It was all covered with rubber, like the tyres of a pram, but the objection to this seems to be that it is so thick that by the time you have cut it down to go into the ordinary connector it is weakened and very easily breaks off if it gets a slight pull or jar. Apart from that it is the longest lived flex that I have found. If it could be made thinner, or if connectors could be made different, it would be a great help.

A Subject for Invention.

While on the subject of connectors, will somebody please invent a lamp-holder and connector into which an ordinary woman can put the flexible cord without loss of screws and temper; the screws are the most microscopic things you could wish to find, and I do not know how many times I have cut my thumb in trying to scoop out the piece of wood in the lamp holder to make it big enough to take the cord. Connectors, at least those with which I have had experience, are charming devices to wile away a pleasant half-hour if one is fond of jig-saw puzzles. There may be a knack in it, and the people who make them may be able to do fabulous numbers in the course of a day, but to the ordinary householder, who with luck only has an occasional one to do, they are extremely trying, while to send these small repairs out means unnecessary expense and one which I studiously avoid, since I was told by one contractor that he could not send a man out of his shop, which is about ten minutes' walk away, to ring my front door bell unless he charged half-a-crown before any work was done at all inside.

Fuses Easy to Replace.

The fuses seem to be made by a different set of people altogether, as I have never yet found any which were difficult to replace. This is getting away from the home electric, but at the same time these little points are ones which mean more to the average householder than a lot of figures and statements about efficiency. Also will those who are building and wiring new houses put in more plugs. Ironing is much easier when you can connect up to a handily-placed plug, and a plug seems to cause less trouble than a lamp holder. I would sooner use a Bissel carpet sweeper upstairs than an electric vacuum cleaner when I have to have yards of flex trailing about because there are no plugs in the bedrooms. Plugs can't cost a lot when they are done with other work, but people don't like having work done after the house is finished and furnished.

Cooking Experiences.

In the course of my experience of electric things for cooking, I have gone through the initial stage that I related above with the old biscuit tin, then on to a big cooker which was slow but sure, then to a flat where it was impossible to get big enough mains to use anything but small appliances, down to my present modern cooker. Here I should like to mention a hint that might be useful to somebody who is placed as I was once, by the boiling plates breaking down when I was expecting friends to dinner. The vegetables were cooking when something happened, and both boiling plates went on strike, so I turned the iron upside down and propped it up with two fire bricks out of the grate and balanced the saucepan with steamer on top of that. It certainly took a long time, and if I remember rightly the potatoes took an awful lot of mashing, but still it saved the situation.

The Use of Table Apparatus.

And now about the domestic things you use on the table, even though you have a big complete cooker, once you get used to it, there is nothing nicer than to do the breakfast, or the little snacks that follow an evening out, when one arrives home late and hungry, on the table. I have a little nickel-plated griller which fries on top as well, a toaster, and a coffee pot; it was not without a bit of experimenting that I decided these were as useful as the beautiful illustrated pamphlets said. For instance, if you get up from the table, or turn round in your chair, catch your feet in the piece of flex, upset the coffee on the clean cloth, or pull the toaster off the table, it does not help you to enthuse about table cookery, and when a genius invents a beautiful little nickel-plated griller, that grills and fries without splashing any fat all over the place, and with feet that do not get hot and spoil your table, it is a pity that you have to catch hold of a piece of hot metal to disconnect it when a wood handle on the other side of the plug would obviate the necessity of either doing that or getting up and pulling the plug out. The disadvantage of these appliances is that you have a lot of flex and connectors lying all over the place.

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How Some Difficulties were Overcome.

We have got over this at last, by getting a set from the same maker so that one flex and connector does for everything, the bowl fire, coffee pot, iron, griller, and toaster; we have made a wooden block with a connector on the back that fixes on the edge of the table or the table leg. We bring the flex along the floor, round the table legs and on to this block; on this we just have short pieces of flex and a connector, the latest addition being connectors that contain a switch so that you can cut the current off without touching the appliance. The cooker is the best I have seen up to date, it has a useful sized oven in which you can pack a lot when you want to. The oven possesses a thermometer which is extremely useful, as if you keep a little chart beside you, even the most ignorant of maids cannot but know when to turn it down, and I can truthfully say that I have never yet had a failure, either with the meat, pastry or cakes in the electric oven. The cooker I have at present has two open coil boiling rings on the top, but there is plenty of room between the wires, so that if anything boils over, it falls through on to the plate below, it can be cleaned, and although we have had several boiling over catastrophes, and it has been in use for nearly two years, we have not had to renew the wires.

The Cost Question.

Even at 3d. per kWh I find I can cook for five people for just under 7s. per week, this goes up to 8s. or 9s. when we use the electric fires. I always read the meter every week, a tip that was given me by a friend in a Supply Company, so we can easily check if the consumption has been excessive in any particular week, and if it is found steadily creeping up, can take steps to economise.

On the question of the prices for cooking, I cannot understand all the different rates, but perhaps some engineer or some high authority will explain, how it is and how long it will be, before we have a rate that will allow us to use electricity for our bath and more freely for fires and cooking.

I have looked into it in an amateur sort of way and have made enquiries of people at exhibitions, etc., and all I can find is that electricity is made out of coal and oil, and that men have to be paid to look after the works. As there is no difference in quality as far as I can see I do not understand why it should cost the people who supply me three times as much for the same material as the people who supply a few hundred yards away. There are a lot of districts in London where people can get electricity for 1d. per unit, and I could certainly spend the extra 2d. on every cooking unit I use, to good advantage. I feel that somebody is making too much money out of me.

An Electric Washer.

The next and last thing I want for my home is an electric washer. Here the first cost is the stumbling block. It costs very little to work, but £50 is a lot of money, and that seems to be about the cost of a good one. I have gone into the question pretty thoroughly by looking at all sorts and asking people who actually have them, and think that the one that has two cups which go round and up and down is the best. It certainly seems to get dirt out very thoroughly, but the washer will have to wait; if I could only get current for 1d. a unit and save the extra 2d. I should soon have one.

I can honestly say, however, that I would always willingly pay more for electric cooking if necessary, as I am sure we are all better in health and temper through not having any fumes in the house; the cooker has been splendid this summer and my kitchen always keeps cool and clean.

Woman—the Domestic Engineer.

By MARGARET M. PARTRIDGE, B.Sc.

Domestic engineering forms a tremendous problem for man and woman to tackle before perfection can be reached. This, as some aver, is a woman's job, and housewives may well have to be domestic engineers in the same sense that many of their husbands are carpenters. The handy woman contributes as much towards home comfort as the most superior cook. But woman's present domestic mission is to educate—to introduce labour-saving appliances into the home and give instruction in their care and management. Mistrust of mechanical and electrical aids is by far the most important hindrance to progress. Conferences about household management are urgently required. In this way distrust can be turned to affection. This is all work which the rightly educated woman can do, and will lead to the abolition of the domestic drudge as a factor in our social life.

There can be no two opinions about domestic engineering—there is a tremendous mountain of work for man or woman to tackle before perfection is reached in the way of the complete, comfortable, worry free, automatic, self-cleaning home. Within the last twenty years much has been done—especially on the other side of the duck pond—but as long as housewives continue to wash up tea things, cup by cup, with hot water and a rag, and are afflicted by those gossip provoking scandals called servant difficulties, so long must we confess ourselves beaten by the problem before us.

When a problem has proved baffling for a long time there is usually a cry for someone else to come and have a batter at it, and in this instance we are beginning to hear from some quarters "Why don't women take over domestic engineering themselves? and there is undoubted wisdom in the murmur. Why? Not because women have more inventive powers than men. They haven't. Not altogether because they know the difficulties to be overcome better, though that is certainly a factor in favour of the woman domestic engineer. No—housewives should all be domestic engineers in the same sense that many of their husbands are carpenters. The handy woman—able to repair a leaky tap, a tiresome lock, a sewing machine or an electric iron—contributes as much towards home comfort as the most superior cook. This does not exclude the professional woman engineer, able to design domestic machinery, to install country house lighting or pumping plant and to give advice about washing machines, churns, cookers and the thousand and one appliances so necessary to the comfort of the complete home. She may well hold an important place in our social system of the future—but it must be confessed that she won't be able to achieve everything in the way of bettering domestic conditions and solving housing and servant difficulties until she can get the full co-operation of the mechanically educated housewife.

Woman's Present Mission.

At present, however, her mission is to educate. She can do a lot towards introducing labour-saving appliances into houses and in instructing housewives in their care and management. She can soothe and instil confidence in those last century ladies who know that electricity and thunder are intimately connected and dangerous, and that any modern machine "works" or "fails to work" according to some law of predestination without reference to the being in charge at the time. This may sound trivial, but few will deny that the volume of mistrust of mechanical and electrical aids to housewives is still by far the most serious hindrance to progress towards the ideal. When 90 per

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cent. of English housewives have failed to discover the advantages of the electric vacuum cleaner, and think that the only proper way to wash clothes is to rub them by hand, how can one expect the engineer and inventor to produce press-button methods of washing plate and crockery or of making beds? No! We have the organisation to produce proper (and shoddy) labour-savers, but the country is not yet ready to turn its attention to making the most of them in the home. Our education and traditions lead us to hold conferences about "servant difficulties" instead of about "household management."

Some Reasons for the Present Discontents.

The reason for this state of affairs is not far to seek. With very few exceptions women, the home-makers, receive in their education no mechanical or scientific training whatever. Thousands upon thousands start housekeeping without an idea what a spanner is, what you may expect electricity to do, what causes the water to run out of a tap, and many think they have an adequately furnished house when they possess neither a hammer nor a screwdriver. A truly appalling situation to confront the Electricity Supply Co. or the domestic accessory manufacturer. The only possible course open to them is to enlist the services of women demonstrators. Not the young lady who can use, again and again, the same piece of apparatus, and has no knowledge beyond, but women who can really advise about either the domestic science or the engineering aspect of the case, who can carry out necessary repairs or take charge of maintenance departments. Such women will earn the confidence of the housewife and will be in a position to give the assistance so necessary for the completely non-mechanical.

It is remarkable how distrust and dislike of machines will turn to pride and almost affection when the "works" are explained. I could quote instances without end of people with country house lighting plant, motor-cars, vacuum cleaners or electric kettles who have had apparatus of which they have been unable to make full use owing to ignorance and nervousness, and who have been made happy and confident by a little helpful information at the right time. One illustration will suffice.

An Illustration in Education.

A lady came to me the other day explaining that she had been cheated abominably by a firm of engineers who had installed an engine-driven pump. The engine wouldn't work—consequently she had no water. She wished to prosecute the erring engineers, scrap the engine and have a hand pump instead. Altogether a thoroughly cheerful state of affairs. She came to me because she had lost confidence in men, and thought that, being a woman, I might sympathise more. I did. I took her over the engine bit by bit, showed her why it had failed to run in this instance and how she might rectify the fault on any future occasion. Showed how simple it really was and how cleverly each bit did its job, and now there is no more proud possessor of an engine, or any more ardent partisan of women engineers.

If every possessor and purchaser of labour-saving apparatus understood how to make the best of it, the domestic drudgery saved by them alone would justify optimistic prophecies of automatic comfort and cleanliness in every home. But it is only those who can talk to the housewife in her own language about washing, cleaning and baking who will be able to bring about this desirable state of affairs, and this is as obviously woman's work as nursing or cooking.

Where, then, are we to find our domestic engineers? Is it possible for women to acquire the necessary amount of skill and will they be able to withstand the severe physical strains which are supposed to be the lot of engineers?

These questions are frequently asked. I will deal with them in their reverse order.

Some Questions Answered.

The question of physical ability is a matter for the individual to decide. Engineering does not involve as much physical fatigue as nursing, gardening or washing (the rub-a-tub variety), but nevertheless I should not advise parents of delicate girls to choose it for their daughters' profession. The normal, healthy, games-loving product of our big girls' schools is perfectly capable of fitting herself for the work.

The question of skill or mental ability I feel inclined to treat with contempt. However, in case there are honest enquirers I would remind engineers that our profession is not really as difficult as surgery—yet women frequently make good surgeons. Further I need only refer the sceptical to some of the achievements of members of the Women's Engineering Society to obtain complete conviction.

The question of finding our engineer is a more difficult one. The training of the complete domestic engineer should include domestic science, electrical and mechanical engineering and general workshop practice—including a thorough course of repair shop, fitting and testing and a smattering of machine shop and drawing office work. Perhaps this seems rather an extensive programme, but to most women it is one teeming with interest—not unduly strenuous, and well within the scope of the girl leaving school after matriculating.

Women and Men—Some Differences.

By nature women are as able to use their brains as men, but by training and tradition they usually use them in rather a different manner. To take an instance—I once had the privilege of teaching boys and girls, apprentices, the work of an electrical test. These young people had all reached the same standard of education in secondary schools, they were all about the same age, and all came to their work straight from school. Their occupations were interesting and varied, and included such diverse things as finding the fuel consumption of a country house lighting set, the mileage of an electric bath-chair, or the resistance of an immersion heater. Of course both boys and girls had individual characteristics, but one difference between them was most marked. When a boy had a job to do he had never done before he went straight to the spot, and if he wasn't sure how to make his connections or take his readings he didn't let a little thing like that stand in his way, but just went ahead and trusted to luck. A girl, on the other hand, never started a job unless she thought she was sure she knew how. She would take pencil and paper to a corner and puzzle out the instructions received until either she understood them thoroughly or had to ask to have them amplified. The boys usually got results first, but they collected more accidents on the way. The girls, with fewer mishaps, also achieved results in time, and when it came to repeating the process a second, third or twentieth time they were the more neat-fingered, quick and accurate. I am of opinion that equality of experience eliminates these differences of method to a certain extent. A man of experience, given a new and untried problem, pauses and thinks more than he did in his youth, while a woman of experience, with added self-confidence, does not hesitate so long before rushing in to tackle the job.

The Results of Conservatism.

All this goes to prove that domestic engineering is by no means an unsuitable profession for women, but it is not yet clear where she is to be trained. The practical difficulty facing a girl who wishes to take it up is that of getting the necessary workshop experience—without which no amount of theory is of any use. Manufacturers are as conservative as housewives, and few will take the obvious risks of receiving girl apprentices in their shops, though many domestic accessory makers would be only too willing to employ skilled women on their commercial

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staff. If only we could persuade our educational authorities of the value of practical science and mechanics—with special reference to simple household contrivances—as an item of girls' school curriculum we should be well on our way towards our goal, and the instruction received at school would prove a useful foundation for the subsequent training of the professional engineer. But 'tis a faint hope.

A Hint to Teachers.

A few months ago I offered to give a short series of practical demonstrations on such useful matters as replacement of fuses and tap washers, soldering, care of portable electric apparatus, etc., to some of the girls of an urban secondary school, but the Head Mistress replied that such instruction was unsuited for the class of school where the girls were not wealthy and were unlikely to be in a position to have electricity in their homes. As long as such a point of view is found among educational experts it is useless to look for help there, and education—as always, a little out of date and behind the times—will only fall in with modern development when professional experts have smoothed the way.

The fact still remains, however, that there are a few women who have had most of the experience a complete domestic engineer should receive, and very many more who are partially equipped, and who, given the opportunity, would quickly and willingly complete their training. It is to be hoped that the next few years will see the majority of them actively engaged, first in teaching housewives how to study their own comfort, and then in designing and inventing further apparatus so that the domestic drudge will soon be a forgotten evil.

Electricity and the Life of the People.

By SUSIE E. HAMMER.

How shall houses be equipped to save womenfolk the soul-destroying drudgery that has been their lot down the ages? With electricity—the new servant—which is cheap, convenient and cleanly. To overcome the reluctance of woman to use this new servant we must teach, repeat and demonstrate its advantages—as a mother's help, for room and water heating, ironing, washing. For no home can be managed with the maximum of comfort and the minimum of labour without the use of electricity.

" Nothing that is can pause or stay
To-morrow will be to-day."
Longfellow.

From the cradle to the grave life is made up of a series of problems to be solved.

But yesterday this nation's thinkers and workers turned ploughshares into swords under the stress of dire necessity—rapid scientific advance was made in flying—to-day flight is a daily business necessity—ploughshares have come into their own again.

Men of the electrical industry are making history fast. They are tackling, and successfully tackling, the home and its problems. How shall houses be equipped to save womenfolk the soul-destroying drudgery that has been their lot down the ages?

The Day of No Servant.

To-day is the day of " No Servant "—the necessity which was the mother of the invention of many of the up-to-date electrical domestic helps.

No servant! Nay, the new cook-general, the dainty mother's help—electricity—is knocking at the door, and asking for the place. Let her in! She will not fail—she will not give notice. Her service will cost less than that of a maid, and her cleanliness and convenience will save at least one old-time maid's work.

Women are very conservative at heart, and take a long time to shuffle off old habits and assume others, but those housewives, and especially those with their own work to do, who have not listened to the rumour " Electricity is so expensive," but have found out for themselves, are most thankful that the new maid has come to their assistance, and are finding her cheaper, cleaner, and more convenient than any other. Many have adopted electric lighting for years, but they have stopped there, and passed by the feast of labour-savers that electricity has spread before them.

How shall we compel them to come in? We must teach, and repeat, and demonstrate, over and over again, what she can do, first as mother's help—then as cook.

As Mother's Help.

Lighting, heating, cleaning, ironing, cooking, these are her services for all homes—rich and poor. Other services such as clothes-washing, dish-washing, knife and boot cleaning, are for the present only within the means of the mansion or the wealthy—ventilating, refrigerating, etc., are for the factory, the municipality and other organisations. Power for all users is cheap, but for the home of moderate means the apparatus for the last-named is too costly.

Electric lighting is *it*—first and foremost—unrivalled—it has no dirty fumes, as have all other methods, to blacken globes, ceilings, decorations, furniture—no flame to burn up the life-giving oxygen in the air and so cause headache and tired nerves—no matches to be dropped about in an irritating litter—no danger of fire.

Electric Heating.

A coal fire is still the best for a living room that requires to be heated all day, even with its necessary labour of wood-chopping, cinder sifting, blackleading, chimney-sweeping, fuel replenishing, etc., but for the occasional heating of a room or bedroom, the modern electric fire is absolutely best and cheapest—all the labour of a coal fire is washed out. By the simple act of switching on, 80 per cent. of the electricity paid for warms you at once—radiant sun-like heat. The remaining 20 per cent. warms the air of the room—without combustion, fumes, or dirt. The radiator can be moved about to any part of the room—or house—as required, say near baby's cradle, or beside the piano when Sissy practises, or facing the visitor's chair.

A gas stove, on the other hand, only gives out 50 per cent. as radiant heat, the other 50 per cent. is sent up the chimney to make the necessary draught to cause the flame to burn, and to carry off the poisonous fumes. Matches and a fireguard are necessary, and the stove must be a fixture—with a flue.

Ironing.

In ironing, electricity is a perfect maid again. The electric iron has not to be carried backwards and forwards to the coal or gas fire to pick up dirt, which must be constantly cleaned, as well as heat. She heats as she works, and ironing can be done in half the time, with half the labour. At the rate of 1d. per unit for power, as in Hackney, ironing costs ½d. to ¾d. per hour.

Cleaning.

A vacuum cleaner swallows dust and dirt, as it were, instead of merely shifting it.

The potter says in his song—

All things must change—
To something new—to something strange.

This cleaner is new and strange. A room can be tho-

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roughly cleaned without "turning it out," as in the old broom-and-duster days.

With a "vac.," carpets, bedding, furniture, picture frames, tapestry, etc., can be cleaned where they stand, and as dust is not scattered but is sucked up into a bag to be emptied elsewhere, one part of a room can be finished before another is commenced, which lessens discomfort, and makes even spring cleaning a pleasure.

It is surprising that every housewife has not a vacuum cleaner already; perhaps the price has been prohibitive (12 guineas). No doubt competition will alter that in time. In the meantime, husbands! sons! daughters! friends! club together and buy one as a combined birthday and Christmas present for mother, instead of buying individual gifts, or have a common money-box for all to save up for one. It might even be that enterprising undertakings will hire these as well as cookers, or introduce hire-purchase system. Then "mercy would be twice blessed," for with the apparatus in the home up would go the scores of units consumed.

Water Heating.

A constant supply of hot water always ready at a low cost is the greatest boon in the home Coal is not satisfactory—so much labour and unpleasant attention are required. Gas is far too expensive.

Electricity has now, after much research and experiment, come to the rescue, and an invention, partly electric, partly coal-heating, has come on the market, which solves this problem of hot water.

In the writer's own converted maisonette, the bath used to be filled with water, heated by coal in a copper. Now a George Nobbs "Genii" heater, a tank over the bath with immersion heaters, most successfully supplies bath and wash-basin with continuous hot water costing less than ½d. per hour for current.

All the labour connected with the old method is again washed out, and the cost of the coal is saved into the bargain. To get a bath in this house to-day is simplicity itself.

Electric water heating—at first not quite satisfactory, is now being successfully extended to factories, restaurants, etc., and has come to stay.

A bedside kettle with a switch handy! Think of the luxury of the early "pick-me-up" cup of tea, of the winter morning shave. Think again of the ease with which baby's middle-night feed can be made or warmed. Electric curves on a chart in Hackney from maisonettes distinctly show the increased middle-night load for this.

Clothes Washing.

This ever-recurring bugbear of home-life means, in the old-fashioned way, many hours of laborious dirty work, in a most trying atmosphere; but the new invention has changed the old order of things, and with its help a big wash can be accomplished in a couple of hours. The electric washer, after it has been filled and started, does all the hard, nerve-racking work itself, leaving the mother free for other tasks.

One shilling a week would pay for the current used in the machine, and for heating the water, less than the cost of the coal used; but here, again, the first cost of the utensil is too expensive for the ordinary housewife. Public institutions, laundries, etc., are benefitted.

Surely, if this back-aching work can be taken from the mother, her health and happiness, and, through her, that of her children, would be much improved.

Here is food for thought for our health, child-welfare, and maternity committees, which are seeking the blue bird of happiness for the potential and actual mothers of our nation.

Could not this service be hired out through these committees to households?

Electricity as Cook.

The old saying that the "way to a man's heart is through his stomach" is demonstrated over and over again when the appetising joints and dishes, fresh from the cooker, are placed before him—and oh! the cleanliness, the certainty, the economy—never before such a treasure of a cook, and she will not let you down!

As compared with kitchener cooking, all the advantages of preserving flavour are retained, but electricity demands no steady supply of fuel, has no smoke to scatter dust and dirt, no flues with the accompanying sweep, no dirty sooty saucepans.

As compared with gas cooking, it is cheaper and more economical in food shrinkage, and far more hygienic. Chemistry shows that food cooked in the steady unexposed heat of electricity is more health-giving than that cooked with gas fumes and combustion circulating through and around it. Certain it is that meat retains its flavour, is more juicy and tender cooked this way, besides losing far less in weight during the process. By comparing weights of joints before and after cooking, with various housewives using the old and the new methods, it has been proved that an average joint of from 5 to 6 lb. in weight before cooking, loses over 2 lb. in weight when cooked in a kitchener, over 1½ lb. when cooked in a gas oven, but loses only 6 oz. to ½ lb. when cooked in an electric cooker.

Therefore, 1 lb. of meat in 7 lb. is saved by this method.

For example:—Two similar legs of mutton of same weight were cooked on the same day, one in a gas oven, one in a cooker. When both were carved, five more persons were served from the latter than from the former—more than enough meat was saved in weight to pay for electricity used.

The Sunday joint will last a day longer by this method, and the power used is cheaper than gas—roughly 1d. per head per day is the cost of cooking by electricity in Hackney. Then, conspicuous by their absence, are the fumes and smell of cooking, and burning fat, the hot stifling air greeting each entrant into the house; gone, too, is the aftermath of cleaning and blackleading stove and greasy bars and blackened utensils. Again, no danger or opportunity—alas! so frequently seized upon just now—of gas poisoning, "the means to do ill-deeds" being removed.

Some More Advantages.

More advantages of the new cooker are:—

1. As there is no flame, more space is available in the oven, and more dishes can be cooked at one time, thus economising heat and space.
2. The cooker itself takes up little room and gives out little heat, so that a dresser or cupboard can be quite close at hand with all necessary cooking ingredients and utensils; thus many steps can be saved; in fact, the scullery becomes the work-room of the home—its kitchenette—and saves the labour of keeping the kitchen as well as scullery clean.

Last, but not least, cooking by electricity is so simple. Cooking can be done by the clock. A clock-face such as used in a kindergarten school is useful as an indicator: 20 minutes with the "high" switch on, than 1 hour or 1½ hour at "moderate" or "low," or "off," according to the weight of joint, and that is all. No basting, no peeping required, and—repetition being part of electrical education—this cook never fails.

What Hackney is Doing.

"Experience teaches." The moment has arrived in the history of electrical development when the woman must come in, until knowledge has taught her the wisdom of accepting this new service as fully as is possible.

Hackney is in the van of this new domestic service that is helping to solve the problems of to-day, as well as to assist materially undertakings by making use of waste load at "off-peak" times.

An exhibition where no trouble or expense was spared started this latest movement. A go-ahead publicity department has done great things; showrooms are up to date, but entirely new buildings for this last, and for offices, are about to be erected. Salesmanship lectures have been given to the staff concerned. Demonstrations of cooking, etc., in showrooms and in showroom windows are a practice. A lady-demonstrator follows up the "sale" or "hire" of a cooker or utensil, to keep in personal touch with the

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user, and last, but not least, alterations or repairs are immediately attended to.

In fact, every possible method to teach the value of electricity to its potential users has been adopted, and still wider schemes are being arranged for the coming season.

A good plan would be to educate teachers of cookery and household science in this new method, so that they in turn could spread the good news to the young idea. "Cookers" then would soon be found in the L.C.C. and other schools of cookery, in place of the gas stove of to-day.

Hiring and Charges.

There are already over 200 cookers in use in Hackney, and many hundreds are using other domestic implements.

The cookers are the property of the undertaking and are hired to the consumer. At present the cost is 10s. to 15s. per quarter, according to size, but there is now under consideration the advisability of reducing this hiring fee, so as to compare favourably with that of gas cooking stoves.

After all, current is what the undertaking is out to sell, and the domestic load at "off" times is the paying proposition; even with power at 1d. per unit, each cooker consumes on the average 2 000 units per annum.

At the exhibition the first 30 applicants for a cooker had its use "free" for the first quarter. This was an advertisement stunt, and went like wild-fire.

Recently built workmen's dwellings, part of the Council's housing scheme, are "electric homes." Each is equipped with a "Tricity" cooker, a 3-pint kettle, and six lamps.

By the prepayment system the consumer pays 8d. per unit for lighting, as against 6d. of the ordinary consumer, and 1½d. per unit for cooking, as against 1d. for the consumer who hires his cooker. There has been nothing but praise from all for the new method. Cheaper and cleaner than gas is the experience all round.

In ordinary small homes the experience has been the same. Here is an example of the cost in a maisonette, part of a large house now converted into two.

1921.—Total cost for cooking by gas, lighting by electricity, but exclusive of heating of water for bath and domestic purposes; this was heated daily in the copper by a coal fire.

One quarter .. roughly £9.

1922.—Corresponding quarter. Total for cooking, lighting, and heating all water for bath and domestic purposes, by electricity.

Roughly £6.

Therefore, one-third of the cost in money saved, in addition to other economies in labour and the added comfort, which would have been cheap even if the balance had been on the other side.

Again, accounts taken at random from the undertaking's list:—

During 2½ winter months, one maisonette paid 12s. for lighting and 11s. 6d. for cooking.

Another during two winter months paid 8s. 8d. and 7s. 6d.

No great expense here!

No doubt, as appliances become easier to obtain, the "all-electric home" will be no longer a nine-day's wonder.

Electricity and Fords.

Brighton, it is rumoured, is now building, by private enterprise, several all-electric houses without flue or chimney. "To-morrow will be to-day." Perhaps our old-time house of to-day will be as rare amongst its fellows in the near future as the hansom cab amongst the ubiquitous "Fords."

The conclusion of the whole matter is that no home can be managed with the maximum of comfort attained by the minimum of labour without the aid of electricity.

It is up to undertakings to tackle the problem of how best to broadcast the good news, as successfully as the industry has tackled the problem of how to "break in" electricity and so fit her for her new rôle of "domestic servant."

Had Shakespeare prophetic intention when he advised:

"We must take the current as it serves,
Or lose our ventures."

Electricity and the Housing Problem.

By SYDNEY M. BUSHELL.

Town-planning is necessary to secure better houses in pleasant surroundings, and electricity supply will have an enormous influence on every aspect of this movement. The expansion of both population and industry demands the establishment of satellite towns round our crowded cities, and the establishment of these towns will afford a unique opportunity for electrical development in the houses, in the factories and on the farms. Even in building these towns great use may be made of electricity. Hand in hand with this change must go the reorganisation of existing urban areas, and here again electricity, rightly used, can be of the greatest assistance. Houses must be designed so that electricity can be used to the best advantage, and electrical engineers must employ their ingenuity to improve and cheapen the apparatus. For the question is mainly one of cost.

THE true housing reformer desires not only better houses and plenty of them, but also that they shall be built among pleasant surroundings and situated so that the inhabitants may journey easily to their work and have at hand the means of education and recreation, as well as the wherewithal to satisfy all the other needs of a healthy and civilised community. Town planning, in its very widest sense, is needed to secure all this and it is easy to see that electricity supply will have an enormous influence upon its every aspect.

The location of industry is vitally affected by the distribution of electricity, and town planning has as much concern with the location of factories as it has with the location of houses. Electricity, produced cheaply by water power, may redistribute the population of the world. Already steel is being smelted in Norway by electric heat generated by a never-failing waterfall, and large quantities of carbide of calcium and of aluminium are made by the same means. It is more than possible that such countries as Norway and Sweden may, in the not far distant future, become our keen competitors, and might even supply us with electricity.

The Need of Satellite Towns.

However, to come down to the more immediate needs of the present and of our own country, we are now beginning to realise that the best, and indeed the only economical way, to solve the problems of the expansion of both population and industry is to establish satellite towns round our already overcrowded cities. Here electricity may really come into its own. The ordered growth of a satellite town, with its plan prepared beforehand, will afford a unique opportunity for electrical development, because there will be no lengths of unproductive mains running along unoccupied roads, as in the present form of suburban development. As it is cheaper to wire houses during construction, the inhabitants of the new towns are likely to demand electricity for all sorts of purposes, and the

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new factories, which are indispensable to the success of all satellite town schemes, will still further cheapen the supply by increasing the demand.

Agriculture, as well as manufacture, is an important part of any satellite town scheme, and it can easily be understood that with an assured market so near, intensive farming of a market gardening and dairying character will be most profitable. Electrical energy will be extremely useful on farms of this kind for churning, cream separating, fodder chopping, and many other things which must now be done by man or horse power and a portable electric motor will give much less trouble than the oil engine which is now used on up-to-date farms. In fact, the application of electricity to farming would work a revolution in the industry. The only difficulties in the way of cheapness and availability of current could be surmounted in a satellite town, which has as part of its town plan an agricultural belt, every part of which is within easy reach of the electric mains.

Electricity and the Building Trade.

The building trade is an industry which has hardly yet begun to use mechanical power, and our houses are still literally built by hand. A portable electric motor might be as useful here as in the farmyard. In any case, work during the winter months would be much more feasible with a good supply of light. Thus the use of electricity would increase our output of houses. Usually cables are not laid until after the houses are built, but in a satellite town with its pre-arranged plan, the cables could be laid beforehand without risk of loss.

The Reorganisation of Urban Areas.

Although conditions of overcrowding can only ultimately be dealt with by a migration of urban populations, the big cities cannot be left as they now are. We must start gradually to reorganise our urban areas. Electricity, in the form of cheap motor power, particularly for small factories, may tend to make the present congestion even worse than it is, unless town planning regulations for built-up areas are put in force. If, however, these regulations are adopted, then electricity is so readily applied anywhere that it will be one of the most potent means of securing the ultimate re-arrangement of industrial quarters.

Although the effect of electricity upon town planning and the location of industry is ultimately of as much importance to women as to their husbands and fathers, its application in the home is of more immediate consequence to them. We are at present only at the dawn of labour saving by electrical devices. The difficulty of getting cheap domestic service will, no doubt, hasten its development.

How Lighting might be Improved.

Lighting, up to the present, has been the commonest way of using electricity. Even so, the paraffin lamp still gives, for ordinary uses, the kind of artificial light best suited to human eyes, and if manufacturers could produce a cheap bulb giving a similar spectrum to that of lamplight, it would be the greatest boon. All the same, electricity is the only form of illuminant whereby each person may safely have a lamp placed where he wishes to use it. The housewife may have a bulb placed over sink or stove, inside a dark cupboard, or anywhere else. If she has an invalid to nurse, then a reading lamp is easily placed at the bedside. To the same wiring may be attached a bed-warmer or a kettle to boil water for the many purposes of the sick room, thus saving many a journey to the kitchen. In the nursery a tiny bulb forms a night-light which it is safe to leave with the most mischievous of children, and the baby's bottle at 3 a.m. is robbed of its worries by an electric heater. The mercury vapour lamp, with its ultra violet rays is now proved to be so efficient a substitute for sunshine in the cure and prevention of rickets and many other childish diseases that the up-to-date bathroom, especially in the town house, might well be fitted with one for giving a daily sun bath. It should be borne in mind, however, that a continuous current is necessary for mercury vapour lamps.

Warming and Ventilation.

The question of warming rooms is bound up with that of ventilation. The electric heater does not ventilate the room as a gas or coal fire does, but mechanical ventilation by means of an electric fan inside a ventilating shaft is cheaper and much more efficient than any other method. Granted proper ventilation, electric heaters are most healthy and labour saving; they cannot be beaten for occasional use, though the present cost of current is against their adoption for constant use, except by the wealthy. Portability is their greatest advantage; they can be placed anywhere and one or two will serve a whole household.

Architects, in planning houses with a view to electric installations, may effect a good many economies. The substitution of a ventilating shaft for the bedroom chimney economises building materials and adds to the space in the room. Many difficulties of design would disappear with the chimney, and each room may consequently be planned for comfort, with a portable heater placed wherever it is wanted. Rooms need not be high, for electric bulbs may hang within a few inches of the ceiling, and the space thus saved might be used to increase the size of the room in other directions. Very few rooms in an ordinary modern house have sufficient floor accommodation to give one a sense of spacious comfort, and, on the other hand, many rooms, bedrooms especially, need not be so large if ventilation is efficient and draughtless.

Electric Cooking and Cost.

The adoption of the electric cooker is very much a question of cost. The oven acts like a fireless cooker, a great deal of the cooking being done after the current has been turned off. Meat cooked in this way retains its juices in a fashion not possible by any other method. Although the electric oven, properly used, offers the least wasteful method of using heat, the hot plate is extravagant, and as it is the most frequently used part of the cooker, especially among working people, makers would do well to turn their attention to its efficiency.

The plate warmer is a boon to the servantless house, for everything may be put upon the table at once and the second course kept hot while the first is being eaten.

Electric Power in the Home.

Although the amount of current required for running a little motor is small, yet the application of electric energy to housework has many difficulties. Firstly, the average woman needs instruction in engineering. Secondly, housework itself is a series of skilled operations, each of which takes a comparatively short time and is repeated at intervals; thus the number of times a machine may be needed each week may be so few, that the time saved will not warrant the capital expenditure. Thirdly, each operation consists of, roughly, three stages—preparation, doing, and clearing away. When considering the advantages of any mechanical device, the time for the whole job, including all its three stages, must be taken into account. If judged from this standpoint, some of the devices now on the market would not pass muster. A few experiments in scientific motion study would be useful and enlighten both houseworker and manufacturer.

Some Criticism of Present Appliances.

To criticise a few of the appliances now obtainable: the vacuum cleaner scores on the preparation stage, as no dust sheets are needed to cover things up, but it takes longer to do the actual work. This, however, is done so excellently that no brush, however carefully used for however long, could possibly equal the result; and it thus scores tremendously from the sanitary point of view. Unfortunately its cost is impossible, except for the well-to-do, otherwise its use would be universal.

The electric iron scores wholly on the preparation stage,

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as it is always clean and the worker need not waste time changing irons. An arrangement on the iron which could be set to "cool," "medium," or "hot," would be a convenience, as different materials need different temperatures, and regulating the heat by turning the switch off and on is troublesome. All things considered, however, the electric iron is quite the most labour saving and convenient device on the market.

The desirability of the present types of washing-up machine for *small* households is questionable, and here also the price is quite prohibitive. Even when it washes-up satisfactorily all kinds and *shapes* of dishes, silver and the like, the preparation and clearing away stages are not shortened, and it is necessary to wash-up the washing-up machine! It is not worth while to do this three times a day, and every family is not provided with enough crockery for a kind of Mad Hatter's tea party, consequently the possible usefulness of the machine in its present form is doubtful, at least for the small family. The same may be said of the clothes-washing machine.

A small general utility motor which could be applied either to the sewing machine or bread mixer or things of that kind, and which could have different polishing wheels adapted for cleaning shoes, silver, or anything of the sort, would be simply invaluable in a small household.

Use the Public Supply.

It is always a matter of surprise to me that people go to the expense of having a private electric installation for lighting alone. Running the engine is certainly not much less dirty or troublesome than cleaning paraffin lamps, but is much more expensive, although it must be admitted that the expense of house decoration is considerably diminished by the use of electric light. If heat and power could be supplied as well, it would indeed be worth while. This would probably necessitate a bigger installation, longer running, and larger accumulator capacity, but would be well worth it in country houses.

A Question of Cost.

Really the question of applying electricity to domestic uses is entirely one of cost, not only of the current, but of appliances and their upkeep. The housewife's allowance is limited, and if she is put to much expense by saving labour, then labour saving devices are not for her, however much she may desire them.

With industry it is otherwise, a saving of labour cost will mean increased profit, and there is every inducement, therefore, to adopt labour saving devices. This is specially important in occupations of a semi-domestic kind in which the work has hitherto been done by hand, and in which women are mainly employed. The electrically driven sewing machine means not only increased output, but better health to the worker, who is saved from the treadle. In hotel and restaurant work, washing-up machines will be of the greatest service and a blessing to the women whose arms are plunged in greasy water from morn till night. The same thing applies to laundries and the washer and wringer. In fact, many of the domestic appliances, which are exceedingly clever and ingenious, but not suited for ordinary household use, will find their way into boarding houses, institutions, and other places where housekeeping is done wholesale.

In the meantime, there is a great field for the invention of domestic appliances for the small household, always bearing in mind the special circumstances and limitations which I have described.

Electricity and Better Hygienic Conditions.

By ISABEL BASNETT.

Hygienic, labour-saving devices clamour to be used; and are neglected. The reasons are cost and fear. But the cost of electricity is set off by other advantages, and to clear away the fear of electrical apparatus that exists is a matter of education. Electricity spells labour-saving and health, and the power available to generate it must not be allowed to run to waste.

When posterity comes to study the history of our own times, the thing that will surely astonish it the most, will be the knowledge of the fact, that we made so little use of inventions and discoveries which should have lightened the burden of our lives to such a large extent.

This fact is sufficiently astonishing here and now. With hygienic, labour-saving electric appliances clamouring to be used all round us we still fail to take advantage of them, and in home, street, workshop and factory continue to use, to an incredible extent, the dirty, cumbersome coal fire or the dirty and dangerous coal gas.

Two Unwarranted Fears.

Why? The reasons against the use of electricity for cooking, heating, etc., in the home appear to be two only. First, that it is expensive; secondly, that the ordinary English housewife is afraid of apparatus, and she will have to be convinced that there is no sound argument on the score of expense and that her fear is unwarranted, before we can appeal to her on the all-important ground, that the use of cleanly electric appliances makes for healthier life in the home and in the city.

To take the first reason. The use of electric power in some places may result in a bigger quarters' bill than one for coal or gas (in other places it would not, and a larger use of electric power would quickly weigh down the balance in favour of electricity everywhere), but an intelligent comparison in the running of the household on coal or gas, with electricity, will show expenses under the two former which disappear or are more than halved under the last. For instance, the saucepan almost entirely disappears if an electric cooker is used. Food can be cooked in fireproof china or glass vessels to an extent which is impossible with a gas cooker or coal range, and served in the same vessel. Moreover, food is not wasted in the cooking, as heat can be regulated to a nicety. A double economy is indeed affected, because once the hot plates of an electric cooker are heated, sufficient heat is retained, when the current is cut off, to keep any food in the process of cooking at boiling point for a considerable time—quite long enough to cook potatoes, stew fruit, etc.

Electricity's Greatest Economy.

The greatest economy is, of course, the entire absence of dirt and dust. Where electric heaters in sitting-rooms are used, the life of covers, carpets, curtains and furniture generally is considerably lengthened. One cleaning only is needed where electricity is used, to three where coal and gas are installed. Windows, paint and walls keep their freshness much longer. When the time for cleaning does come, with vacuum sweeper, electric duster and carpet cleaner, and washing and ironing apparatus at her hand, the necessary cleansing becomes to the housewife a pleasure, not a toil.

In the sick room an electric heater is ideal. The air of any room can be raised quickly and surely to any warmth. Again, the absolute cleanliness and *quietness* in sickness render the electric heater invaluable. How often is the patient irritated or disturbed when sleeping by the

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replenishing or "doing" the fire, or the continuous roaring of the gas fire.

As to the second reason against the use of electricity—i.e., the very real dread of apparatus. It is up to the vendors of electric power to clear away this feeling by popular lectures and demonstrations. Once the housewife realises how exceedingly easy, safe and simple, the management of electric apparatus is, this dread will soon vanish.

When these two ideas of expense and fear have been eliminated from the mind of the housewife, she will begin to consider the use of electricity from the health point of view.

Electricity Spells Labour-saving and Health.

If the use of electricity spells labour saving in capital letters, it also spells health.

The pollution of the air of our great cities and towns, due to the use of coal in our houses and factories, is the direct cause of an enormous amount of ill-health among men, women and children. Many more cases of pulmonary diseases occur in the smoky towns than in the country. The number of deaths among children from taking cold after measles, for instance is, again, far higher in the towns. The strenuous efforts made for infant welfare have reduced the number of deaths of babies under one year, very considerably in many large towns; if the air were clean and pure this number would be further reduced.

By far the largest amount of air pollution is caused by the domestic coal fire, and, moreover, most of the heat goes up the chimney. A knowledge of these facts should make the housewife realise that the use of electricity is aiding her own economies and removing the cause of much ill-health among the community.

With regard to the use of electricity in the factory and workshop. Granted that for some processes of manufacture at present, the use of electricity does not seem to be practicable—it could be installed in very many works with infinite advantage in health and economy.

No one has ever considered how much the beauty of our towns would be enhanced if the chimney-pot was eliminated. This consummation could be achieved by the general use of electricity—for electricity requires no special ventilation, as in the case of gas or coal.

A Surprise for Posterity Unless . . .

To conclude. Posterity will have another cause for surprise unless we bestir ourselves. This will be caused by our extraordinary neglect of the sources of power; we let the power remain locked up in our coal mines and run to waste in our harbours, rivers and streams. What we want is a national campaign pointing out the immense advantages of electricity and showing how simple the establishment of electric plants would be when the means to generate power lie at our very doors.

Electricity and the Brighter Domestic Day.

By ALICE BURNETT RAE.

The dawn of a brighter day! Yes! Brighter in so many ways for us householders, thanks to the introduction of electricity into our homes. Our kitchens are brighter, cleaner, healthier since the electric cooker has found its way there. Decorations last years longer when we have no smoke or fumes to contend with; our very garments remain clean longer as we have no grease or smuts to sully them. Variable tempers, both upstairs and down, remain serene under such circumstances, as owing to the food being so much better and more hygienically cooked our digestions do not suffer. Then there is the vacuum cleaner; with it dust is eliminated as if by magic, and the dreaded spectre of spring cleaning is no more. In fact, we can "spring clean" every day, and do not need to drag our carpets up at stated intervals, living meanwhile in a state of chaos. Curtains, books, the very walls themselves, can all be treated easily and with small effort whenever we feel inclined without upsetting anyone's temper or interfering with the general routine.

An Untold Blessing.

This is an untold blessing, especially in a professional man's household, where the housewife must always be ready for any emergency that may arise, and the house is practically always under observation. Again, small in size, but looming large in its capacity as a labour saver, is the electric domestic iron. It is a matter of wonder what we ever did without it, and should by chance our iron require new flexible cord or be *hors de combat* for a day or so, it is a calamity. We simply cannot go back to the older method of heating irons by coal or gas, and feel lost until our treasure is in working order once more.

The Joy of the Electric Heater.

One more item I must mention, which is more in evidence in the winter than the summer months, viz.: the electric heater. What joy there is in being able to have our heat just when and where we want it, not necessarily taking the place of the coal fire, as it does not interfere with the grate, it can stand on the hearthrug or anywhere else and is always available when wanted; in the middle of the night in case of illness it is always ready to cheer and warm us, without the preliminary of sulky faces or muttered threats of notice. How we have suffered in the past, and how grateful we are that these same sufferings are over.

The Crux of the Matter—Cost.

Now the crux of the whole matter from the point of view of the financial head of the house is the cost; in the district in which I live, this is most reasonable, 1½d. per kWh is the highest charge for heating and cooking and the Supply authority meet us in every way, from teaching the cook to maintaining and hiring the apparatus. Can more be asked? And speaking more particularly from the point of view of one who has to run a large London house with its huge basements, high rooms, endless stairs, electricity is the only thing that makes it possible to live in any kind of comfort both mentally and financially. Apart from the fact that electricity costs less than any other kind of heating, one has also to consider that a house run by electricity requires less domestic help. For instance, in a house where there are three required in the kitchen, with an electric cooker a scullery-maid can be dispensed with, and when in an ordinary way there are two, one can manage with a single-handed cook and a "'tweeny." Upstairs, under-housemaids can be dispensed with to a great extent, and when it is considered that in these days every maid costs from £80 to £100 per annum and that half the time no money can procure a capable maid, it goes without saying that our friend electricity not only saves us financially, but also mentally and physically, and that when the mistress of the house ceases to be worried and feels absolutely independent of the very inferior help one has so often to put up with, then the rest of the family gain in a hundred ways, and indeed there has dawned a brighter day.

Here I would like to put in an appeal to other electricity companies to make it possible for London housewives to have the same chances of making use of electricity as we have in our borough.

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"The Electricity Age."

By J. HORACE BOWDEN, General Manager, Poplar Electricity Supply Undertaking.

With the advent of water heating on a commercial footing through the medium of electricity it may reasonably be assumed that a new era in electricity supply has begun, and that we are entering upon what will in the future be known as the "Electricity Age." In the past, efforts have been made to store waste heat in the form of electrical energy in secondary station batteries for use over peak loads, but this method has proved very inefficient and the cost of maintenance extremely high, therefore the anticipated results have not been realised. Thermal storage of steam has also been attempted at the station end of electricity supply, but this practice has been practically abandoned on account of cost, unreliability and danger in operation.

Heat Storage in Water.

Twelve months ago the writer conceived the idea that if it were found practicable to store heat in water at the user's end of the system during off peak hours, it would be possible, given a sufficient demand for hot water and steam, to maintain, as nearly as may be, a 100 per cent. load factor on the station, and so enable electricity supply to enter into competition with gas supply on an equal footing. It appeared to him that, under existing conditions of supply, any load that could not possibly alter the peak demand could be charged for on the basis of *average* fuel cost, and the difference between average fuel cost and running fuel cost would allow for profit, which at present-day load factors, is approximately 25 per cent.

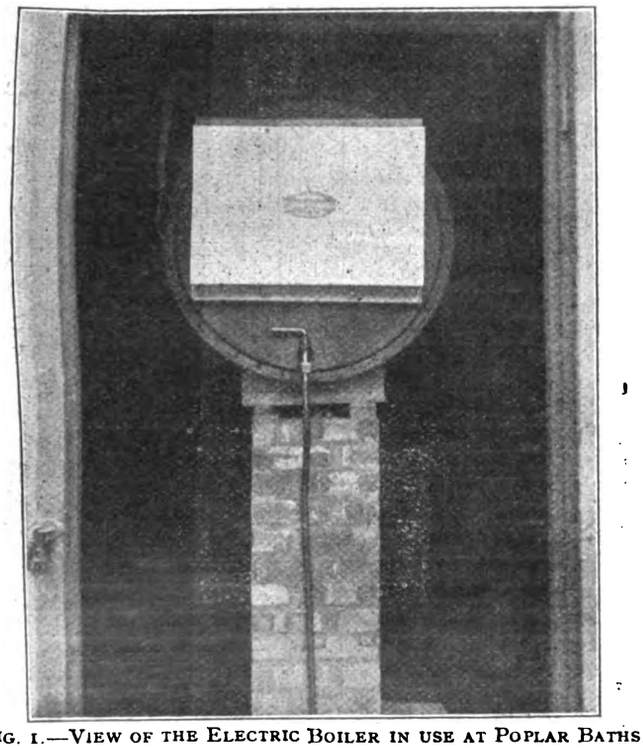

FIG. 1.—VIEW OF THE ELECTRIC BOILER IN USE AT POPLAR BATHS.

In respect of lighting and power supply to-day, it may reasonably be assumed that electricity can compete favourably with any other medium of supply, therefore existing methods of charging can be standardised and the heating load cultivated as a by-product branch of the industry. It is perfectly obvious that if all off peak supplies are given at the average fuel cost, plus a small margin for profit, the enormous increase in load factor will enable the average fuel cost to be reduced to a minimum, and therefore the general supply for lighting and power will benefit to an extent which would not be possible without the additional off peak supply.

This fact can easily be demonstrated in figures, as in the following schedules, viz. :—

	Existing Conditions.	100 per cent. Load Factor.
kWh generated	34 400 000	144 102 000
Works kWh	1 720 000	5 764 000
kWh sent out	32 680 000	138 338 000
Distribution losses	4 472 000	17 292 000
kWh sold	28 208 000	121 046 000

Average coal per kWh generated	18 ÷ 7¼ = 2·483 lb.	16·7 ÷ 7¼ = 2·301 lb.
Coal lost in transit	1 908 tons	7 400 tons
Running coal ..	2·223 lb. 34 132 tons	2·223 lb. 144 000 tons
Standby coal ..	0·26 lb. 4 000 tons	0·078 lb. 4 000 tons
Total coal purchased	40 040 tons	155 400 tons
Lb. coal per kWh sent out ..	2·614 lb.	2·516 lb.
Graded coal, percentage price	55% 24s.	55% 24s.
Rough slack, percentage price	30% 17s. 6d.	40% 17s. 6d.
Fine slack, percentage price ..	15% 14s. 6d.	5% 14s. 6d.
Average price of coal	20s. 7d.	20s. 11d.
Average calorific value ..	11 000 B.Th.U.	11 000 B.Th.U.
Efficiency in U.S.O.	11·86 per cent.	12·32 per cent.
Per cent. works to kWh generated	5	4
Per cent. distribution losses..	13	12
Per cent. kWh sold to kWh generated	82	84
Per cent. coal lost in transit..	4·765	4·765
Maximum demand in kilowatts	13 150	16 450
Load factor kWh generated ..	30 per cent.	100 per cent.
Load factor kWh sold	24·5 per cent.	84 per cent.
Cost of coal	£41 208	£162 522
Handling coal	2 451	9 800
Handling ashes..	1 124	4 500
Contingencies	250	1 000
	45 033	177 822
Cost per kWh sold	0·383d.	0·3527d.
Oil, water and stores	500	1 000
Wages	6 735	7 000
Salaries	3 349	3 349
Station maintenance	7 500	10 000
Total generating cost	63 117	199 171
Distributing costs	12 018	15 000
Rates and wayleaves	9 360	9 360
Management	12 035	15 000
Total working costs	96 530	238 531
Cost per kWh sold	0·8213d.	0·4731d.
Loan charges	53 723	53 723
Contingencies and/or profit ..	40 000	40 000
Income required	£190 253	£332 254
AVERAGE CHARGE PER KWH ..	1·618d.	0·659d.

		d.	£		d.	£
Private supply	3 000 000	3·3	41 250	3 000 000	3	37 500
Power supply	20 985 000	1·46	127 564	20 985 000	1	87 419
Public lighting supply..	1 500 000	1·385	8 656	1 500 000	1	6 250
Cooking supply ..	1 755 000	1·333	9 750	30 000 000	0·75	93 750
Hot water supply ..	685 000	0·671	1 915	62 751 000	0·387	101 232
Off peak heating ..	223 000	0·8	743	2 750 000	0·5	5 730
Vehicle supply	60 000	1·5	375	60 000	1·5	375
Total supply	28 208 000	1·618	190 253	121 046 000	0·659	332 254

In making the foregoing calculations, it has been assumed that the cooking supply will carry with it a certain amount of hot water.

Water Heating at a Low Rate.

The basis of calculation for cooking supply is at the rate of 3 000 kWh per annum per cooker installed, and it has been assumed, for the purpose of demonstration, that 10 000 cookers have been placed in circuit and that the continuous hot water load is 130 W per cooking outfit, which would add 1 300 kW to the maximum demand. With hot water available at 150 deg. F. the loading on the cooker would probably not exceed 4 kW, therefore 10 000 cookers, with a diversity factor of 20 when combined with a general power and lighting supply, would add a further 2 000 kW to the maximum demand.

With private, power, public and vehicular demands remaining stationary, and cooking, hot water and off peak heating fully developed, not only would it be possible to supply water heating at the low rate of 0·387d. per unit with a plant having an efficiency of 11·68 per cent. at present, but all the other supplies would be considerable cheapened.

An Electrical Bath Installation.

Consideration of the possibilities of electrical water heating was forced upon the writer when requested to consider a proposal to supply hot water for public baths which were then being heated by gas, for which the Gas Company were charging ordinary rates which worked out, in the summer months, at 3·63d. per bath.

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On the basis of 0·51d. per kWh a competitive supply would allow for anything under 7 kWh per bath and the proposition proved attractive, but immediately the Gas Company became aware of the contemplated competition they consented to allow the trade discount of 35 per cent., which they had previously refused to consider, which reduced the cost to 2·36d. and only allowed for 4·63 kWh per bath, which was a totally different proposition. In the meantime, a tender for installing an electrical boiler and storage tank had been received, based on an estimate of 6·5 kWh, but in view of the keener competition, it was decided to carry out the experiment of installing half the capacity estimated for.

The actual results have proved that the smaller installation is capable of meeting the full demand, and under careful supervision, in midsummer, it is possible to heat the water for a bath with an expenditure of 3 kWh of electricity. No data is as yet available for winter use, but it is only reasonable to assume that the comparative results will show a saving over gas.

This is a striking example, showing how the Baths and Electricity Committees of a Local Authority can work together for the public good. The Baths Committee of the Poplar Borough Council have decided that a large number of scattered baths throughout an area is of better public service than a smaller number of central baths of greater accommodation, and where the bathing accommodation is limited to, say 20 slipper baths, the source of heat must of necessity be either gas or electricity.

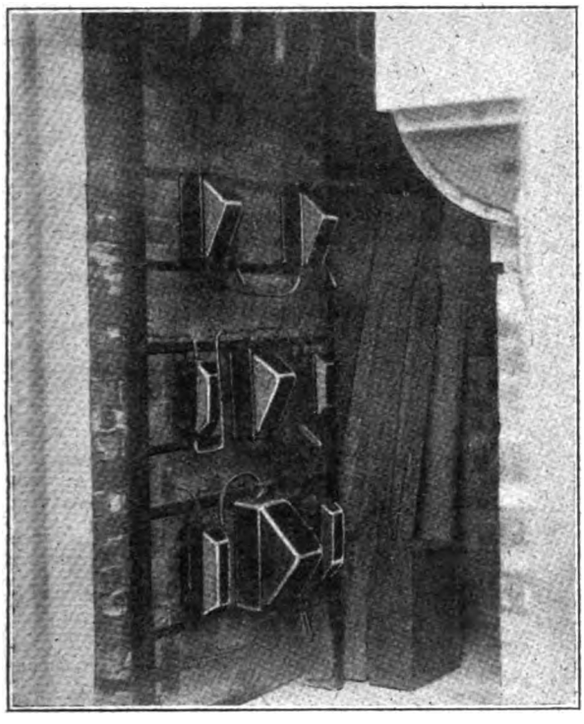

FIG. 2.—VIEW OF THE SWITCHGEAR AT THE BATHS INSTALLATION.

It is intended to extend the hot water supply to all public institutions, when and as it becomes practicable to do so, but the field for supplying hot water and steam to factories is of much greater importance.

A Practical Proposition.

It is a practical proposition to-day to supplant the use of gas entirely for manufacturing purposes, but to supersede coal, coke, or oil is a much more difficult problem, but it is a problem to which the electrical profession should devote all its energies in solving, as it is only by this solution that the ideal or 100 per cent. load factor can be reached.

The position to-day in respect of heating appears to be similar to the position of power supply twenty years ago. Then only small installations were experimented with, but the use of electric power has grown to such an extent that electrical driving is not now the exception, but the rule, excepting in factories where hot water and steam are necessary for production of commodities.

The probable course of progress in the development of electrical heating will be that small factories will find it cheaper to instal an electrical boiler and thermal storage tank than to produce their own heat from coal, coke or oil, with its attendant labour charges, necessary space and capital cost, and, when the existing steam plants of the larger factories become obsolete, electrical heating will probably be adopted.

Hot Water for Domestic Use.

The supply of hot water for domestic purposes is a totally different problem and is one which can be tackled right away. Every domestic cooking outfit should include a hot water tank constantly in commission. The time is now ripe for a domestic heating campaign, which should include the slot system of charging.

A town of 250 000 inhabitants has a potential demand for 50 000 domestic cooking outfits, calculating five persons per household. The average requirement for lighting, heating and cooking is certainly not less than 3 000 kWh per annum. 130 W for water heating continuously would ensure the sale of 1 139 kWh per annum which must be paid for, and is alone a sufficient warranty for the establishment of a slot system of charging.

An output of 150 million kWh per annum at 100 per cent. load factor for a town of the size quoted is surely an ideal that every electrical engineer should endeavour to approach. And such are the potentialities of a domestic heating load, although difficult to realise.

The greatest obstacles to the progress of domestic heating, are: (1) Non-existence of a standard electric cooker; (2) high cost of existing types of cookers; (3) high cost of slot meters, and (4) want of co-operation amongst supply engineers in standardising appliances and tariffs.

An Electric Heating Association.

Some years ago the writer evolved the Point Five System of Charging and assisted in forming the Point Five Association, which did a great deal of useful work in promoting the use of multiple tariffs, and it is his opinion that the time is opportune for the formation of an Electric Heating Association, consisting of engineers desirous of promoting a heating load. An association composed of, say twenty engineers of large towns, meeting at frequent intervals, could do much to produce a standard cooker and the combined demand would enable manufacturers to turn out heating appliances and slot meters to specification at a very much lower cost than those prevailing to-day, as selling expenses could be eliminated to a great extent.

Selling More Electrical Goods.

Some Suggestions for the Retailer.

A comparison of the selling methods of British and American electrical dealers shows that the former have much to learn from the latter. Due allowance must, of course, be made for the difference in the psychology of the public appealed to in each case, and it must be conceded that British electrical dealers' methods compare favourably with those of other retailers; but there is no doubt that even closer attention to the hitherto untried ways of approaching the customer will result in largely increased turnover. In this connection it is of interest to note what is being done in the States to-day. In a small town of 3 500 inhabitants a dealer, with a view to increasing his sales of electric washing machines, invited the public to send their washing along to his shop, and then to come in and see it done. Sixty-five people accepted the invitation, and 27 sales resulted. Similarly, 36 electric cleaners were sold as the result of an offer to clean one rug from each household free, an allowance of about £1 being made on old cleaners exchanged at the shop for new ones. Successful business resulted from the enterprise of one dealer who placed two electrically-operated sewing-machines on the footpath outside his shop. These machines were operated by a pedal, alongside which was a card bearing the invitation to "step on it." On complying with this request passers-by were able to note at first hand the ease of operation and other advantages before their gaze encountered another card inviting them to "come inside."

One dealer found it profitable to call on grocers in his district and sell them electric coffee-roasters, and this idea alone might well be extended to a large number of retail traders in the vicinity. Another retailer added appreciably to his sales of wireless receiving apparatus by getting public-spirited people to present sets to local hospitals and other institutions.

A profitable field awaits development by the electrical dealer who has brought the lighting of his own shop to the highest possible state of efficiency and attractiveness, for he can then call on local shopkeepers and, with the practical demonstration of the advantages of suitable window lighting close at hand, should have little difficulty in persuading others to let him put their establishments on a similar plane.

The foregoing examples may serve as pointers to similar and even better sales' promotion methods. In any case the apparent truism that where one electrical appliance has been sold, another and yet another can also be sold, merits careful consideration.

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Importance of Using Lamps at Rated Voltage.

By W. MILLNER, B.Sc., A.I.M.E.E. (Lighting Service Department, B.T.H. Co.).

The total cost of light produced by a lighting installation is made up of three factors—the cost of energy consumed, the cost of renewal of lamps, and interest on capital invested in the installation. The latter charge is so small in comparison with the other two that it can be neglected without appreciably affecting the results.

Since the introduction of incandescent electric lamps, efficiencies have been enormously improved, the modern gasfilled lamp giving about seven times the amount of light for the same consumption of energy as compared with the lamps of 1880. This gain in efficiency has had more effect on reduction of the cost of light than all other causes together. The efficiency of a lamp is governed by the temperature at which the filament is operated, and a very small change in filament temperature has a very great effect on the output of light from the lamp. A reduction of 1 per cent. in the temperature of the filament causes the light output to be reduced by 11 per cent.

The Life Question.

The life of a lamp, or the number of hours burning before failure (not counting mechanical breakages), depends entirely

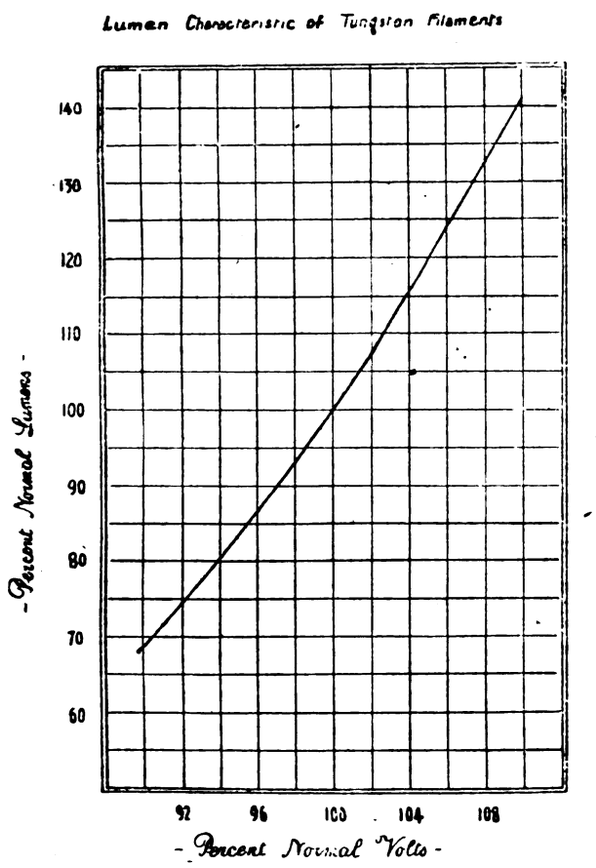

FIG. 1.

upon the efficiency at which the lamp is operated. It has been estimated that, if one of the present 100 W gasfilled lamps were operated at the efficiency of the lamps of the 'eighties, it would have, if not broken, a life of 47 000 years. During this period the excess of coal consumed in comparison with the present 20 W lamp, which would have the same light output, would be enough to coal a large battleship for seven trips round the world. The physicists, to whom this advance is due, have thus played no small part in the conservation of our coal resources.

A large number of people attempt to reduce their lighting bills by installing lamps of a higher rated voltage than the voltage of the circuit to which they are connected. In this way the renewal charge is reduced, but the loss in efficiency is out of all proportion to the saving effected, with the result that the actual cost of the light produced, which is the commodity being paid for, is increased. The rated average life of present lamps is 1 000 hours, and any attempt to prolong this by running the lamps at a lower efficiency is uneconomical in all cases except where the charge for energy is negligible. This is a happy state which is practically non-existent.

Life and Voltage.

If the change in light output was proportional to the change in voltage, some excuse might be offered for this practice, but a study of the curve in Fig. 1 will show that a 10 per cent. reduction in applied voltage reduces the light output by 32 per cent. Again, owing to the temperature co-efficient of tungsten, the reduction of current through the lamps is not proportional to the reduction in voltage. This is advantageous in that it makes the lamp, to some extent, self-regulating on fluctuating voltage. The effect of voltage variation in current passing through the filament, and the total energy consumed, is shown in Figs. 2 and 3.

Take a concrete case of a 100 W, 100 V gasfilled lamp; we find from the makers' lists that the light output is 1 300 lumens, and the list price is 5s. For 1 000 hours normal life the energy consumed by the lamp at 6d. per kWh is 50s. The total cost of supplying 1 300 lumens for 1 000 hours is 50s. plus 5s., or 55s.

If the same lamp is operated at 10 per cent. below the rated voltage, we find from the curve Fig. 1 that the light output is reduced to 68 per cent. of the normal, or, instead of obtaining 1 300 lumens from the lamp, we now obtain only 885 lumens.

Reference to the curve showing the relation between wattage and voltage shows that the reduction of 10 per cent. in voltage causes the lamp to consume only 84½ per cent. of its normal consumption; in other words, the nominal 100 W lamp at 10 per cent. reduced voltage consumes 84½ W. Therefore the energy cost of supplying 885 lumens for 1 000 hours is 42s. 3d., and if we assume that by reducing the voltage we have doubled the life of the lamp, which is a generous assumption, as mechanical breakage will probably prevent this figure being reached, the cost for renewal per 1 000 hours is 2s. 6d. Therefore the total cost of 885 lumens

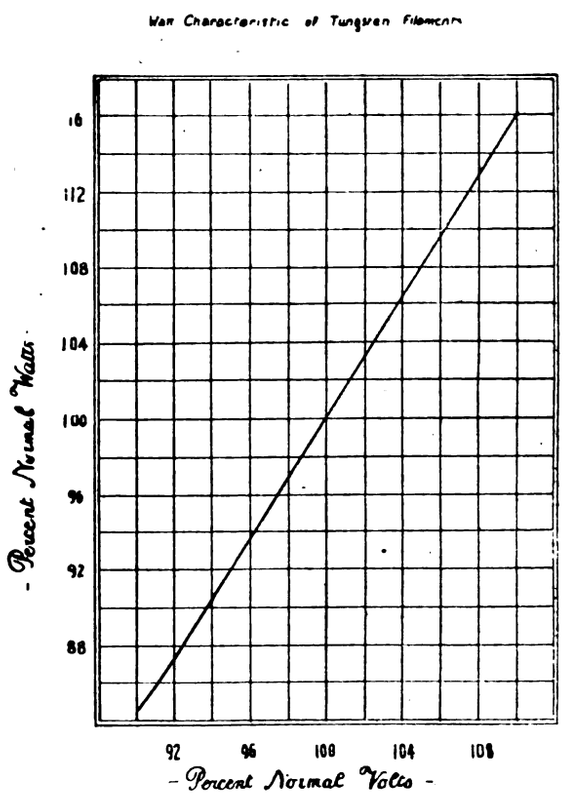

FIG. 2.

for 1 000 hours is 42s. 3d. plus 2s. 6d., which equals 44s. 9d. At this rate the cost of 1 300 lumens for 1 000 hours would be 65s. 6d. Thus we see that, instead of saving money by installing lamps of higher rated voltage than the circuit, it actually costs 10s. 6d. more to obtain 1 300 lumens for 1 000

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hours. This can perhaps be more clearly emphasised by tabulating the items.

	At Rated Volts.	At 10 per cent. below Rated Volts.
Output of lamp	..1 300 lumens	885 lumens
Consumption of energy ..	.. 100 W	84·5 W
Cost of energy per 1 000 hours	.. 50s.	42s. 3d.
Cost of renewals per 1 000 hours	.. 5s.	2s. 6d.
	Total cost of 1 300 lumens per 1 000 hours = 55s.	Total cost of 885 lumens per 1 000 hours = 44s. 9d. Cost of 1 300 lumens per 1 000 hours = 65s. 6d.

Extra cost incurred per 1 300 lumens per 1 000 hours by burning lamp at 10 per cent. below rated pressure = 10s. 6d.

This figure is the loss for a single lamp. It does not

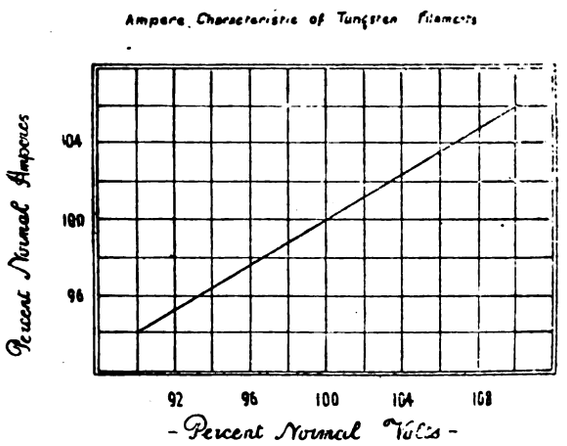

FIG. 3.

require much imagination to realise that a very considerable sum is involved when a large installation with several hundred points is under consideration.

Lamp Efficiency and Total Cost.

The economy of a lamp cannot be judged by the number of hours which it will burn, for the above example clearly shows that the efficiency is by far the most important factor affecting the total cost of the light produced. The life of a lamp depends upon the efficiency at which it is operated, and it is impossible to alter one without affecting the other, and the length of life which gives the most economical result in service depends on the cost of current and the price of lamps. In general, the high cost of energy justifies lamp lives being made shorter with a consequent gain in efficiency and any reduction in the price of lamps also calls for higher efficiencies to give the most economical service.

When consumers realise that the commodity for which they are paying is light, and not current or lamps, they will realise that it is not economical to attempt to increase the useful life of a lamp by such means as running it on a circuit voltage lower than the rated voltage of the lamp. Minute care is taken to ensure that the efficiency of transformation of energy in the power house is at the very highest possible efficiency, and it is surely useless to take this care if the final transformation of electrical energy into the form in which it is required, that is, light, is only carried out at a small percentage of the possible efficiency which can be obtained.

Manganese Steel.

Its Importance in Modern Engineering.

Sir Robert Hadfield has written for the British Science Guild an account of "The discovery of manganese steel and its importance in modern engineering," which the Guild has issued in pamphlet form. Sir Robert tells the story of his discovery of the alloy steel which, owing to its combination of hardness and toughness, has proved so remarkably successful for tramway track work and other purposes. He also deals briefly with his later researches on nickel steel, low hysteresis steel, and other material. The discovery of manganese steel, he says, proved not only of prime importance in itself, but it originated the modern era of the use of alloy steels.

The B.A. Scientific Exhibition.

Some Interesting Electrical Apparatus.

One of the most interesting features of the recent British Association meetings at Liverpool was the Scientific Exhibition which was held in the Central Technical School from September 10th to 22nd. During the course of the exhibition a number of lectures were given, including one by Prof. Barr on "The Optophone" and one by Sir Frank Heath on "Research and Industry."

H. W. Sullivan.

One of the most complete electrical exhibits was that shown by H. W. SULLIVAN. This included a group of instruments specially designed for measurements of precision with alternating currents having frequencies up to thousands per sec., together with telegraph testing and signalling apparatus.

Much interest was shown in Cox's selenium magnifier for submarine telegraphy. In this instrument the image of a grid is projected on to the mirror of the receiving galvanometer and thence to a selenium cell which is sub-divided to correspond with the image of the grid. The sub-divisions of the cell are arranged in the four arms of a bridge circuit, the image of the grid being adjusted so that when the galvanometer is at zero each of these four arms is half "light" and half "dark," and the bridge is balanced. Deflections of the galvanometer by received signals cause corresponding movements in the image of the grid over the surface of the cell, with consequent changes of resistance in the bridge arms and resulting current in the local receiving apparatus. Magnification can be obtained up to ten thousand or even up to 20 000 times the received signal.

Apparatus for the determination of effective resistance, inductance and capacity at radio-frequencies, of condensers and inductances was also shown. These included a thermionic valve oscillator for generating the supply at frequencies corresponding to wavelengths of from 600 to 17 000 metres, a screened Wheatstone bridge for the measurement of resistance at radio frequencies, a laboratory standard variable air condenser and a range of four continuously variable standard inductances covering a range of from 100 to 60 000, constant in value and of low effective resistance.

The oscillatory circuit, consisting of capacity and inductance to be measured, is made to form the "X" arm. This oscillatory circuit is first tuned to resonance for the particular frequency at which the measurement is being made, so that it offers a minimum impedance to currents of that frequency. Having obtained this preliminary "resonance balance," the "X" arm may be treated as a resistance only, and a final balance of the bridge obtained by adjustments of the ratio and rheostat arms in the usual manner.

Marconi Co.

The MARCONI INTERNATIONAL MARINE COMMUNICATION Co. exhibited their marine direction finder, a receiver for a rotating wireless beam, an installation for ships' liteboats and a duplex telephone set. The third of these was described in our article dealing with the Shipping, Engineering and Machinery Exhibition at Olympia.

The marine direction finder has a range of about 100 miles, and is fitted with a special aerial consisting of two loops of wire at right angles to one another. The best results are obtained when these are supported on a set of five spars erected specially for the purpose, and recent reports show that over 90 per cent. of bearings which have been recorded are within two degrees of accuracy.

H. Tinsley and Co.

H. TINSLEY AND Co. had a number of examples of their well known apparatus, which are already familiar to our readers. These included an inductance and capacity bridge which was used by Mr. Tinsley in his researches upon the Sydney-Auckland Cable. Its accuracy was in many cases to two parts in a million.

A new form of vibration galvanometer of the moving coil type was shown. This is of very robust construction and has an interchangeable suspension piece. The range is from five cycles per sec. up to 1 000 cycles per sec., but it can be made for higher frequencies if desired. The low frequency ranges have been specially designed for investigations on submarine loaded cables.

Cambridge and Paul Instrument Co.

The CAMBRIDGE AND PAUL INSTRUMENT Co. had a range of their apparatus, including the Ray track equipment embodying modifications by Mr. Shimizu in the cloud expansion apparatus designed by Mr. C. T. R. Wilson and the Moullin thermionic voltmeter.

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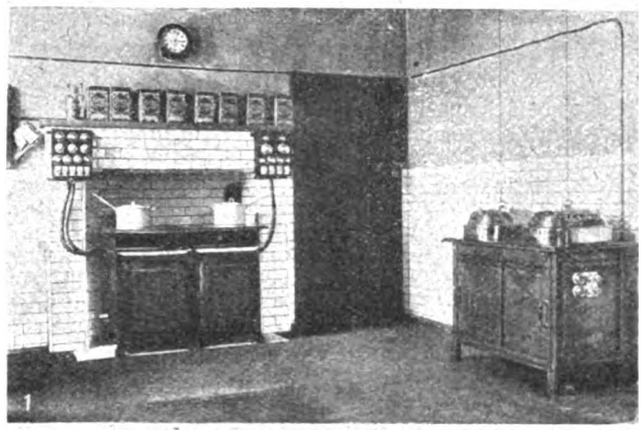
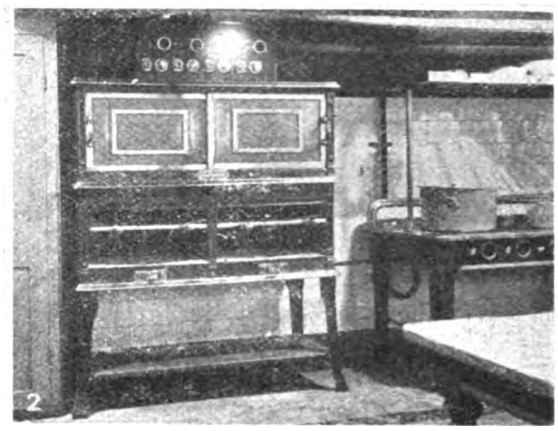
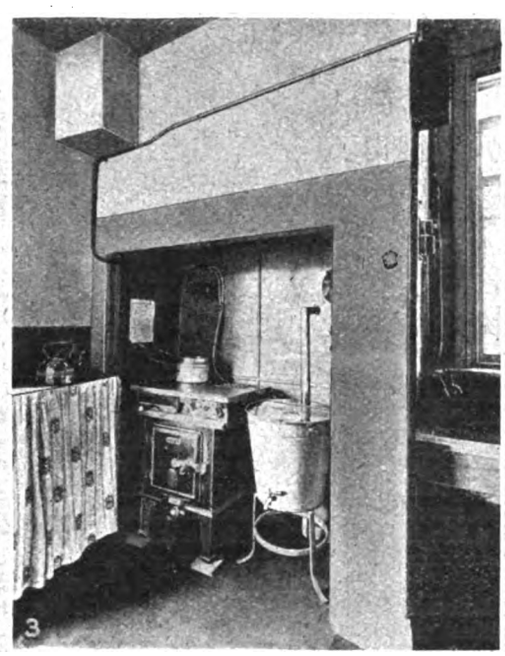
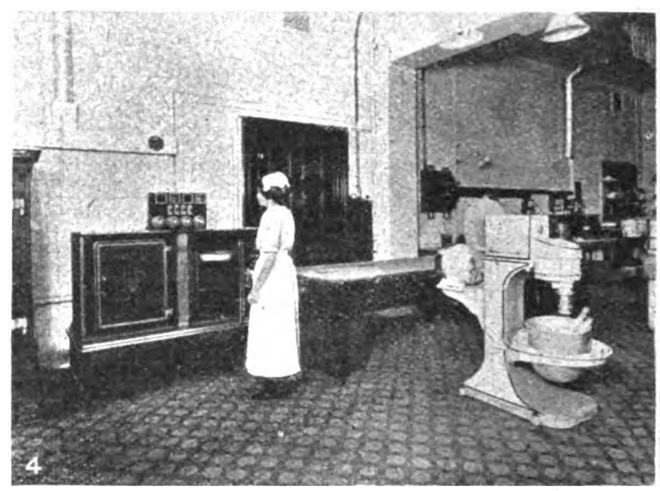
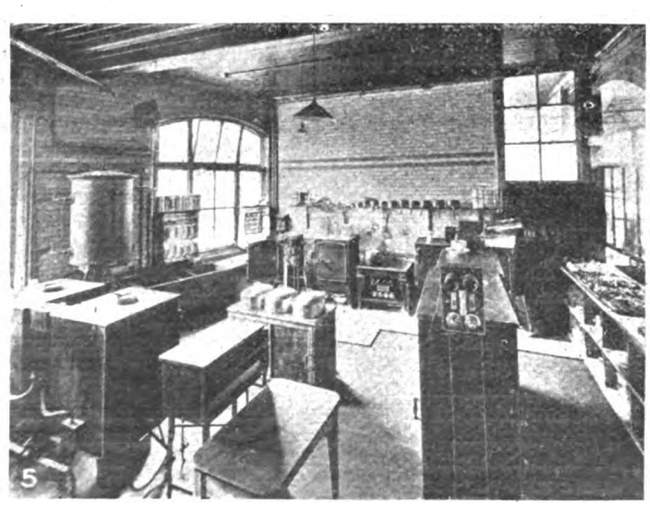
Some Pictures of Progress in

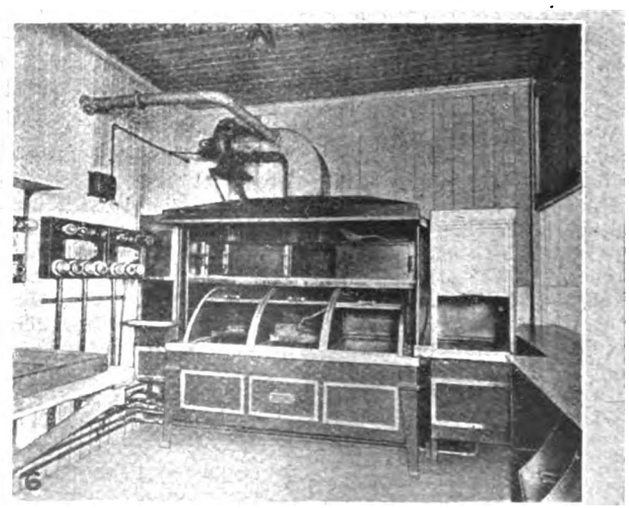












1. The Electric Kitchen at the Sudbury Golf Club, on the North Metropolitan Electric Power Supply Co.'s Mains.—2. A View in Debenham and Co.'s Staff Kitchen, on the Marylebone Mains.—3. A Kitchen, on the Newcastle Electric Supply Co.'s Mains, showing Cooker and Wash Boiler fixed in recess from which range was removed.—4. A Large Double Roasting and Baking Oven at Glasgow with Illuminated Switchboard. An electrically operated Cake Mixing Machine is also shown.—5. A Canteen in the Newcastle Area which caters for 280 Dinners daily and for Breakfasts and Teas.—6. A Five-Pan Electric Fish Fryer in a Newcastle Fish Shop. It is so clean and "fumeless" that other foodstuffs can be exposed for sale on the same premises.

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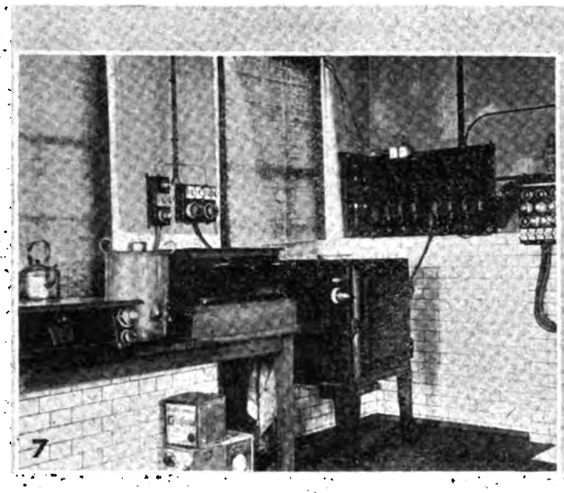
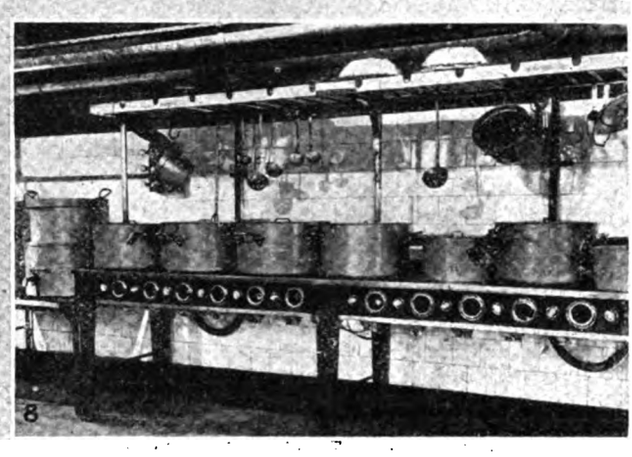
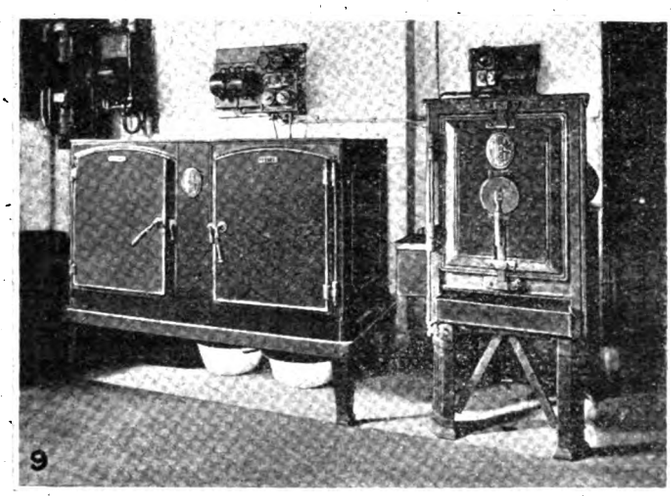
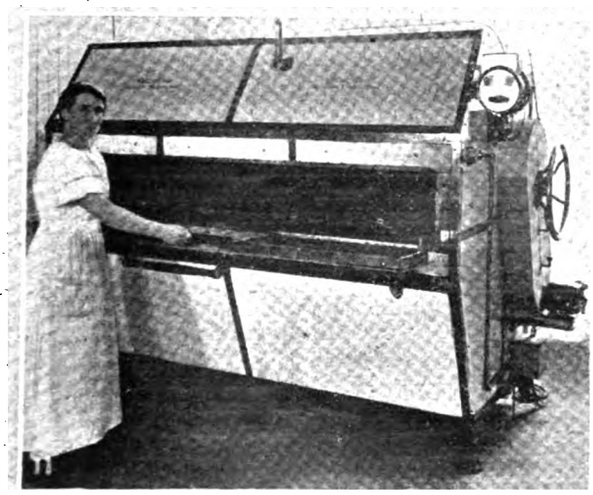
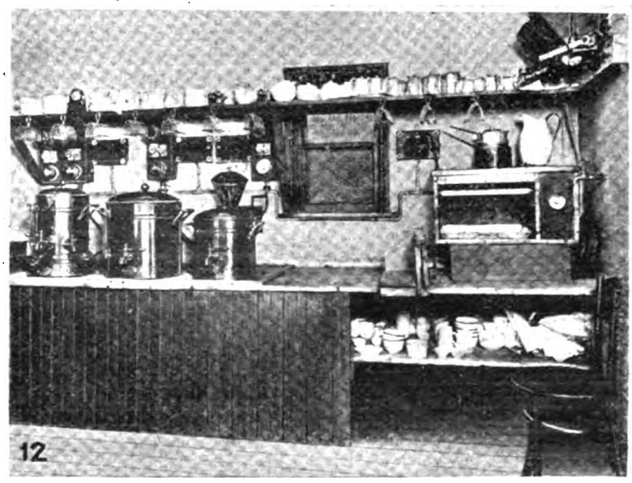
the Electric Cooking World.











7. Another Corner View in the Electric Kitchen at the Sudbury Golf Club House. 8. Another View in Debenham & Co.'s Staff Kitchen. 9. A Double Roasting Range and Steaming Oven installed in an Hotel Kitchen at Newcastle-on-Tyne. 10. An Electric Boiling Table in a Glasgow Kitchen. It contains four 3 kW open type sections in addition to two electric grills. 11. An Electric Baker's Oven for Bannocks at a Glasgow establishment. 12. A Corner of the Still Room in a Newcastle Hotel, showing Egg Poacher, Coffee and Water Urns and Toaster.

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Pushing Electric Lighting.

As already announced in THE ELECTRICIAN, the ELECTRICAL DEVELOPMENT ASSOCIATION has arranged this winter for a series of monthly salesmanship conferences, the first of which was held at St. Bride's Institute, London, on Friday last, when Mr. W. B. Woodhouse, President of the E.D.A., was in the chair.

The CHAIRMAN, in opening the meeting, said it was interesting, in a period of very great trade depression, to seek reasons for the progress and prosperity of the electrical industry. This industry was one of the outstanding industries at the present time which seemed to be going ahead. The reason, in his opinion, was that the use of electricity led to economy, and that was a point which had a very close relationship to the object of the Salesmanship Conferences.

The Object of the Conferences.

Mr. J. W. BEAUCHAMP, secretary and director of the British Electrical Development Association, then gave an address in which he dealt first with the scope and object of the E.D.A. Sales Conferences, and secondly with the commercial aspect of electric lighting. In the first part of the lecture, Mr. Beauchamp urged the necessity of leaving aside at these conferences narrowly controversial subjects, which there were other means of discussing, and of concentrating upon salesmanship and better methods of putting the advantages of electricity for all purposes before the public. He added that plans were being considered for the inauguration of a salesmanship school for the electrical industry. It was hoped that particulars would soon be available in order that those who wished might afford some of their assistants or employees an opportunity of studying modern salesmanship in greater detail than was possible at these conferences.

The Business Aspect of Lighting.

The second part of Mr. Beauchamp's address consisted of some notes on the business getting aspect of electric lighting. The principal point emphasised was that the percentage of possible lighting business actually obtained was not so very great, and that we were apt to be blinded in our efforts in this direction by assuming, as was so often said, that electriciy "had got the lighting business." We wanted to secure a wider appreciation on the part of the public of the principles of good lighting, to shew people the advantage in comfort, economy and efficiency, and even the amenities of our leisure and play arising from the use of effective lighting, and use much more of it. Merely pushing lamps and wiring and making lighting units cheaper might have the effect of increasing the maximum demand, but it might also bring no better load factor. When the public really understood the advantages of good lighting they would use more of it over longer hours, and, in the case of domestic lighting, get much more satisfaction and pleasure out of their homes.

When putting forward a new lighting standard, the personal feeling or taste of the buyer must be considered. There were many positions where brilliance was undesirable, and a judicious splitting up of the installation had much to recommend it. Not only did this have the advantage of improving the load factor but, particularly in the home, it avoided monotony, enabling a room to appear under three or four different lighting conditions according to the manner in which it was being used. Perhaps we had barely come to the stage of colour lighting in the home, but the possibilities must be borne in mind. American decorators had introduced the "mood" room, in which different colour schemes were adopted according to whether the room was used for rest, amusement, or work, and the same effects could be produced with lighting with the expense of decorative schemes.

Multipart Tariffs and Lighting.

Again, in connection with lighting, multipart tariffs would play an important part, and it was easy to frame a tariff which would give the undertaking all the return it wanted for normal lighting and encourage longer use with lower rates. Such tariffs were working well in connection with shop lighting.

DISCUSSION.

Mr. W. E. BUSH (B.T.H.Co.) said that electric lighting represented 75 or 80 per cent of the contractor's business, and yet the general tendency had been to put all our energies into developing heating and cooking. Properly exploited, electric lighting could be made to produce a greater revenue for the industry than a similar effort put into the sale of any other commodity which the industry had to sell. Approximately only 15 per cent. of our homes were wired and probably only 50 per cent. of our factories, offices and shops, whilst only a very small percentage of our streets and thoroughfares had electric lighting. The only satisfactory way to sell light was to demonstrate it. It was no good to talk about it to the customer or even to use fine illustrations of equipment. There were 265 500 factories registered in London, and assuming only 200 000 of them were wired, it would be a conservative estimate to say that 5 000 of them were well lighted. There was thus a margin of 195 000 factories requiring a proper lighting equipment, and at £100 each that gave the enormous total of £19 000 000 worth of business waiting. There were 758 000 offices in London, and taking 50 per cent. as being wired, and £25 as the possible expenditure to bring the equipments up to date, here was another £9 000 000. Again, there were 500 000 shops, and assuming one quarter of them wired and £25 expenditure required on each to bring them up to date, gave a further £2 000 000 worth of business. Calculating in the same way, he got a figure of £1 000 000 for public buildings, thus giving a total of over £30 000 000 worth of new business possible in premises already wired. If the wiring of new factories was taken into account, then a total of £87 000 000 was reached, which, moreover, did not include extra switchgear, and plant required to give the additional supply, nor the revenue to the supply undertakings.

Lighting Sales in America.

Mr. G. S. MERRILL (U.S.A.) said the problem of increasing lighting sales in America had been taken in hand by electrical leagues, formed locally by the contractors, supply authorities and manufacturers of lighting apparatus, which worked through a Joint Committee representing the National Contractors Association, the National Electric Light Association, and the various organisations representing the different branches of the industry.

Mr. W. R. RAWLINGS suggested that harm was being done by preaching the doctrine of increased illumination intensity without regard to the individuality of the customer.

Mr. L. L. ROBINSON (Hackney), after referring to the advantage of good shop lighting, said that his Council had agreed to go to an expenditure of as much as £30 000 for a real showroom, and he intended to proceed on the lines not of being what the ordinary showroom now was in most cases, a store, but of having special rooms fitted up to show the effect of lighting as it had to be used in the home or elsewhere. However, he could not wait for this showroom to be completed and had taken a flat and furnished it as completely electrically as he knew how.

Mr. W. MILNER spoke of the beautiful effects to be obtained with glassware instead of silk shades.

Mr. W. E. WARRILOW expressed regret that there were not more contractors and retailers present, for after all these were the people most affected.

An "Electrical" Newspaper.

Mr. W. R. RAWLINGS, speaking a second time, said there is a real need for an electrical "newspaper" which would reach the housewife through the bookstalls and otherwise.

Mr. W. A. GILLOTT referred to a showroom which he is fitting up which was absolutely without any means of natural light, but he had so arranged matters as to give, as required, daylight effects, moonlight effects and so on.

Mr. A. F. RILEY (Benjamin Electric Co.) regarded domestic lighting as a very small field, and suggested greater attention should be paid to industrial and commercial lighting.

Mr. F. R. MORTON (Sun Electrical Co.) asked for a little more imagination on the part of the lamp companies in their literature. There had recently been issued five million pamphlets in connection with the recent reduction in lamp prices and they contained anything except illustrations of real applications of the light itself. One showcard, which he had taken down in his premises as soon as he saw it, had a gasfilled lamp sticking out about 3 in. below the shade. The public would be educated more rapidly by showing them examples of modern lighting.

A Great Thought.

For domestic and industrial heating, for water heating, and for cooking, electricity was not then [the early eighties], and is not now, a really dangerous competitor [of gas].—Mrs. Cloudesley Brereton.

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Electric Fires and How to Buy Them.

By "A SPECTATOR."

It is difficult to analyse accurately the problem of merchandising electric fires and other domestic heating appliances. For it presents a situation which has many aspects. In the first place we have the views of the contractor and the retailer, and the difficulty of convincing them of the market which can be built up in fires in spite of the competition of supply authorities; secondly, the lack of enterprise shown by the average supply authority in dealing with the question of heating; and thirdly, the methods or policies of the various fire manufacturers.

The Great Fundamental.

Before I attempt to analyse each of these conditions which make the larger development of domestic heating such hard going, I shall very briefly refer to the great fundamental, that is, that there is undoubtedly a large market for electric fires. This has now become an accepted fact, but like so many accepted facts, only lip service is paid to it, and it has become a lifeless commonplace. It is necessary, however, in a note of this kind, which is intended to further the ideal of "bigger business" in electric heating, to stress the point. Perhaps many great causes have been lost by the continual reiteration of the ideal behind them, hence I will cease to talk of ideals. Rather will I discuss the question as a "money making proposition" What is the best method to adopt to make the merchandising of fires for the winter season a money-making proposition?

Some of the Difficulties.

Turning again to the difficulties which beset what should be a money-making proposition, undoubtedly the contractor and retailer have fallen into a slough of thought and see no vision of any really large turnover. They see the competition of the local supply authorities, with their trading rights and their power to "hire out" fires, and sometimes to offer them on advantageous hire-purchase terms. I shall be unwise and confuse the issue if I discuss the rights and wrongs of these conditions. Rather would I use valuable space to urge contractors and retailers again and again (if I may use common parlance) to get to it. The market is there, and there is no commodity in the world that can be the exclusive monopoly of one class of trader or one section of any trading community. In hardly any other industry is the hiring system or the hire-purchase system so well established as in the gas industry, and yet the retailers secure a large business.

If my statement is doubted let my reader explore the principal "High Street" in any busy town, and particularly in the London suburbs. Numerous gas fires, but how few electric fires! I know, of course, the difficulties created by the lackadaisical attitude of many supply authorities, and this is probably the greatest difficulty. I realise that a contractor or retailer cannot afford to purchase a stock of fires to use as a mere display to arouse public interest so that in time this interest would formulate into a demand for more progressive methods on the whole question of heating circuits and heating rates. It is, however, a truth that so long as retailers ignore the merchandising of fires, so long will the supply authorities continue to make "fire business" their own pet hobby to develop or hamper as they please.

Incentive to a Change of Thought.

It would be a tremendous incentive to a change of thought if they saw that contractors and retailers were really determined to secure their share of the business and to force the conditions which would make the market grow. No one will ask what I mean when I refer to the lackadaisical attitude of the supply authorities. Perhaps I use the wrong word, but supply authorities who persistently hamper the development of domestic heating are common enough. Incapacity of mains and the high cost of renewals are the most usual excuses. But all such excuses are impossible of acceptance. Supply authorities have a duty to perform to the electrical industry as a whole as well as a duty to the public, and limiting the argument to "fire business" it is their duty to furnish the wherewithal which will result in profits to manufacturers, factors and retailers, and contractors, and incidentally to themselves. Many will question the wisdom of my attitude to supply authorities and describe it as monitory. Being but "A Spectator" I see these conditions as they are really, and I feel that I do promote something towards the solution of many difficulties by stating my views baldly.

Happy-go-Lucky Methods of Manufacturers.

The third difficulty is largely the result of the others which I have touched upon. It is the happy-go-lucky methods which the average manufacturer of electric fires adopts in announcing his or their apparatus to the trade and to the public. The majority of catalogues and other publicity matter are published far too late in the season for the average contractor or retailer to make any real or mutual use of. It is impossible to expect a buyer to make plans for the season's business if catalogues, etc., are not available before the end of September.

Planning on a Seasonal Basis—Some Essentials.

If we are to conduct our merchandising on "seasonal" lines, then we must *plan* our business on such a basis. I question whether it is the practice of other trades who develop business on "seasonal" lines to leave their announcements so late. I also venture the opinion that each manufacturer should establish and maintain list prices throughout the season. It is a practice for some manufacturers to alter their list prices in mid-season, and it is obvious that such a practice is most disturbing to the buyer. It is natural that buyers will hesitate to order stock because they have the fear that prices will drop during the season. In the past few years there has been some little excuse for the practice owing to the difficulties in the way of stabilising costs. This condition is, however, now much easier to control, and certainly it should be possible for a manufacturer to assure buyers that prices and discounts will remain stable for the season. These mid-season changes are not always dictated by a drop in costs. They are made with the hope of securing more business, but I reiterate with emphasis that such a practice engenders a lack of confidence on the part of buyers and they will not stock fires in quantities if they cannot feel confident that prices will remain stable.

How to Increase Turnover.

Having analysed thus far some of the ills from which the body politic of the fire business suffers, what is the best method to adopt to increase turnover? It would be foolish of me to suggest that the one and only method is for contractors, retailers and supply authorities to order large stocks at the early part of the season. Certainly such a plan would be a good foundation for success, but there are other methods that will achieve the desired end. In an article on the subject of selling it is the practice of the majority of writers to lay great stress on the selling campaign. Without belittling the importance of a thoroughly organised selling plan, it is my deliberate opinion that the most important lesson to be learnt is the art of buying. As in the case of other lines of merchandising we have to ask the question—how do we buy? What do we buy? It has been said that "as a man buys, so shall he sell." Is it not time that the average contractor, retailer, or supply company buyer is lacking not so much in the knowledge of how to sell, but in the sound knowledge of how to buy? Again, let me ask—what do we buy? In the main we buy discounts, and it is that mistake which reflects on the future of any programme.

Discounts not the Deciding Factor.

Do not buy particular manufacturers' fires solely because the discount is, say, 50 per cent., or 33⅓ per cent., as compared with, say, 25 per cent. and 20 per cent. This discount, whatever it is, will not make sales. The public do not select a fire because of the discount the seller secures, and a large discount will not make an appeal to the prospective buyer any the more. I do not suggest for a moment that because a line of fires are offered at a discount of, say, 50 per cent. they are not worthy of consideration, or that prospects of selling such a line are negligible. It cannot, however, be emphasised too much that consistent with quality, a manufacturer is only able to make attractive list prices if the contractor or retailer will be satisfied with a reasonable discount. In other words, it should not be forgotten that, speaking generally, a discount of say, 25 per cent. means much more attractive list prices, which in turn means greater turnover, and there is nothing else which will reduce overhead expenses and increase net profits than increased turnover. It is not the purpose of these notes to offer a cut and dried selling campaign. Local conditions and tastes vary so much. The first lesson to be learned is that of how to buy fires, and on the following pages will be found a comprehensive review of the majority of the best lines of fires which manufacturers have to offer for the winter season.

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Recent Electric Fires.

To deal with the subject of marketing fires in this issue of THE ELECTRICIAN *needs no apology. Heating provides the immediate scope for business besides the lighting field, but little can be gained by "hoping for more business." Business must be created; in other words the desire to buy must be created. Many plans to do this can be enlarged upon, but as "A Spectator" pertinently points out in another column, probably what is needed more than anything else, is not so much a recipe on how to sell, as a sound knowledge on the subject of buying. The purpose of these notes is to render a service to the trade by reviewing some of the best types of fires that will be on the market during the coming season. A careful study of the review will add to the reader's knowledge of buying.*

The Arora Co.

The *pièce de resistance* of the ARORA Co.'s productions for the 1923–4 season is the new design of fire which we illustrate in Fig. 1. It is known as the "Rosebery." The design is one which has become both popular and conventional. Tastes in fires, however, run very much in grooves. Certainly taste requires that the lines of a fire shall be bold in outline, and this has been achieved by the Arora

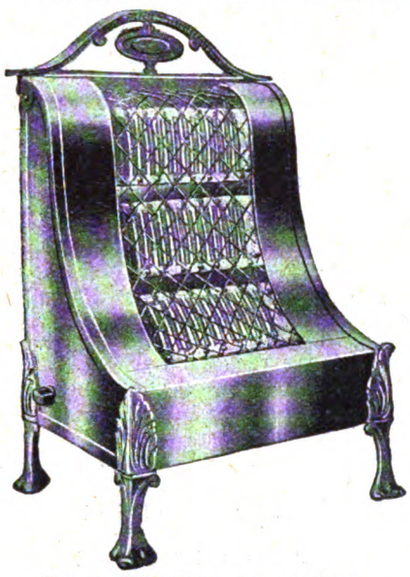

FIG. 1—THE NEW ARORA FIRE.

Co. The two elongated S shaped front lines are of polished cast aluminium, and the remainder of the fire is built up of castings and sheet metal. It is well to mention that the fire can be supplied in various finishes—oxydised silver, antique copper, polished brass, and bright rustless steel.

Automatic Telephone Manufacturing Co.

The AUTOMATIC TELEPHONE MANUFACTURING CO.'S contribution to the fire market this season consists of a revised pattern of Xcel-Fullray fire with the important property for a bowl fire of being very stable. Many bowl fires have an irresistible attraction for the careless servant or innocent child, with the result that there is always a danger of them being upset when the current is on, with resulting damage to the carpet if to nothing else. Owing to its large diameter cast base the Xcel-Fullray fire is almost impossible to overturn, while its strong brass wireguard and adjustable reflector are other points in its design worthy of notice. The element is so arranged that the coil will not sag, and attains a bright red heat which gives it a cheerful appearance. It is easily removable when required, but when in position is extremely rigid. A deep copper parabolic reflector projects all the heat rays and the fire, which is priced at 30s., with a loading of 600 W, is made in several finishes.

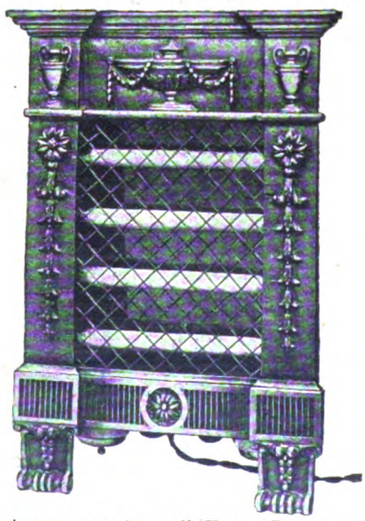

FIG. 2—AN ARTISTIC "ADAM" FIRE (BASTIAN AND ALLEN).

Bastian and Allen.

The name "Bastian" needs no introduction to the trade. For the 1923–4 season BASTIAN AND ALLEN have ready a number of designs which should prove to be of particular appeal. In our opinion the fire which should be the best seller will be the "Adam" design which we illustrate in Fig. 2. As will be seen, the whole note of the design is the Adam period, and the makers do well when they recommend this fire for modern drawing rooms and boudoirs on account of its decorative note. All fires manufactured by Bastian and Allen are supplied with the quartz form of heating element, which, according to the claim which the makers have made for many years, means "real red heat." This is the selling slogan for Bastian fires. We cannot close this note without making reference to their Louis XV fire which we illustrate in Fig. 3. This fire is built up with the standard quartz elements and is a design that is particularly suitable for oxydised finishes. In both designs any loading can be supplied between 1 000 and 2 000 W. The whole range of Bastian fires is one which merits the attention of buyers during the coming season.

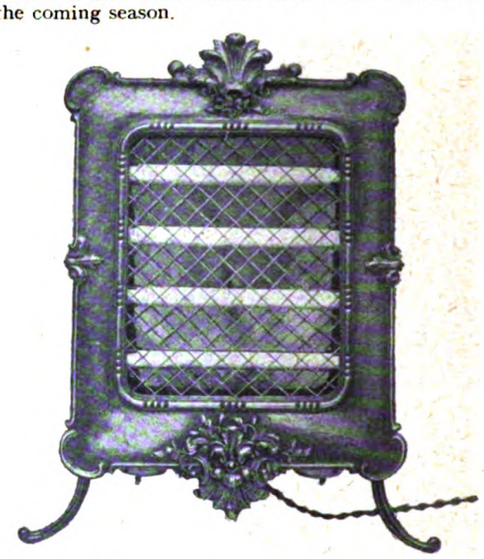

FIG 3—A LOUIS XV FIRE BY THE SAME FIRM.

Belling & Co.

Before bringing to the notice of buyers one or two new Belling designs, it is opportune to make some comments on the publicity policy of the Company. By the methods which they adopt, they provide contractor and retailer with a most powerful selling force.

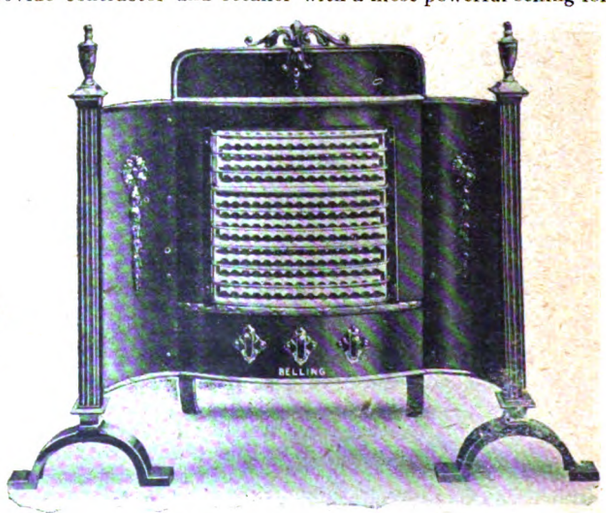

FIG. 4—THE BELLING CORINTHIAN FIRE.

That force is an attractive catalogue written in a chatty and informative manner for the domestic user. It is the deliberate purpose of BELLING AND CO. to provide the trade with a catalogue which is a medium by which the retailer or contractor can solicit fire business from the domestic buyer. This service which the makers render to the trade must be stressed. It is undoubtedly a failing

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of many manufacturers to provide lists written in a highly technical manner. Obviously we are not referring to catalogues which are only intended to be trade catalogues, but it is essential that any publicity which the manufacturer intends should be passed on to the public by the retailer, must be free from technical details. As is the case of the Belling catalogue, the whole note must be chatty and informative.

FIG. 5.—A "REFLECTOR COAL FIRE" (BELLING & CO.).

Many of the designs which are shown in the list for the 1923–4 season have familiar aspects, but the years have proved them to be favourites of the public, and they will sell well. There are two newcomers amongst several others, which must be mentioned, and these are illustrated under Figs. 4 and 5. The first will be known as the "Corinthian." It is made of sheet metal with a restrained ornamental note. This fire has a capacity of 3 kW with a three-switch control. In Fig. 5, Belling's designer has been much influenced by the fancy of the public for a fire which has the effect of coal burning in a grate. The design is, of course, the development of the two designs of "imitation coal" fires which Belling's placed upon the market last year, and which they will continue to market this year. Every fire in the Belling list is worthy of note, but in spite of our lack of space we must also refer briefly to the "Economic" fire. This is a small sheet metal fire of tasteful design and will fill the demand for a heating unit of low consumption. The fire can be fitted with two bars and three bars, giving a total loading of 1 200 W and 1 800 W respectively. Another design of particular interest is a small compact fire known as the "Fixall." This design is for permanent wall fixing, and the housewife will come to bless the contractor who recommends it as a "comfort-giving" appliance for the bathroom. English homes are not noted for their comfort in bathrooms, and retailers could make a particular appeal to the public with this small fire.

But when all is said and done, the heart of a fire is in the element, and we need only mention that all Belling fires are fitted with the well-known Belling elements, and judging from what we know of their activities, improvements are always being made.

Benham and Sons.

The business of the contractor in heating apparatus need not be confined to the conventional radiant element fire. There are many heating jobs in prospect where it would be inefficient and expensive to instal such fires. In fact there are a large number of small heating jobs which could be carried out without limiting one's self to the installation of these radiant fires. We refer now, of course, to the low temperature radiators, and any review of this type must include the "Electro-Vapour" radiator. Here, again, the manufacturers, BENHAM AND SONS, provide the trade with much convincing publicity. We illustrate in Fig. 6 an electro-vapour radiator which can be supplied in a number of capacities ranging from the No. 2b, which has an approximate heating capacity of 600 cub. ft. for a living room, and 1 200 cub. ft. for a bedroom, up to the No. 9b size, which has a heating capacity of 3 000 cub. ft., for a living room, and 6 000 cub. ft. for a bedroom.

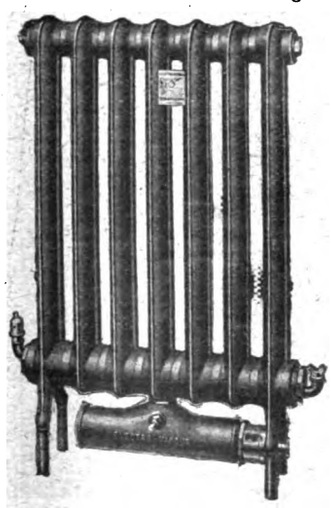

FIG. 6.—AN ELECTRO-VAPOUR RADIATOR (BENHAM AND SONS).

In making mention of Benham's electro-vapour radiators, we appreciate that the apparatus is not one which strictly falls under a merchandising line. We do wish to emphasise, however, that there is no reason in the world why the contractor should limit his vision to the small fry jobs for electric heating. Large heating jobs can be economically and effectively carried out by an electrical installation, and the electro-vapour radiator is one of the several types of apparatus with which such jobs can be secured.

Best and Lloyd.

BEST AND LLOYD, occupying as they do an exalted place in the trade for design and quality, it naturally follows that their range of electric fires takes a very high note. In fact, it could be said that the "Best" fires stand in a class of their own.

In making these comments on the fires manufactured by Best and Lloyd we realise how inadequately we can deal with the subject owing to the limitations of our space. We understand from the manufacturers that they propose to run this season practically the whole of the last year's designs, and selecting those patterns which might be called domestic type we find no less than twenty. It is questionable whether any other manufacturer has such a complete range. In addition to these last season's models, Best and Lloyd will put on the market nine new designs almost immediately, and they have been good enough to send us advance information of these. We have selected two of the more simple designs, because we must remember that in these columns we are discussing fires which will make the best merchandising lines. That is to say, fires of good design and at moderate price. Particularly does this apply to makers' catalogue No. 22 809, which we show in Fig. 7. This is a type of fire built up on the open grate idea, with a polished copper interior reflector. It can be supplied in wrought iron finished dead black, or in wrought iron finished in oxydised copper. It is fitted with two elements each taking 500 W, and has a one-switch control. We choose to illustrate the fire shown in Fig. 8 because, in our opinion, the designer has succeeded in getting away from the flat-faced design. This fire is made in a brass case, with four elements each taking 500 W, with a two-switch control.

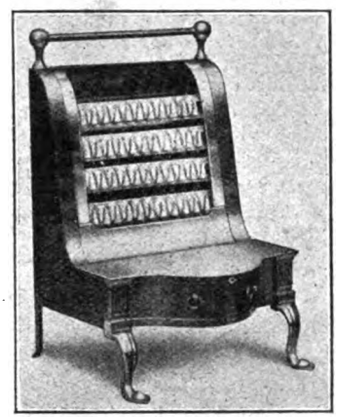

FIG. 7.—A WELL-DESIGNED GRATE FIRE (BEST AND LLOYD).

FIG. 8.—A DEPARTURE FROM THE ORDINARY (BEST AND LLOYD).

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Burnley Components.

It is safe to prophecy that the small fire which is now known as the "bowl" type of fire, will be in great demand this season. BURNLEY COMPONENTS, LTD., are manufacturers of a fire of this type at a list price of 34s. 6d. It has several points of merit.

The Cable Accessories.

The CABLE ACCESSORIES Co. who manufacture the well-known "Revo" fires advise us that their programme for the coming season will be to offer to the trade the same designs which they marketed last year. They feel that many of these designs have become established favourites with both the public and the trade.

The Carron Co.

The CARRON Co. will continue to run this season the majority of the fires which are familiar to the trade through last year's catalogue. Two new designs will be put upon the market. These will be of the portable type, constructed of cast iron, and fitted with two fireclay elements, each loaded to a maximum of 1 000 W and controlled separately by tumbler switches. These designs can be finished in black, armour bright or electric bronze. A feature of one design is that the trivet can either be fitted top or bottom. The total maximum capacity of each fire is 2 000 W. The Carron Co. limit their programme to cast iron fires, but in spite of this limitation their designs take a high note, and, what is more important, the elements are reliable and efficient.

General Electric Company.

As each autumn approaches we are all on the *qui vive* to know what the GENERAL ELECTRIC Co. are offering for the coming season. As in years past, the "Magnet" range could form the basis of a most comprehensive merchandising programme for the season,

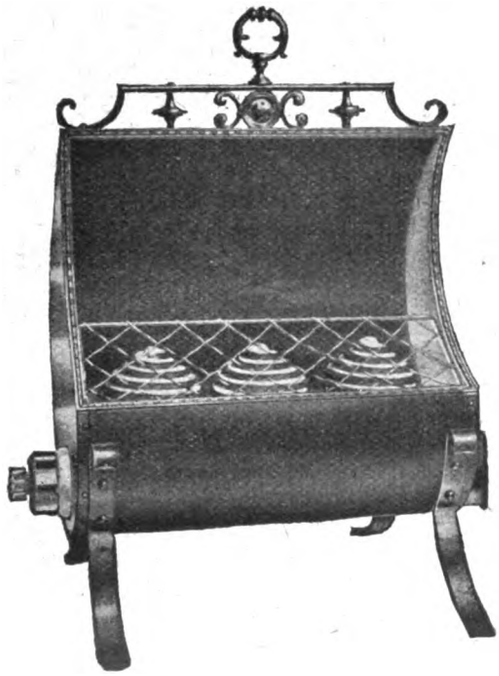

FIG. 9.—A FIRE BUILT ON THE REFLECTOR PRINCIPLE (GENERAL ELECTRIC Co.)

because, reviewing advance proofs of the G.E.C.'s publicity, there would seem to be no end to the number of designs and types of fires which they are offering to the trade. Before we comment on several of the designs we wish to refer, as we have done in the case of one or two other suppliers, to the question of publicity. When the profits and turnover on fire business for the season are being estimated, the publicity service of the G.E.C. can be put at a very high value, as undoubtedly the series of folders which they have in the press for distribution to the trade forms one of the most ambitious publicity campaigns of this season. Assuming that the publicity is used in the right direction and backed by all that is necessary to make sales, then its value cannot be over-estimated. Leaving aside for the moment the character of the publicity, we have the compelling value of the trade word "Magnet." For years this has been the lodestone with which many contractors and retailers have attracted a large turnover.

In the "Magnet" fires for the new season, the General Electric Co. have pinned their faith to some old designs which, experience has proved, appeal to the public. They anticipate that the bowl fire, or to use their more descriptive term, the "pedestal heater," will be as popular this year as it was last. Should anyone be tempted to argue that his type of fire can only be sold round about a certain price, they will be satisfied with catalogue No. H.O.750, which will be marketed complete, ready for use, at 35s. The G.E.C. have great faith in this type of fire, that is to say a fire built on the reflector principle, as is shown by the fact that they have developed three new designs which, while they are not of the bowl type, are built up on the same principle. Fig. 9 will at once reveal the note in this new development. This particular fire bears catalogue No. H.O.761, and is equipped with three elements similar to that which they use with their No. H.O.750 bowl fire. The same design can also be supplied with two elements. These elements have been supplied to consume either 600, 750 or 1 000 W each.

FIG. 10.—A NEW DESIGN OF BOWL FIRE.

It is obvious that the G.E.C. have anticipated that there will be a reaction in time against the crude form which the bowl fire must necessarily take, and therefore they will have ready for the season a more elaborate design of fire which we show in Fig. 10. This fire will satisfy those who do not like the 35s. pedestal fire, but whose purse will stretch to 56s.

It would be impossible in the limits of our space to do justice to every design of fire which this company offers. It will indicate the extent of the programme if we mention that the G.E.C. have advised us up to the time of going to press that in the art metal range they will have five different designs, and in the sheet metal range four different designs. The cast iron range totals five different designs, some new, some old. To conclude the list mention must be made of the range of earthenware fires, which are the exclusive novelty of only one or two makers.

Hotpoint Electric Appliance Co.

As is well known the HOTPOINT ELECTRIC APPLIANCE Co. have joined forces with the Falkirk Iron Co., hence we have the excellent combination of an active sales force marketing the products of a manufacturer who has the reputation going back many years.

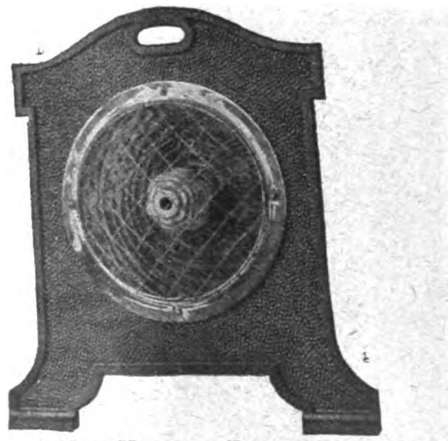

FIG. 11.—A NEW HOTPOINT FIRE—THE "SPRITE."

With one exception the whole of the "Falco" range consists of designs in cast iron. It is the opinion of manufacturers that time will prove that cast iron cases for fires are a better job and will prove superior to sheet metal. Certainly cast iron fires lend themselves to some very beautiful colour effects in porcelain enamel, and by using an electro-deposition method, finishes such as nickel-plate and oxydised-silver can be attained. To the criticism that

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this finish is expensive, the reply is that it is far more durable and lasting than can be obtained on sheet metal fires. In the porcelain enamel finishes, Falco fires hold the laurels. Some of them are indeed an achievement in colour, and particularly pleasing is the homely "Teapot" brown. The essential for success in this porcelain enamel finish is a fine casting, and this has been achieved in Falco fires. We cannot conclude these remarks on finish without mentioning their rustless steel fires. These have a handsome appearance in the bright rustless steel from which they are made, and in spite of their comparatively high price they will induce many a prospective buyer to pay the increased price.

The Hotpoint Co. will continue to run the whole of the fires which they placed upon the market last season and which are shown in their list No. 317.

We have a secret to disclose as to what the Hotpoint Co. propose to do to secure fire business this season. That secret is the "Sprite" fire, which we illustrate in Fig. 11. This is a fire of excellent design, and it will find ready sales at its price of about 30s. This, in our opinion, is a remarkably attractive price for such a bowl fire. Another new Hotpoint line for the season in their range of "Falco" fires is the "Adaptable" fire. The idea underlying the design is entirely new, and its ready application to practically any fireplace will catch on with the public. In a catalogue which the Hotpoint Co. will issue shortly this fire is very fully described, and is referred to as "a change for the best." It is a very apt expression.

L. G. Hawkins and Co.

"None of us were fully prepared for the fan sales created by the heat wave—thus profits were lost. The chilly mornings of autumn, followed by the cold winter days surely spell radiator sales."

This is a preface to a circular letter which L. G. Hawkins and Co. have sent to the trade. Obvious though the reflection may be, it is undoubtedly a truth and will serve as a lesson. Further, the "thinkahead" form which, with characteristic resource, the firm have hit upon, will reveal what can be done very simply in the way of laying out a programme for the season instead of buying from hand to mouth—week by week.

Hawkins are, of course, noted for their "Universal" bowl fires. For the coming season the range will include some of last year's designs, and one new type which will be known as the 9954. To quote the words of L. G. Hawkins, "It is the latest production—a bold, handsome device, complete and ready for use. Decorative bronze finish, polished copper reflector—requires no cleaning. Fully guaranteed. 47s. 6d."

The Imperial Engineering.

The Imperial Engineering Co. is another newcomer to the heating field, but they have quickly learned what that field requires. Already their list for the 1923–4 season has been received from the printers and copies will be supplied on application. The range consists of four designs of the flat faced type, each design taking rather the same note. Prices are most attractive and Imperial Engineering Co. have undoubtedly set themselves out to capture business in fires with attractive prices, at the same time not neglecting reliability in the elements. In the bowl type they have three designs, and also two other designs of small portable fires which could be put in the same class.

Jackson Electric Stove Co.

On another page, our contributor "A Spectator," makes criticism of the method which manufacturers adopt with their publicity. He criticises the fact that it is usually late in the season before they have their lists ready for distribution to the trade. One manufacturer who must be exempted from this criticism is the Jackson Electric Stove Co. Their list was ready for distribution in the early part of August.

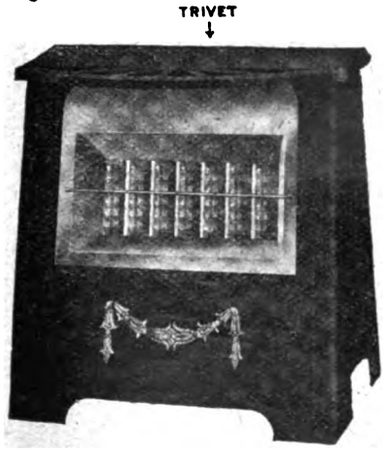

Fig. 12.—A New Design (Jackson Electric Stove Co.)

Little can be said that is not already known about the merits of the Jackson fire. Each fire is a first-class heating unit, combining efficiency and design. This point should be emphasised because it is a temptation to so many manufacturers to sacrifice one detail for another. Many fires have excellent elements regarded as heating units, but the fires make no appeal, and are not successful as merchandising lines because of their design, or lack of it. Other manufacturers err the other way, sacrificing everything to the design of the case.

As is the plan of other manufacturers, the Jackson Stove Co. will continue to run this season some of their old-established lines, and the trade will be interested because some have proved themselves to be excellent sellers. The "Cheery" model, which they introduced last season, and, as they anticipated, was a great success, will again be available. A useful improvement has been made in that the fire is now fitted with a cast iron front and trivet.

We commend the attention to two of Jackson's new designs for the season. Fig. 12 will be known as the No. 580, and at 38s. 6d.

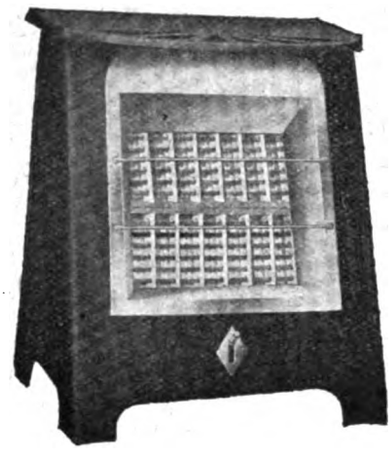

Fig. 13.—A Cheap 2 kW Fire (Jackson Electric Stove Co.)

for a 1½k.W fire we seem to be touching bottom prices. Certainly this view is strengthened when we mention that the No. 581 fire, which we illustrate in Fig. 13, is a 2 kW fire listed at 56s. In both cases the prices mentioned cover fires finished in ebonite black (which is a particularly tasteful finish and seems peculiar to Jackson fires) and with trivet.

Charles Joyner and Co.

Angelus fires have a note in their design which is hard to describe. One would naturally use the word "distinctive," but it is both the right and the wrong word to employ. Probably it is better to say that the designs are "different," and it is easy to see that their reputation for design in fittings has been carried on in their range of fires.

In the small booklet which Joyner's have issued for the season, pride of place is given to the "Angelus Sunbeam," which is made in two designs. The cheaper design has the familiar note of other fires of this type. Following these two types the range includes several fires in sheet metal and several in cast iron. We note that Joyner's will continue to carry out in their programme this season the "Gothyn-Angelus" fire. This fire is unique in design, the framework being built up with porcelain tiles.

We have referred to the booklet issued by Joyner's and it is of interest to mention that a supply of these, overprinted with customer's name and address, will be provided on request.

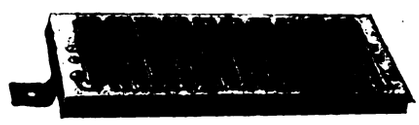

Fig. 14.—Moorwoods' Standard Element.

Moorwoods, Ltd.

"At the mercy of the elements." This is the very arresting title which Moorwoods, Ltd., have given to their list of "Moorwood" fires. Moorwoods are new comers this season to the fire business, but it is evident that they have studied requirements and tastes very closely before they have launched their programme.

Before commenting on the design we must spare space to briefly describe the standard element which is fitted to all Moorwood fires. We illustrate the element in Fig. 14, and as will be seen it is built of extra heavy strip formed into a continuous length of corrugations, which, it is claimed, greatly increases the heating surface. The strip is mounted on a specially designed extra heavy solid fire bar of refractory material forming the complete element. The fixing arrangements of the element are simple, and they are interchangeable with all Moorwood fires.

Turning now to the types and designs of fires, it may be mentioned that the manufacturers have followed the plan of having two types, namely, cast iron and sheet metal. All the designs take the flat faced note. We illustrate in Fig. 15 one very pleasing design which we have selected from the total of four fires which Moorwoods have in the cast iron range. They also have four designs in their sheet metal range, all of which can be supplied in a variety of

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finishes. No attempt has been made to cater for the demand for low capacity fire in sheet metal, the whole of the four designs being supplied with a 2 250 or 3 000 W rating.

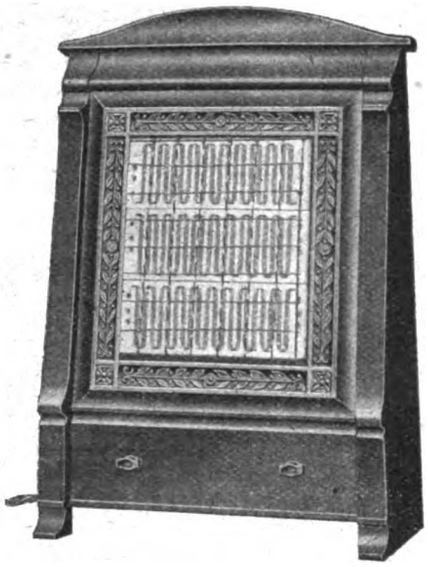

FIG. 15.—A CAST IRON MOORWOODS FIRE.

May and Podmore, Ltd.

Manufacturers may be excused if their designs run on conventional lines. Prices dominate so much that the designer has but a narrow scope. Those manufacturers who can escape from the "weary, flat, stale and unprofitable" and at the same time keep within the limits of price, have achieved much toward success. The "Maymore" range manufactured by MAY AND PADMORE will include the designs which they put on the market for last year's trade, including a new design which they will shortly announce. In the main the range is limited to cast iron fires with vitreous enamel finishes in various colours. The manufacturers issue a catalogue with the various designs illustrated in colour, which not only reveal the colours of the porcelain, but brings out the details of the design of the fires.

Metropolitan-Vickers Electrical Co.

Last season many new designs of fires were launched on the merchandising field, and some proved to be good sellers and many proved to be bad. We have not much fear of contradiction in the guess that we hazard that the "Cosmos" fire was one of the best sellers of last year, and we see no reason why it should not be so this season. Certainly if publicity alone would sell fires then a large number of "Cosmos" fires will be sold this season, because very few manufacturers offer the trade such compelling publicity

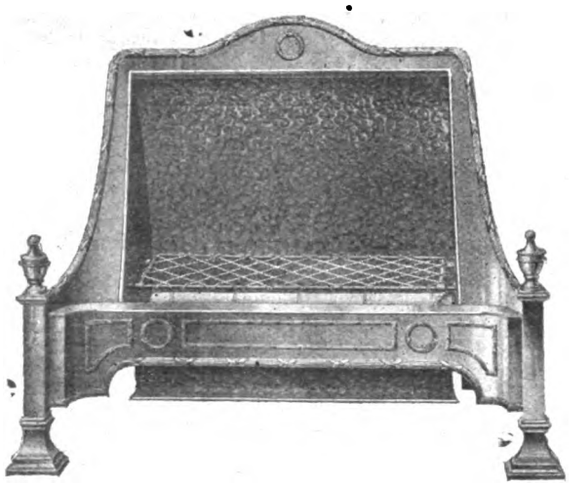

FIG. 16.—A METROPOLITAN-VICKERS "ADAMS" FIRE.

in the way of folders such as the Metropolitan-Vickers are putting behind the "Cosmos" fire. The chatty booklet written in an inimitable style, entitled "How to Choose an Electric Fire," by "Justa Housewife," should be distributed broadcast by the retailer. It will surely make a sale with the most hard-faced husband.

The METROPOLITAN-VICKERS ELECTRICAL CO. advise us that they now have six models in the "Cosmos" range in addition to the bowl fire. In Fig. 16 we show the "Adams" model, which is the most ambitious design in the whole "Cosmos" range. There are more simple designs built on the same style ranging from 52s. 6d. for 1 kW fire up to an "Empire" design in oxydised silver at £7 5s.

H. W. Sullivan and Co.

H. W. SULLIVAN AND CO. have published their catalogue of fires for the season, and it contains many designs which proves that the Sullivan line merits the attention of all retailers. In a preface to the list mention is made to the Sullivan elements, one being known as the "Clip" or the original Sullivan element, and the other the "Uniglow." We suggest that particular attention be given to the technical data on these elements because undoubtedly they have contributed very largely to the success of the Sullivan fires. When reviewing the catalogue of various makers, our first thoughts naturally turn to designs which are new and original. Several will be found in Sullivan's catalogue, particularly their pattern G, which we show in Fig. 17. This, we venture to say, will be a very

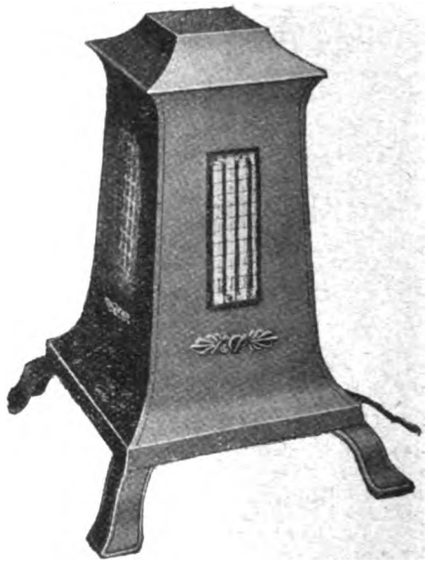

FIG. 17.—SULLIVAN'S PATTERN "G" FIRE.

successful seller for large rooms, and also situations which are outside the immediate domestic field, such as halls, waiting-rooms and hotels. The range includes several designs of the bowl fire, but we should imagine that the pattern "U" fires which Sullivan's placed on the market last year will be in even greater demand this year.

Electric Fires.

The new "Heatrae" lines for the season, marketed by ELECTRIC FIRES, include one which will satisfy those critics who lament the fact that the majority of fires cannot render any domestic service other than heating a room. Few fires can be used for boiling a small kettle, or saucepan of milk, or making toast. The "Tea Time" fire, which is the name given to Fig. 18, is therefore a fire which not only has a pleasing shape, but at the same time possesses a good talking point in the usefulness of the small boiling ring or heating unit at the top. The two fire bars of the fire proper are each separately controlled by switches, the boiling ring being quite independently worked by a third switch, so that it can be used without bringing the fire bars into circuit.

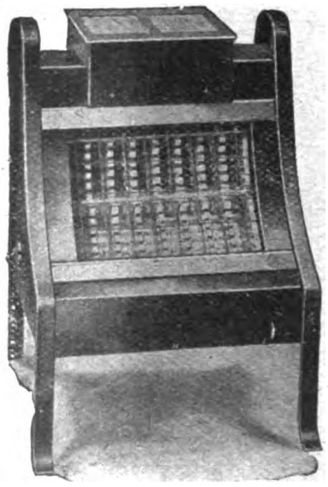

FIG. 18.

Another new fire by the same company is the "Norvic." This is the realisation of the designer's conception of a design that is different. Underlying the design are the constructional arrangements of the elements which allow the heat to be distributed radially round the room. Though the company are comparatively new in the heating field they have already established a reputation which has placed them in the front rank of manufacturers.

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Siemens' Advertising Campaign.

How the Retailer will be Assisted.

From information received, as they say in a place with which we hope our readers have only a bowing acquaintance, we understand that the SIEMENS and ENGLISH ELECTRIC LAMP Co. have embarked on an extensive and varied advertising campaign to the large user, small consumer and to the trade. We wish the venture every success.

As a part of this campaign artistically drawn advertisements will appear in the leading daily and evening newspapers throughout the country, in a number of trade journals of various kinds, and in the best weekly and monthly magazines. These will all insist on the necessity of purchasing electric lamps through local dealers and will therefore be a great aid to the retailers.

In addition to this Press campaign, the Company will also exhibit 16 and 8-sheet posters throughout the country from the middle of September until well into the New Year. The design entitled "After Sunset" (Fig. 1) is a most arresting picture and should be seen by some hundreds of thousands throughout the country. This "After Sunset" design will appear in all the trains on the Bakerloo, Piccadilly, District, Central London, Hampstead, and City and South London Railways.

Double crown posters, with the showcard design, "The Midnight Sun," (Fig. 2) will appear on the platform approaches of all stations from Hammersmith to Finsbury Park and from Liverpool Street to Marble Arch. This is a wonderful design and cannot but arrest attention.

FIG. 1.—SIEMENS' AID TO SELLING LAMPS.

The "Midnight Sun" showcard, printed in 10 colours, eyeletted and strung for hanging for display in shop windows, etc., will be sent to resellers on request. Further supplies are available of the "Satisfied Consumer" showcard.

A Three-Colour Display.

Another distinctive display in three colours is to be found in Siemens' enamelled signs, which are made in two sizes, 12 in. by 4 in. and 27 in. by 9½ in. These are suitable for fixing in interior or exterior positions and a considerable number have already been so

FIG. 2.—THREE NEW SHOWCARDS.

fixed all over the country. Early application should be made for these, as we understand the supply is limited.

Electric Window Signs.

There are also available electric window signs in two designs, i.e., "Fountain" and "After Sunset." These signs consist of a triangular metal container with slots for a lampholder and a wire attachment, over which a cylinder revolves behind the scene. The heat of the lamp keeps the cylinder revolving. The fountain signs depict a bright café and garden scene, with the fountain playing, so that the novel effect of running water is produced. The "After Sunset" sign shows the world in bright colours and gives a very fine cloud effect. A changing lighting effect is obtained by means of a special revolving cylinder. Single lights are illuminated one at a time through small holes from the bottom of the globe to the top,

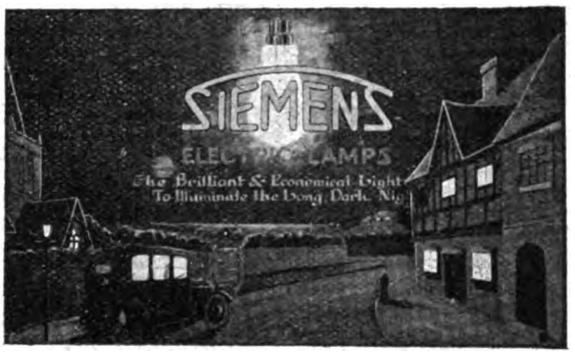

FIG. 3.—A ROAD SCENE WHICH IS BEING USED AS A WINDOW DISPLAY.

and all the lamps remain alight for a few seconds and are all extinguished at once. The pictures and cylinders for these signs are interchangeable. We are informed that a number of these signs may be obtained on loan and early application is desirable, in view of the heavy demand for them.

Window Displays.

In addition to the electric signs there are larger window displays in two designs: A road scene with illuminated buildings and a motor-car and sea view in the distance, and an interior casement window scene looking out to sea (Figs. 3 and 4). These displays are ready assembled and only require opening out and the struts fixed. Both are most interesting and possess pleasing and engaging features, especially when lighted up after dusk. These are available for loan to the trade and can be booked in advance.

In addition to all this the Company have prepared two attractive novelty cards for circularising. One is a folded cut-out with an

FIG. 4.—ANOTHER SIEMENS WINDOW DISPLAY.

"After Sunset" picture on the cover and a setting sun which, when opened, revolves and shows an electric lamp beneath a shade. The other is a plain postcard, on the address side of which is a seal with printed instructions which read:—

"Open seal, moisten blotting paper and rub therewith interior surface of card."

This operation produces a very fine fixed photograph of the "Midnight Sun" showcard.

These cards are being mailed to thousands of consumers throughout the United Kingdom, and recipients are requested to go to their local dealers for their supplies of Siemens lamps.

The requirements of the trade for lamp price lists is well met by a vacuum and gasfilled lamp leaflet No. 86 and an automobile and battery lamp leaflet No. 87. Both of these have an appropriate cover design on which is provided a space for overprinting the dealer's name and address. Some thousands have already been overprinted and supplies to resellers who have not yet received them will be sent on application.

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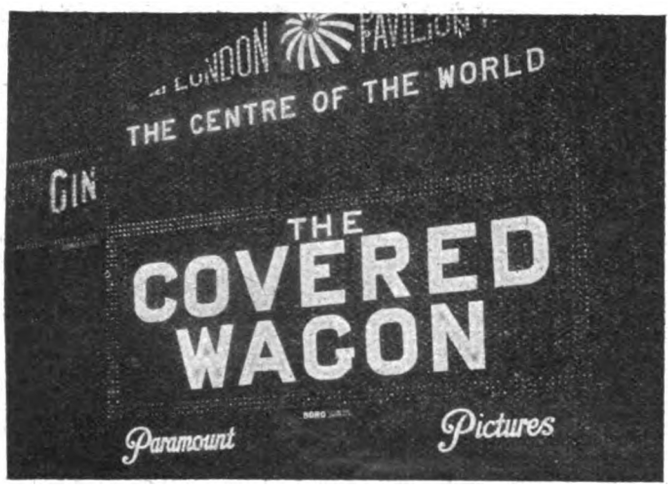
Large Electric Sign.

Advertising "The Covered Wagon."

We reproduce herewith a night photograph of an electric sign which is the largest ever built and erected in England, and has moreover, the distinction of having the largest candle-power in the world.

This sign, which covers both the Piccadilly Circus and the Shaftesbury Avenue frontages of the London Pavilion, advertises the "Covered Wagon" film, and was built by the Borough Bill-posting Co. and the Strand Electric and Engineering Co., to the instructions of Mr. Mortimer Norden, the President and General Manager of the Northern Sign Co., the largest manufacturers of electric signs in the United States. The sign was constructed and erected within 14 days of Mr. Norden's arrival in England, a piece of work that is a great testimony to the efficiency of the firms concerned.

The sign consumes some 200 kW, and a special service had to be brought into the building to cope with this load. It contains 5 000 lamps, those used to illuminate the channel letters being of 60 W daylight gasfilled type, while the borders are composed of lamps of colour-sprayed type. The use of daylight gasfilled lamps



THE "COVERED WAGON" SIGN AT NIGHT.

for electric signs is rapidly growing, and their employment for outlining letters and other striking features of electric signs gives a far more novel and brilliant effect than anything hitherto attempted in this way.

The use of the colour-sprayed lamps is a distinct novelty. These lamps are not lacquered in the ordinary sense, but are coloured during their manufacture. The process consists of spraying the lamp bulb with a special semi-opaque or completely opaque enamel of an appropriate colour which is stoved on to the glass at a very high temperature, and which, in addition to modifying the colour of the resultant light, gives a remarkably efficient light-diffusing surface. Filament glare is thus eliminated, and large numbers of lamps, high illuminating and striking colour schemes, may therefore be employed without risk of garishness.

The colours, moreover, are permanent, which varnish tints certainly are not, and a very large variety of beautiful colours can be supplied instead of the limited range of somewhat crude tints available in varnishes. The latent possibilities of such lamps from the sign manufacturer's point of view are endless, and a wide field in decorative and artistic signs is therefore opened up by their introduction.

In the sign in question the border lamps are tinted a special apricot tint which was produced to fall in with the colour scheme of the sign, and the lamps were specially manufactured at the OSRAM-G.E.C. lamp works within the 14 days between the placing of this order and the first exhibition of the film.

Electric Baking at Glasgow.

Among the electric cooking installations which we illustrate on p. 340 and 341 of this issue is a Westinghouse automatic baking oven which was sold by the Glasgow Electricity Department six months ago to a bakery specialising in the manufacture of Scotch oatcakes. We are pleased to learn that the oven is giving every satisfaction. It is loaded at 25 kW and its design follows the usual Westinghouse model which has already been described in these pages. The control is by push button and the temperature is kept at the right point by means of a thermostat. The baking temperature required is 450 deg. F., and this is attained after the oven has been switched full on for 45 minutes. The biscuits or other material to be dealt with are placed on revolving shelves which are driven by a motor. The action is therefore entirely automatic.

An opportunity is being taken in connection with this installation to do a little propaganda for electric cooking. With each packet of oatcakes sent out from the factory is enclosed a leaflet illustrating the bake oven and pointing out that to use electricity for this purpose means no smoke, no fumes and perfect cleanliness. This is an example worth following in other similar cases.

How Would You Do It?

A Chance to Win a Motor Car.

Modern advertising has brought in its wake what might be called a cult of modern conceit, because there are few of us who are not possessed of the idea that we could advertise any particular product better than it has ever been done before. "Now I know what I should do if I had my way." How often do we comment thus on the work of others, and how often do we pour advice into the ears of the other man, but it is seldom that we are offered a prize for doing so.

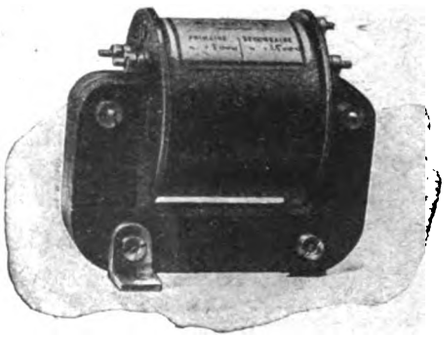
The METROPOLITAN-VICKERS ELECTRICAL Co. must have given months of anxious thought to their publicity and advertising campaign on "Cosmos" fires, but beyond doubt there are many of us in the trade who fancy we could have done it much better, and it is to find out that better method, or better idea, if it exists, that the "Met-Vick" are offering a prize of a Wolseley two-seater motor car for a really workable suggestion. We warn our readers that it will be a hard task to better the "Cosmos" campaign when it is considered for a moment what that campaign is. Two folders have been published, one devoted particularly to the bowl fire; the other folder including the whole range of fires. In addition to this is a small booklet entitled "How to choose an electric fire. By Justa Housewife." These three pieces of publicity are the munitions with which the retailer can get the business from the public. So much for the publicity. Turning now to advertising, the programme covers a series of full page advertisements in the electrical press.

When the publicity and advertising of a product is being laid out, it is obvious that one must be very clear as to what the programme is to achieve. The "Met-Vick" Co. have not left us in the dark as to what they want. All the requirements are clearly laid out in a booklet which they have published giving the details of the competition. Briefly, what the "Met-Vick" say to the industry is, "Here is our publicity and our advertising programme. It could have been done better, we know, and we offer a prize of a £250 motor car for the best suggestion of improving it."

A competition of this kind is a novelty in the electrical trade, and if we are really sincere when we say that we could have done the "Cosmos" publicity and advertising campaign better than the Metropolitan-Vickers Co. have done it, then all of us must put pen to paper and take our chance not only of winning a "Wolseley ten," but of increasing the selling force of the industry.

A Low Frequency Wireless Transformer.

The "M.E." low frequency transformer made by La METALLURGIQUE ELECTRIQUE, whose British agent is Mr. Ashton Bremner, is a piece of equipment which should be of interest to those engaged in wireless work. It is made in three types, each of which has



THE "M.E." LOW FREQUENCY TRANSFORMER.

5 000 primary turns, combined with either 25 000, 20 000 or 15 000 secondary turns so as to give a ratio of transformation of 5 to 1, 4 to 1 and 3 to 1 respectively. The illustration shows the compactness of the apparatus.

The Liffey Water-Power Scheme.

Dublin Electrical Engineer's Views.

Whether taken as a technical proposition or as a commercial proposition, the Liffey water-power scheme was an excellent one, said Mr. L. J. KETTLE, the Dublin City Electrical Engineer, in a speech at a luncheon in Dublin last week. There was, however, a slight difficulty as to who should take in hand the work of developing the Liffey, and as to the extent to which the development should be carried.

In his opinion the solution seemed to lie in the active co-operation of all the interests concerned—the Dublin Corporation, the Dublin Tramways Co., the Lucan Tramway Co., the Blessington Tram Co., and all the local councils and companies interested in obtaining power. A joint board should be formed, working under a company organisation, and all the business of power manufacture should be handed over to the board, including all the existing stations, if the board so desired. Until the Liffey power was rendered available the board would run the existing stations in the best and most centralised manner and in the common interest.

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Legal Intelligence.

B.T-H. Patent Litigation.

Infringement of Letters Patent.

In the Vacation Court on September 19th, Mr. Justice McCardie had before him the case of the BRITISH THOMSON-HOUSTON Co. *v.* WENTWORTH on two motions by the plaintiff company, to restrain until the trial of the actions or further orders, the defendant from infringing the plaintiff's Letters Patent.

Counsel for the defendant said his client was a small but honest trader, and purchased the infringing lamps—about two dozen—at a sale in Paris. The defendant did not, in the circumstances, wish to contest the actions, and the two dozen lamps he had bought he was quite prepared to give up. Three actions had been started against the defendant in respect of the sale of the lamps, because it was alleged they represented different patents.

Counsel for the plaintiffs said that the patents were all of a different character. One related to the particular construction of the leading-in wire and another for an alleged novel construction of the whole lamp.

Counsel for the defendant said his client was willing to treat the motions as the trial of the actions and submit to the injunction and to pay any reasonable sum as damages. Counsel for the plaintiffs said he could not agree to take anything but the ordinary order. It did not of course follow that the plaintiffs would necessarily pursue their right to an inquiry as to damages, but what the plaintiffs mainly wanted was an injunction. He was not at the moment prepared to treat the motion as the trial of the actions, unless the ordinary order followed. Counsel for the defendant said he should not object to an inquiry as to damages.

His Lordship granted the interim injunction.

A Perpetual Injunction.

Mr. Justice McCardie also heard the case of the BRITISH THOMSON-HOUSTON Co., *v.* THE ELECTRICAL MOTOR WORKS upon the application of the plaintiffs for an interlocutory injunction restraining the defendants until the trial or further order from infringing the plaintiff's Letters Patent.

Two men, who traded in partnership as The Electrical Motor Works, appeared in person, one of whom stated that they did sell a few lamps of all sorts which were included in some Government surplus stock which they had purchased.

The defendants said they would consent to a perpetual injunction with costs, and the ordinary order.

His Lordship ordered accordingly.

Attempted Theft of Electricity.

Consumer Fined £10 at Wallasey.

For unlawfully attempting to consume electricity belongingto the Wallasey Corporation, R. B. Ball, of Liscard, was fined £10 by the Wallasey magistrates recently. It was stated that the meter had been tampered with and an attempt had been made to prevent the electricity passing through being recorded.

Electrical Equipment for Canada.

Large and Increasing Demand Predicted.

The Canadian demand for all kinds of electrical equipment, large and small, will be extensive during the current year, according to Mr. F. W. FIELD, H.M. Trade Commissioner at Toronto. In his report on industrial conditions in Canada to June last [H.M. Stationery Office, 2s. 6d.] he states that the increase in electrical energy consumed in many Ontario municipalities has commenced to place a serious physical burden upon the local distribution systems. Increased individual demands have caused expansion in the aggregate quantities of electrical energy consumed in excess of that which many local distribution systems were designed to handle. This work will make demands upon manufacturers of line material, transformers, and other equipment for local distribution systems.

Domestic Load Doubled.

In Ontario the average individual domestic load has, in the past five years, doubled; this is largely due to the extending use of electric cookers, heaters, water heaters, and other domestic appliances. There is also a demand for electrical energy for rural and farm purposes. Similar expansion is also in evidence in Quebec Province and Western Canada. Canadian and United States electrical manufacturers had a fairly good year in 1922, but anticipate greatly improved business in the near future.

While mentioning that in connection with a recent invitation by the City of Winnipeg for tenders for turbo-generators, three United Kingdom firms made offers which compared favourably with those of their competitors, Mr. Field calls attention to the keen competition which British firms have to meet in the electrical field from Canadian and United States firms. As he truly remarks, the selling story of the American salesman in Canada is usually half told—by means of extensive advertising in the Dominion by his principals—before he commences to sell his wares there. In this connection the recommendation is made that British firms, individually or collectively, should improve the conditions under which their local agents work.

Institution of Electrical Engineers.

Programme for Session 1923-24.

The arrangements made by the Institution of Electrical Engineers for the coming session are now available. As already announced, the opening meeting is to be held on October 18th, when the President, Dr. A. Russell, will deliver his inaugural address. The ordinary meetings, will be held on Thursdays at an hour to be announced later, and at the first of these, on November 1st, a paper on "Industrial Research, with Special Reference to Electrical Engineering Development," will be read by Mr. W. Wilson. A joint meeting with the Société des Ingénieurs Civils de France (British Section) has been arranged, when a paper by M. A. Bachellery, on "The Electrification of the Midi Railway" will be submitted. On November 29th (joint meeting with the Physical Society of London) there will be a discussion on "Loud-Speaking Telephones," while on December 13th, Mr. D. Brownlie will present a paper on "Pulverised Fuel and Efficient Steam Generation."

The New Year will open with a lecture by Dr. S. P. Smith on "Railway Electrification in Foreign Countries," on January 3rd. The annual dinner will be held on February 21st. Subjects for the three meetings preceding, and the four following the dinner will be announced later. April 24th has been selected as the date of the fifteenth Kelvin Lecture, and the annual general meeting is fixed for May 8th.

Meetings of the Wireless Sections will be held on the first Wednesday of each month at 6 p.m., commencing on November 7th with the inaugural address of Mr. E. H. Shaughnessy, the chairman of the Section.

Electric Storage-Battery Locomotives.

A £1,000 Prize Competition.

In order to encourage the production of a safe and efficient type of electrical storage-battery locomotive for use underground in coal mines, and with a view to displacing pit ponies in deep and hot mines, Lieut.-Col. G. R. Lane-Fox, M.P., Secretary for Mines, announces that Mr. Charles Markham, colliery director, of Ringwood Hall, Chesterfield, has placed at his disposal the sum of £1 000 to be offered as a prize for the best vehicle which fulfills certain specified conditions.

Mr. J. A. B. Horsley (H.M. Electrical Inspector of Mines), Mr. Sidney Bates (Institution of Mining Engineers), Mr. Roslyn Holiday (Mining Association Great Britain), Mr. Roger Smith (Institution of Electrical Engineers), and Mr. Herbert Smith (President of the Miners' Federation of Great Britain) have consented to act as judges, and with the co-operation of H.M. Chief Inspector of Mines, have drawn up the conditions of the competition.

The competition will be open to the manufacturers of any nationality on the first day of October, 1923, and will be closed on such date not less than six calendar months thereafter, as the judges may determine. Working trials, in England, will subsequently be arranged of any vehicles which are selected for test. Copies of the conditions of the competition can be obtained from Mr. A. M. Clegg, Secretary, Electrical Storage Battery Locomotive Competition, Mines Department, Dean Stanley Street, London, S.W.1.

X-Ray Examination of Copper Wires.

Changed Properties of Strained Metals.

An abstract of Mr. AKIMASA ONO'S account of his X-ray interference examination of strained metals, viz., copper wires (in the drawn and annealed states), low carbon steel bars (in the pulled and annealed states), etc., using the rays issuing from a Coolidge tube with a tungsten anti-cathode, is given in the "Japanese Journal of Physics." The results show that the crystal lattices of metals display fibrous structures in the pulled or drawn state, the structural rearrangement proceeding as the degree of strain increases. Particularly in the case of copper of which the atoms are known to be arranged in a face-centred cubic lattice, the inclinations of several simple planes in the lattice to the primary ray and the relative intensity of diffracted rays are calculated. It is shown that the group of small crystals considered to be symmetrically arranged in such a manner that the trigonal axis of the lattice stands in the longitudinal direction of wire, gives rise to the pattern obtained in the experiment on wires drawn to a sufficient degree.

It is suggested that the changes in the lattice arrangement of crystals afford a natural explanation of the change of properties observed in metals that have been subjected to strain.

The Cost of Patents.

Discrepancy between British and American Fees.

At the Newcastle Chamber of Commerce recently the subject of patents and designs was raised by the secretary, Mr. H. Shaw, who has been asked to obtain views on the subject for a forthcoming conference. Mr. Turnbull, borough electrical engineer, of Tynemouth, said it was not generally realised how the Americans were getting hold of our markets to-day. All sorts of things had to be ordered from America which could very well be made in this country, electrical meat cutting machines, for example, and mechanical devices of all sorts. In America a patent could be taken out for 17 years for £7. In England £131 had to be paid for 16 years.

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Electric Traction.

Tramway Extensions and Developments.

BOLTON Tramways Committee proposes to relay portions of the tramway track in Bury Road.

YORK City Council is considering the question of extending the tramway system to Poppleton Road.

BLACKPOOL Town Council is recommended to apply for sanction to borrow £14 000 for eight new top-covered tramcars.

Overhead equipment is being prepared at WEST HARTLEPOOL for the introduction of the trackless tramway system.

CLITHEROE District Council has agreed to receive a deputation regarding the proposed Longridge to Hellifield light railway.

ABERDEEN Tramways Committee recommends the extension of the tramway from Rubislaw to Hazlehead at an estimated cost of £47 000.

LAMBETH Council has decided not to sanction the proposal for the extension of the tramways from West Norwood to the Crystal Palace on the ground that the route suggested is unsuitable.

Fares, Receipts and Passengers.

Owing to the success of the weekly pass system it is probable that the system will be introduced on all tram routes in BRADFORD.

Traffic receipts on LONDON tramways controlled by the Underground Group totalled £41 539 during the week ended September 15th, a decrease of £3 640 on the corresponding week last year.

As from October 1st HALIFAX Tramways Committee will sell penny tickets at 14 for 1s.; twopenny at 14 for 2s.; threepenny at 14 for 3s.; fourpenny at 14 for 4s., or seven for 2s.; fivepenny at 14 for 5s., or seven for 2s. 6d.; and sixpenny at 14 for 6s., or seven for 3s.

Electric Railway Items.

A proposed light electric railway between Keswick and Windermere is being considered by the WESTMORLAND County Council.

For the week ended September 15th traffic receipts on the MERSEY RAILWAY amounted to £4 314, bringing the aggregate for the year to £166 873.

An inquiry was held at TORQUAY last week into the application of the Corporation for an Order enabling them to conduct a light electric railway from Babbacombe Downs to Oddicombe Beach. Sanction was sought to borrow £13 500 in connection with the scheme.

Miscellaneous Traction News.

A specially illuminated tramcar will tour the city in connection with the CARDIFF Shopping Week.

To discuss the possibility of bringing the WAGES OF TRAMWAYMEN nearer to those of 'busmen, a meeting of the interests concerned is to be held next month.

Twenty METROPOLITAN electric tramcars have been experimentally fitted with mirrors to enable alighting passengers to see any vehicle which may be coming up behind them.

Business Items.

Mr. F. G. ALDEN, lighting engineer, of Oxford, has removed his business to larger premises at 7, New Road.

H. AND R. BANNISTER, electrical engineers, Oxford, have removed their business from Church Street to 55, Magdalen Road.

Armstrongs and Main, Ltd. (formerly A. and J. Main and Co., Ltd.), have reverted to their old title of A. AND J. MAIN AND CO., LTD., with offices at Australia House, Strand, London, W.C.2.

THE IMPERIAL ENGINEERING CO., manufacturers of electric heating appliances, Wolverhampton, have appointed Electric Economies, 217, Daimler House, Birmingham (telephone 3384), as their sole agents for the Midland Counties.

THE HOTPOINT ELECTRIC APPLIANCE CO., Berners Street, London, W.1, are among the exhibitors in the commercial group at the 27th Cookery and Food Exhibition, to be held at the Royal Horticultural Hall, London, from October 22nd to 26th.

ELECTRICAL UTILITIES, LTD., have taken possession of their new factory, and their address is now Tudor Works, Park Royal, London, N.W.10. The new telephone number is Willesden 3180, and the telegraphic address "Utilelec, Harles, London."

The BRITISH THOMSON-HOUSTON CO. announce the removal of their Leeds office from Standard Buildings, City Square, to 19a, Wellington Street, Leeds. This move has been necessitated by the rapidly increasing business of the office. The new telephone number is 28011; the telegraphic address, "Asteroidal Leeds," remaining as before.

Electricity in Mines.

Construction of Flameproof Switchgear.

Research on the construction of flameproof mining electrical gear is referred to in the first report of the Safety in Mines Research Board. For carrying out this research apparatus has been installed at the Experimental Station, and a series of experiments designed to assist manufacturers in constructing flameproof and explosion-proof switchgear has been completed. The first section of the work—on the capacity of vented flanges to prevent the passage of flame from the casings of mining electrical gear—is completed, and a report is in preparation. Among the points mentioned as requiring further study in the investigation of signalling systems is the influence of the material of the metallic circuit on the igniting power of the break-flash.

Wireless News.

Empire Wireless Scheme Deadlock.

In spite of the Postmaster-General's statement to the Empire Press Union deputation, headed by Lord Burnham, on August 23rd, that the agreement with the Marconi Co. would be signed in two weeks or a month, a settlement with regard to the working of a new Post Office station has not yet been reached, writes a "Daily Telegraph" correspondent. The Post Office, he states, have introduced new conditions that the Marconi Co. cannot accept, and the only way out of the *impassé* is to refer the whole subject to the Imperial Economic Conference, which will be held in a week's time. Australia, Canada and South Africa, who have entered into contracts with the Marconi Co. for all Empire services, will want to know why these contracts are not fulfilled. The contract with the Australian Government contains clauses which enable it to take a hand in the negotiations with the Post Office. The Australian station for communicating direct with England and Canada was planned a year ago, and is in course of erection.

New Broadcasting Stations.

Negotiations are reported to be proceeeding in the Irish Free State for the formation of a broadcasting company. The company, which is to have a capital of £30 000, has promised to build a broadcasting station in Dublin, with possibly relay stations at Cork and Limerick.

As previously announced, the British Broadcasting Co. will open a new station at Aberdeen on October 10th, the call being 2BD and the wave length 300 metres, and on October 17th a new station at Bournemouth, with a call of 6BM and a wave length of 410 metres.

Wireless Trade Slump in the U.S.A.

An American correspondent of the "Daily Mail" states that fully 45 per cent. of the American broadcasting stations have closed down for an indefinite period. The reason given for this "slump" is that of lack of funds and insufficient returns for the expense involved. It must be remembered, however, that these stations are all separately controlled by individual firms for individual publicity purposes and broadcasting is not organised by one company. Owing to the wireless trade "slump" in the United States and certain other countries, it seems probable, he states, that a considerable number of agencies in this country for foreign firms will be opened, and that considerable stocks of "overflow" foreign apparatus will tend to flood the English market in the near future. Some pieces of cheap foreign apparatus are admittedly quite good, but, for the most part, even foreign competitors admit that the quality of British wireless goods is unsurpassable.

Future of Clifden Wireless Station.

Negotiations are in progress at present between the Free State Government and the Marconi Co. in regard to the future of the wireless station at Clifden, which was destroyed by the Irregulars last year. According to "The Times," the Free State Postmaster-General apparently is anxious that the station shall be rebuilt, and is willing to give a guarantee that all Free State wireless traffic shall pass through Clifden; but as a *quid pro quo* he asks that Free State postal officials shall be employed by the company. The Marconi Co. it is understood, is willing to rebuild the wireless station, but will not promise to employ Free State Civil servants, and the future of the station seems to depend on Mr. Walsh's readiness to waive his demand.

Wireless News in Brief.

From a newspaper advertisement: "For sale, wireless set in brand new condition; or would exchange for something useful."

Only six of thirteen persons who held licences for wireless concerts on licensed premises in Birmingham have applied for their renewal.

To-day (Friday) the British Broadcasting Co. publishes the first number of "The Radio Times." The new publication will contain a detailed programme for the coming week of all the company's stations. It will in no way compete with existing wireless publications.

It is rumoured that the Broadcasting Committee's Report together with a memorandum by the Postmaster-General will be considered by the Government this week end. It is also suggested that the memorandum will contain several important modifications of the Committee's recommendations.

American Electro-Chemical Society.

Discussions at the Autumn Meeting.

The 44th autumn meeting of the American Electro-Chemical Society was to have opened yesterday (Thursday) at Dayton, Ohio, for three days. With Dr. Duncan MacRae, of the Westinghouse Lamp Co. in the chair the programme includes a symposium on the "Electro-Chemistry of Gaseous Conduction," and informal discussions on "Electric Furnace Brass Foundry Practice," "The Development and Future of Electro Deposition"; "Organic Electro-Chemistry"; and "The Utilisation of Chlorine."

Philadelphia has been chosen for the Spring meeting to be held from April 24th to 26th. The two symposia definitely decided on for this meeting are "Organic Electro-Chemistry" and "Recent Progress in Electrolytic Refining."

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Electricity Supply.

Extensions and Developments.

WORTHING has invited tenders for the building operations in connection with the extension of the electricity works.

NELSON Electricity Committee proposes to spend £24 000 on a new 6 000 kW turbo-generator, in preparation for the winter of 1924.

Tullamore Electric Light and Power Co. has offered to light TULLAMORE for £315 per annum. The Urban Council has offered £300.

WALSALL CORPORATION has allocated £2 000 for working capital in connection with the hiring out of electric motors, cooking and heating apparatus. Current for heating and cooking is supplied at 1½d. per kWh.

DONCASTER Corporation has applied to the Electricity Commissioners for a loan of £3 808 for mains, services and meters in connection with the supply to the Bentley Housing Estate, and for £2 400 for street lighting.

NORTH HEATON is to be given an extended supply of electricity to meet the needs of its growing population. The Newcastle-upon-Tyne Electric Supply Co. has had a new sub-station erected in Chillingham Road, and additional cables are being laid in the district by British Insulated and Helsby Cables, Ltd.

HACKNEY Electricity Committee recommends that the borough electrical engineer be asked to prepare a detailed electricity scheme for the borough comprising the laying of distributing cables on at least one side of each street in the borough where there are no cables at present, and lamp service and lamp-post equipment for all existing gas lamps.

Tapping New Areas.

CORSHAM Parish Council is raising no objection to a proposal of Sidney and Ellis, of Bath, to supply the town and district with electricity.

FORDINGBRIDGE Rural Council is considering the proposal of a Wareham firm of electrical engineers for an electric lighting scheme for Fordingbridge.

The AYLESBURY Council is in communication with the Thame, Haddenham, Tring, and Wendover Councils with regard to extension of the electricity mains to those places.

TETBURY Urban Council has decided to support an application by the Western Electric Distributing Corporation for a special Order enabling it to supply electricity in the town.

SHOREHAM Urban Council has complained that the promoters of the electricity supply scheme heve taken no practical steps to supply the district, and the Council has asked the Electricity Commissioners' advice.

Alterations in Charges. Proposed and Actual.

WALLASEY electricity department is reducing its charges for electricity from 6d. to 5½d. per kWh in the case of lighting and from 2d. to 1½d. for heating. The new tariff comes into operation on October 1st.

DUBLIN Corporation has decided to reduce its charges for current for lighting by 1d. per kWh and for power, heating and public lighting by ½d. These reductions are expected to reduce the year's surplus by £30 000.

The North Metropolitan Electric Power Supply Co. has informed the HATFIELD Rural Council that application is being made for authority to charge 10d. per kWh for electricity instead of 7d., the maximum authorised in 1907. The Council has decided not to oppose the application.

WIMBLEDON Electricity Committee has passed the following tariff reductions, subject to the confirmation of the Council, to take effect from the end of September: general lighting, from 6d. to 5½d. per kWh; basement and cellar lighting, from 6d. to 4d.; cooking and heating, formerly 1d. per kWh during the summer months and 1½d. during the winter months, reduced to 1d. per kWh the whole year round; power supply, reductions in the sliding scale from 2d. to 1½d. per kWh; and street lighting, from 3d. to 2½d. per kWh. The estimated cost of these reductions over the next six months is £6 220. These reductions are in addition to those granted in March last, which amounted to £10 736.

Inquiries and Orders.

As the result of an inquiry held last February into the application of the Newport (Isle of Wight) Electric Light Co. for an order to increase the maximum prices for electricity, the Ministry of Transport has issued an order, the effect of which is to renew the current prices.

On the application of the Strathclyde Electricity Supply Co., the Electricity Commission has made the Eastwood and CATHCART ELECTRICITY (EXTENSION) SPECIAL ORDER, and copies of the Order (2s. each) can be obtained from Beveridge and Co., 23, Abingdon Street, London, S.W.1.

Miscellaneous Supply Items.

CARLISLE Board of Guardians is considering the question of lighting the Hospital, Institution and Nurses' Home electrically.

At EDINBURGH a sub-committee has considered the desirability of arranging for one set of collectors to collect city rates, water rates and electricity accounts.

The Electricity Commissioners have made an Order authorising Electrical Distribution of Yorkshire, Ltd., to supply electricity in GUISELEY AND YEADON urban districts. The maximum charge allowed is 10d. per kWh, with minimum charges of 12s. 6d. for each winter quarter and 8s. 4d. for each summer quarter.

Development of Electro-Farming.

Reducing Agricultural Production Costs.

The applications of electricity to farming were discussed last week by the Rotary Club of Oxted and Limpsfield, when Mr. R. BORLASE MATTHEWS reviewed the present practical possibilities, and incidentally mentioned that whereas a year ago, only about 200 British farmers were using electricity on their farms, to-day there were well over 400 farms with electrical installations.

165 Farm Uses for Electricity.

He referred to the rapid development that was taking place here in "making hay without sunshine," and curing corn along the lines with which he had been associated. There were now over 165 different known uses for electricity on farms; hence the varied work of the farm could be materially assisted in many ways. Reference was made to the fact that, on the speaker's own 600-acre farm at East Grinstead, the cost of lighting the cow house was more than recouped by the milk that was saved from spilling. Again, by electrically restoring the longer hours of light per day to which the sub-tropical forerunners of poultry were accustomed, twenty per cent. more eggs were obtained in the winter season—at a cost for electricity of the value of one egg per bird.

The address aroused a keen and interested discussion, especially on the part of the farmers who were present. The comments betrayed a more or less general ignorance of the applications of electricity, and one farmer asked whether an electric motor was as simple to operate as an oil engine! It was news to many to hear that the modern squirrel cage alternating current electric motor, had only one revolving part (and no rubbing contacts) running in a simple pair of bearings, and that a "twitch of the switch" was all that was needed to start up an electric motor; the coaxing, which had to to be expended upon an oil engine to get it to start up on a cold morning was conspicuously absent with the electric motor.

Cheapness of Electricity.

In reply to a query as to whether it was worth the while of the farmer to generate his own current if he could not obtain a public supply, it was shown that most farmers who used ordinary methods paid at least 2s. for the equivalent of one electrical unit, for which an ordinary charge for power purposes was 4d. The chief consideration was cost; no farmer would use electricity just because it was electricity, but he would have to use it when he discovered that it paid him to do so. The only difficulty in the way was that the farmer did not fully understand the possibilities of the applications of electricity, and the electrical engineer did not appreciate the problems of the farmer.

Personal Items.

Mr. CHARLES FURNESS, electrical engineer of Blackpool, was judge of the illuminations at Morecambe Carnival last week.

Mr. GEORGE SHILLITO KING, electrical engineer, of Delph Street, Halifax, was married recently to Miss Gwendoline Maud Swire.

Mr. A. H. GROCOTT, who has been secretary to Ashby, Warner and Co., Lee Conservancy Road, Homerton, since its incorporation, has now been elected to a seat on the board of directors.

Mr. A. HUGH SEABROOK, consulting engineer, 146, Bishopsgate, London, E.C.2, has changed his private address to Wyllyatts Manor, Potters Bar, Middlesex. Telephone, Potters Bar 100.

The marriage was solemnised at Birkenhead last week between Mr. HAROLD GREENAWAY TRACE, manager of W. H. Trace and Son, electrical engineers, and Miss Ethel F. Griffith, of Birkenhead.

Mr. GEORGE ARROWSMITH has joined the staff of Hick, Hargreaves and Co., Bolton, as chief turbine designer and manager of their new steam turbine department. Mr. Arrowsmith was previously chief assistant turbine designer to the English Electric Co., at Rugby, for many years, and is well known as an authority on steam turbine design and manufacture.

Mr. SAMUEL CARLILE, who has been in the tramway department of the Belfast Corporation for twenty-three years, has been appointed manager in succession to Mr. J. D. S. Moffett, who has been appointed to a similar position at Salford. There were twenty-one applicants for the position.

Obituary.

Mr. David Graham.

The death occurred at Ros Mhor, Ardnadam, last week, of Mr. DAVID GRAHAM, who was responsible for the introduction of the first commercial telephone system into Glasgow. Mr. Graham, who was in his 75th year, was trained as a bellhanger, but early in his career he took up electrical engineering, and afterwards established a telephone system with an exchange in the vicinity of Sauchiehall Street. This was the first public telephone system in the city. When the National Telephone Co. commenced business in Glasgow they took over the system. Mr. Graham retired from business in 1891.

Mr. J. A. Phillips.

We regret to record the death, which took place on September 23rd, of MR. JAMES ALEXANDER PHILLIPS, manager of the Supply Department of the British Thomson-Houston Co., Rugby, with which company he had been associated for nearly 25 years. The funeral was arranged to take place yesterday (Thursday) at Mliverton Cemetery, Leamington.

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Tenders Invited and Accepted.

GREAT BRITAIN.

SWINTON AND PENDLEBURY URBAN DISTRICT COUNCIL, September 29th.—300 kW rotary converter, with switchgear. Specification (£1 1s., returnable) from Mr. H. C. Busbridge, electrical engineer, Council Offices, Swinton, Lancs.

BRAMLEY GUARDIANS, October 1st.—Preparation of specification and carrying out work of electric light wiring and fitting at Poor Law Institution, Armley, Leeds. Offers to the Clerk, 1, Green Hill Road, Hill Top, Armley.

ECCLES CORPORATION, October 1st.—Alteration of electric light wiring at the Public Library. Particulars from the Librarian.

FORMBY URBAN DISTRICT COUNCIL, October 1st.—H.t. feeder cable, l.t. service cables, feeders, meters, switchgear, etc. Specification (£1 1s.) from the Clerk.

COMMISSIONERS OF H.M. WORKS, ETC., October 2nd.—Two air-washing machines, with pumps, motors, etc., at the Imperial College of Science, South Kensington. Specification (£1 1s.) from the Contracts Branch, King Charles Street, Westminster, S.W.1.

MERSEY RAILWAY CO., October 5th.—Electrical sundries (item No. 10), metallic and carbon filament lamps and fittings (No. 13), etc. Tender forms from the General Manager, Central Station, Birkenhead.

CHEADLE AND GATLEY URBAN DISTRICT COUNCIL, October 8th.—Sub-station switchgear (Contract No. 9). Specification (£3 3s., returnable) from Mr. C. H. Wordingham, 7, Victoria Street, Westminster, S.W.1, and 33, Brazennose Street, Manchester.

ISLINGTON (LONDON) BOROUGH COUNCIL, October 8th.—Two batteries for 3½ ton "Orwell" and 3½ ton "Edison" dust-collecting vehicles. Particulars from the Superintendent, Cleansing Department, Liverpool Road, London, N.1.

BARKING URBAN DISTRICT COUNCIL, October 9th.—Rails, fish-plates and bolts, and permanent way construction in connection with the laying of about 2 000 yards of single track light railway. Specification from Council's Surveyor.

WALSALL CORPORATION, October 10th.—Two boiler units, with superheaters, superimposed economisers, steel chimneys, feed pump, pipework and auxiliaries. Specification (£5 5s.) from Mr. E. M. Lacey, 12, Victoria Street, London, S.W.1.

BUSHEY URBAN COUNCIL, October 11th.—Wiring and fitting the Council Offices for electric lighting. Tender forms from the surveyor, Mr. E. E. Ryder.

LONDON COUNTY COUNCIL, October 15th.—Single and double pole track and test panels. Specification (£2, returnable) from the General Manager, Tramways Department, Victoria Embankment, W.C.2.

COUNTY OF LONDON ELECTRIC SUPPLY COMPANY, October 22nd.—Tunnel under the river Thames, in connection with Barking power station. Specification, etc. (£15 15s., returnable) from Sir Alexander Gibb and Partners, Queen Anne's Lodge, London, S.W.1.

FALMOUTH GUARDIANS, October 15th.—Electric light wiring and fitting at Poor Law Institution. Specification (£1 1s., returnable) from the Clerk, Town Hall, Falmouth.

SUNDERLAND GUARDIANS, October 15th.—Electrical work at the Guardians' Institution, Cottage Homes and Havelock Tower, Hylton Road, Sunderland, including: Contract (A) static transformer, main switchboard and distribution mains; (B) well motor drive; (C) wiring central area; (D) wiring specified blocks; (E) wiring East block; (F) motors and coupling up same. Specification for the six contracts (£1, returnable) from the Guardians' Offices, 17, John Street, Sunderland.

AUSTRALIA.

SYDNEY CITY COUNCIL, December 3rd.*—H.t. feeder and pilot cables.

NEW ZEALAND.

PUBLIC WORKS DEPARTMENT, WELLINGTON, N.Z., November 20th.*—Portable testing instrument for Mangahao power plant.

SOUTH AFRICA.

JOHANNESBURG CORPORATION, November 1st.*—8 000 traction lamps.

The tender of Babcock and Wilcox for three electric cranes £7 717, has been accepted by NEWCASTLE-ON-TYNE CORPORATION.

GRAYS URBAN DISTRICT COUNCIL has accepted the tender of the Metropolitan-Vickers Electrical Co. for converter plant, £4 922.

HIGH WYCOMBE Corporation has accepted the tender of E. Milner for an electric motor to drive a scrap metal press, at £64 10s.

CANTERBURY BOARD OF GUARDIANS has accepted the tender of E. J. Philpott, Ltd., for electric light wiring at the Infirmary, £137 10s.

The tender of Mr. Ascroft has been accepted for electric light wiring, etc., at the PRIMITIVE METHODIST CHURCH, PITTINGTON, co. Durham.

A contract for the electrical equipment of three 1 200 ton submarines for the FRENCH NAVY has been placed with the Compagnie Générale Electrique de Nancy.

The tenders of W. T. Henley's Telegraph Works Co., £1 066, and the Enfield Ediswan Cable Co., £553 7s., for cable, have been accepted by LEEDS CORPORATION.

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* Particulars from the Department of Overseas Trade.

Miscellaneous.

ELECTRICALLY-HEATED CLOTHING will be worn by the crew of the American airship which is to make an attempt to reach the North Pole.

ELECTRICAL INSTALLATIONS, LTD., have been appointed electrical contractors at the Industrial and Machinery Hall at the British Empire Exhibition.

A Londoner who has returned from a holiday in Italy states that while there he never saw a dwelling, from palace to slum, that did not possess ELECTRIC LIGHT.

During the June quarter the FEDERATED MALAY STATES imported United Kingdom telegraph, telephone, tramway and railway material to the value of $91,807.

We understand that A LOCAL EXHIBITION is to be held in Walsall from November 5th to 10th, and that considerable space will be occupied by the electricity undertaking's exhibit.

The RESTORATION OF PATENT No. 148 380, dated July 17th, 1916, and granted to Albert Van Tuyl Day for "Improvements in or relating to high-frequency signalling," is announced.

A means of AGEING WINE BY ELECTRICITY is said to have been discovered by a French professor who claims to be able to make fresh wine twenty years "old" in a few hours by his process.

A fusion of the ELECTRICAL TRADES UNION with the National Amalgamated Union of Enginemen, Firemen, Motor Mechanics, and Electrical Workers is to be balloted on during next month.

NEW SOUTH WALES imports from Germany during June were valued at £38 862, compared with £32 246 in May and £22 562 in April. German dynamos of the value of £641 were imported in June.

The CANADIAN ENGINEERING STANDARDS ASSOCIATION, which has already issued standard specifications for distribution type transformers, and galvanised telegraph and telephone wire, is now working on watt-hour meters, and wood poles for transmission lines.

The "La Paya," the first to be completed of THREE ELECTRICALLY PROPELLED VESSELS built for the United Fruit Co., of Boston, Mass., has carried out successful trials on the Clyde. The electrical equipment was supplied by the British Thomson-Houston Co., and the wiring, switchboard, and auxiliary motors by the Sunderland Forge Co.

To enable senior members of the staff to meet residents of Slough, to which the works have recently been moved from Warrington, the ST. HELEN'S CABLE CO. invited a company of 120 to a whist drive and dance, those present including the foremen and some of the head girls and their friends, and members and officials of the Slough Urban District Council.

As a result of the appeal for the BRITISH EMPIRE CANCER CAMPAIGN nearly £55,000 has now reached the offices of the British Red Cross Society at 19, Berkeley Street, London, W.1. Voluntary workers are urgently needed to help forward the collection of the large sum of money required. Collecting cards, books of stamps and leaflets may be obtained from the British Red Cross Society to the chairman of which Society subscriptions may be sent.

Assistance for Overseas Buyers.

A Helpful Export Catalogue.

Compiled with a view to rendering the utmost assistance to the overseas buyer, a new export catalogue of "Osram" lamps just issued by the GENERAL ELECTRIC CO., Magnet House, Kingsway, marks a useful development in sales literature. The first few pages are occupied with concisely-stated conditions of sale, followed by standard shipping specifications detailing net and gross weights, sizes, etc. Particulars and illustrations of the standard method of packing follow, whilst another useful page is that devoted to full-size illustrations of lamp caps.

The catalogue proper gives dimensions and complete particulars of all standard Osram lamps, the gasfilled section including street-lighting types, "daylight" projector, and the new sprayed "White Osram" lamps; and it is worthy of note that all Osram gasfilled lamps are now made without that most vulnerable point of electric lamp bulbs, the "pip." In the vacuum section are shown, apart from the standard types, traction lamps, ship type, candle, striplite, tubular, axial, and sign-type lamps, whilst further pages give details of Osram automobile lamps, the "Osglim" with a current consumption of 5 W, and colour caps and hoods for obviating the use of expensive coloured glass lamps. Robertson carbon filament lamps, both of the standard and the radiator type, and colour illustrations of free publicity matter conclude a useful and interesting booklet, copies of which can be obtained upon application to the G.E.C. at Magnet House, or any of the company's branches.

Electrical Development of East Anglia.

An Extensive Rural Scheme in Contemplation.

A London financial group has obtained control of EAST ANGLIAN ELECTRICITY, LTD., with a view to developing it on much broader lines. Mr. A. Hugh Seabrook, of Sir Charles Bright and Partners, Ltd., consulting engineers to the company, has prepared an extensive scheme for the electrical development of rural East Anglia, which promises to be something quite new in this country. The company has secured the services of Mr. B. G. Drummond as general manager, whose headquarters in the meantime will be at Felixstowe. Mr. Drummond has been manager and resident engineer to the Hendon Electric Supply Co. since its inception 16 years ago.

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Companies' Reports, Dividends, etc.

BRITISH ALUMINIUM CO.—Announcement is made of a dividend on the ordinary shares at the rate of 5 per cent. per annum, less tax, for the six months ended June 30th last, payable on October 1st.

Supply and Lighting.

SHAWINIGAN WATER AND POWER CO.—A dividend of 1¾ per cent. has been declared for the quarter ending September 30th, payable on October 10th to shareholders of record September 27th.

LANCASHIRE ELECTRIC LIGHT AND POWER CO.—The directors have declared a dividend at the rate of 7 per cent. per annum for the half year ending September 30th, less tax, on the 7 per cent. cumulative participating preference shares.

PACIFIC GAS AND ELECTRIC CO.—The London office of the National City Co. announces that its head office in New York is offering $10 000 000 Pacific Gas and Electric first and refunding mortgage five and a-half per cent. bonds, due 1952, series "C," at the price of 95½ and interest New York terms.

ELECTRIC SUPPLY CORPORATION.—The directors announce an interim dividend at the rate of 7 per cent. per annum, less tax, on the company's ordinary shares for the half year ended June 30th last, payable on September 26th. The dividend paid for the corresponding period of 1922 was at the rate of 6 per cent. per annum.

MIDLAND ELECTRIC CORPORATION FOR POWER DISTRIBUTION.—It is announced that the transfer books will be closed from October 1st to 13th for preparing dividend warrants on the preference shares at the rate of 7 per cent. per annum (less tax) for the six months ending October 15th, and on the ordinary shares at the rate of 10 per cent. per annum (less tax) for the six months ended June 30th last. Cheques will be posted on October 13th.

BARCELONA TRACTION LIGHT AND POWER CO.—Speaking at the annual meeting in Canada on September 18th, Mr. E. R. PEACOCK said the net earnings for the first half of the current year showed a satisfactory increase; being 14 402 939 pesetas, against 13 687 012 pesetas last year. He referred to the acquisition by an allied company of the control of the Energia Electrica de Cataluna, S.A., the chief rival in Barcelona, which would hereafter work in close co-operation with their own operating companies. He expected substantial advantages would accrue to both companies from this arrangement. The increasing and rather arbitrary taxes continued a cause for anxiety, but apart from the exchange question, regarding which no man could safely prophesy, he would describe the outlook as distinctly encouraging.

£50 000 Advance to Brisbane Tramways.

BRISBANE TRAMWAY CO.—With respect to an advance of £50 000 against interest that has been made to the Brisbane Tramway Co. by the Brisbane Tramways Trust, Mr. Fihelly, Agent-General for Queensland, has been asked by the trust to state that the conditions of advance, among other things, made it clear that the payment was entirely without prejudice to the position of the trust, and was not to operate or to be used in any way as an admission or as an indication of what purchase money would be, and that it was not to be considered as payment of interest for any specific period.

Cable, Telegraph and Telephone Companies.

DIRECT WEST INDIA CABLE CO.—The report for the year ended June 30th last shows a credit balance of £9 701 against £15 965 for the previous year. The balance brought forward is £108 391, making a total of £118 093. Deducting £4 588 expended on repairs, £3 000 interim dividend, £3 930 loss on the sale of American investments, and £80 000 transferred to renewals and general reserve, there remains £26 574. The directors propose to pay a further dividend of 5 per cent., free of tax, making 10 per cent. for the year, carrying forward £23 574 subject to corporation profit tax.

HALIFAX AND BERMUDAS CABLE CO.—As the result of the year's working there was at June 30th last a credit balance of £22 593, as compared with £6 877 for the previous year. The balance to credit of revenue account brought forward from last year is £63 442, and with the above £22 593 makes a total of £86 035. Deducting £395 expended on repairs, £1 500 interim dividend of 3 per cent., free of income tax, paid in March last, £1 343 loss on sale of American investments and £50 000 transferred to renewal and general reserve, there remains to be dealt with £32 797. Of this sum the directors propose to distribute a further dividend of 3 per cent., free of income tax, making the total distribution for the year 6 per cent. This will absorb £1 500, leaving to be carried forward £31 297 subject to corporation profits tax.

New Company.

P. E. BANTING, LTD.—Private. Cap., £1 000 in £1 shares. Manufacturers, agents, buyers, sellers and dealers in all articles, required and used in connection with electrical engineering, etc. Reg. office: 17, Victoria Street, London, S.W.1.

Midland Electrical Engineers' Ball.

It has been decided to hold the Midland Electrical Engineers' ball this season at the Grosvenor Suite, Grand Hotel, Birmingham, on Friday, December 14th next. Mr. R. A. Chattock will again act as chairman, and Messrs. N. A. Collard, Daimler House, Paradise Street, Birmingham, and W. Y. Anderson, 14, Dale End, Birmingham, are joint honorary secretaries. Jack Hylton and his London Dance Orchestra will be in attendance. Tickets are one guinea each, and may be obtained from any of the above-mentioned officials.

Institution Notes.

THE LIVERPOOL ENGINEERING SOCIETY has changed its address to 9, The Temple, Dale Street, Liverpool.

The INSTITUTE OF COST AND WORKS ACCOUNTANTS has removed to 6, Duke Street, St. James, London, S.W.1. The telephone number is "Regent 5407."

The annual festival of the ELECTRICAL TRADES BENEVOLENT INSTITUTION will be held on November 14th, when a dinner will be held at the Trocadero Restaurant. Sir Phillip Nash has consented to be president of the festival this year, and it is to be hoped that he will receive the hearty support of members of the electrical industry by their contributions to the funds as well as by their presence at the dinner.

The next meeting of the BRITISH ASSOCIATION is to be held in Toronto from September 3rd to 10th, under the Presidency of Major-General Sir David Bruce. It is also contemplated to have a trip across Canada to Vancouver before the meeting, and possibly also to Prince Rupert and Victoria. Already the railway companies have promised cheap travelling facilities, and the total cost of the Western trip and the meeting is estimated at £120, or £70 for the meeting only. For 1925 an invitation has been received to hold the meeting in Southampton. There was no report this year from the Fuel Economy Committee, and we understand that the Committee is no longer in existence.

Payment by Results.

Need of Cheaper Production Emphasised.

Many of our readers have followed the discussion on "Payment by Results," inaugurated in "The Times" recently by Mr. P. J. PYBUS, managing director of the English Electric Co. In a further article in our contemporary, Mr. Pybus draws together the threads of the discussion which ensued and emphasises the need of cheaper production.

He states that the one fundamental fact which British industry has to face is that for the greater part of our products there is a maximum attainable world price, subject to slight variations for quality, but otherwise determined by factors beyond our control. If we have prospered in the past, it is because we have produced goods not inferior in quality at a price not higher than the world price. If we are to prosper in the future, if we are even to survive as an industrial nation, it can only be on the same condition. We may discuss the need for benevolence or the virtues of profit-sharing till the heavens fall, but we cannot thereby create any immunity from the constant pressure of that limiting fact or ensure that those who see it in a false perspective will have any profits left to share.

To avoid the possibility of a dishonest employer evading a piece-work bargain, Mr. Pybus proposes that Joint District Tribunals should be established and should be invested with powers comparable to those of a County Court to enforce the sanctity of contracts.

Referring, in conclusion, to the labour situation, Mr. Pybus expresses the opinion that the wilder and more extreme elements of the Labour movement are being rejected by the great mass of working people, and as a result there is a closing-up of the breach between the employer and his workmen to meet the common menace of unemployment and general world conditions.

Prices of Metals, Chemicals, etc.

TUESDAY, September 25.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£66 0 0	—	—
Electro Wirebars	„	£68 5 0	—	5s.
H.C. Wire, basis	per lb.	9 13/16d.	—	—
Sheet	„	10 1/16d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 1 13/16d.	—	—
Brass 60/40—				
Rod, basis	„	7½d.	—	—
Sheet, basis	„	10d.	—	—
Wire, basis	„	10½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 2 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
Lead Pig—				
English	„	£27 0 0	—	—
Foreign or Colonial	„	£25 12 6	—	—
Tin—				
Ingot	„	£202 12 6	£8 17 6	—
Wire, basis	per lb.	2s. 8d.	1d.	—
Aluminium Ingots	per ton	£115 0 0	—	£5 0 0
Spelter	„	£33 15 0	17s. 6d.	—
Mercury	per bottle	£8 17 6	12s. 6d.	—

Sulphur (Flowers)—Ton £8 10s. *Sodium Chlorate*—Per lb. 2½d.
„ (Roll-Brimstone)—„ £8 10s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. „ £25 10s. per ton, £7 10s.
Boric Acid (Crystals). „ £48 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 3½d.; plantation 1st latex, 1s. 3½d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

GOODFELLOW. Mr. E. C., 28, High Street, Highgate, electrical engineer. £19 17s. 4d. August 15th.

GUMMERSON, C. F., 45, Station Road, Whitley Bay, electrical contractor. £14 0s. 11d. August 14th.

INDUSTRIAL ELECTRICAL, LTD., registered office, 10, Southwark Bridge Road, S.E., electrical engineers. £12 18s. 4d. August 21st.

JOHNSTONE, Thomas, 29, Lowther Street, Whitehaven, electrical contractor. £14 5s. 1d. August 14th.

MARTIN, Arthur, 16, Southgate Street, Leicester, electrical contractor. £16 12s. 2d. May 29th.

ROBINSON, Mr., 79, Cemetery Road, Porth, wireless agent. £22 7s. 8d. August 4th.

SAMUEL, C., AND SON, 56, Long Lane, West Smithfield, wireless specialists. £16 13s. August 8th.

Deeds of Arrangement.

BERRY, James Harry, trading as BILL AND BERRY, 18 to 26, Constitution Hill, Birmingham, Electrical Engineers (see last week's ELECTRICIAN) the following are creditors: Bonnella Brothers, £56; Cooke and Segal, £21; Electric Supply Co., £26; General Accessories Co., Ltd., £38; Grimston, Pritchard and Plutte, £53; Hawkins, L. G. and Co., Ltd., £22; Leach, S. G. and Co., £20; London Commercial Electric Stores, £22; Standard Metals Co., £84; Z. Electric Co., £140; Credenda Conduits Co., £23; Barwell, J. and Sons and Co., £37; Bill and Co., Ltd., £63; Clifford Bros., Ltd., £33; Cressall Manufacturing Co., £25; Electric and Ordnance Accessories Co., Ltd., £127; Falk Stadelmann and Co., £32; General Electric Co. (goods account), £73; General Electric Co. (lamps account), £433; Griffin and Co., £39; Kersons Manufacturing Co., Ltd., £106; Midland Electrical Manufacturing Co., £36; Reeves and Co., £94; Sperryn and Co., £36; Triumph Electric Co., £29; Vincents Switch Gear Co., £61; Wilkins and Wright, Ltd., £38; Mackintosh Cable Co., £930; Scupham and Wood, £43; Parkinson, F. and A., Ltd., £29; Blackwell, F. C. and Co., Liverpool, £155; Berry, James, Manchester, £120; British Thomson-Houston Co., £323; Cable Accessories Co., £168; Parsons, C. H., Ltd., Tyseley, £35.

McMILLEN George Hutton, trading as SHIRE ARC WELDING CO., 105, Wells Road, Nottingham. Filed September 18th, Trustee, F. A. Prior, Pelham House, Pelham Street, Nottingham, I.A. Liabilities unsecured, £1 857; assets, less secured claims, £1 479.

Receiverships.

AERADIO, LTD. (formerly H. Stanley Prince, Ltd.). W. Williams, of 59, Chancery Lane, W.C.2, was appointed receiver on September 12th, 1923, under powers contained in debentures dated December 7th, 1922, and February 3rd, 1923.

IRRADIANT LAMP WORKS, LTD.—H. Wrette-Smith, of 69 and 70, Broad Street Avenue, E.C., was appointed receiver on September 1st, under powers contained in debenture dated January 29th, 1923.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Winding-up Petition.

DONALD-BEAN INSULATORS AND ENGINEERS, LTD. A petition for the compulsory winding-up of this company has been presented to the Court by William Mathieson Donald, iron and steel merchant, 30, Gordon Street, Glasgow. (Edinburgh Gazette.)

Company Winding-Up Voluntarily.

DE MARTIS ACCUMULATORS, LTD. Charles Allbrook Frith, 70, Lombard Street, London, E.C., appointed liquidator. Meeting of creditors, 70, Lombard Street, London, E.C., on Wednesday, October 3rd, at 11 a.m.

Notices of Intended Dividends.

VIVIAN, Albert, 180, Gray's Inn Road, W.C., electrical engineer. Last day for receiving proofs, October 4th. Trustee, D. Williams, Official Receiver, Bankruptcy Buildings, Carey Street, London, W.C.2.

WEEKS, William Edward, 59, Victoria Street, and 12, Filton Avenue, Horfield, Bristol, wholesale electric dealer. Last day for receiving proofs, October 2. Trustee, J. P. Emett, 18, Nicholas Street, Bristol.

Patent Record.

APPLICATIONS FOR PATENTS.

September 10th.

22 647 N. WILLIAMS. Metal sunk switch boxes.
22 650 J. P. TROUP and H. WALKER. Tramway points control.
22 651 and 22 652 J. A. CRABTREE. Electric switches.
22 656 H. M. LUCY. Wireless aerials.
22 670 R. J. WY HEATH. Thermionic valve holders.
22 672 UNDERWOOD (MANCHESTER), LTD., and W. G. UNDERWOOD. Globe-supporting galleries for electric light fittings.
22 691 WESTERN ELECTRIC CO. Signalling systems.
22 694 R. H. WAPPLER. X-ray shield.
22 707 GENERAL ELECTRIC CO., LTD., and C. HIGGINS. Incandescent lamps.
22 730 BRITISH THOMSON-HOUSTON CO., A. P. YOUNG and L. GRIFFITHS. Magneto-electric machines.
22 731 F. J. CHAMBERS. Electromagnetic wave receiving and amplifying systems.
22 732 METROPOLITAN-VICKERS ELECTRIC CO., W. J. BROWN and E. Y. ROBINSON. Protection of h.t. currents by means of induction coils.
22 735 G. GMUR ET CIE and G. GMUR. Observing and recording changes in currents and in magnetic fields.
22 743 MORLEY AND IMPEY and A. G. RENDALL. Reflectors.
22 747 EDISON SWAN ELECTRIC CO., F. A. GOULDING and C. E. HIATT. Thermionic valves.
22 752 H. G. WAITE. Radio receiving sets. (11/9/22 France.)

September 11th.

22 773 G. G. J. YVON. Instrument groups for observation of illuminants, absorption and diffusion. (2/10/22 France.)
22 781 F. N. DAVIDSON and E. D. G. MILSOM. Electric lamps for surgical purposes.
22 786 A. WILKINSON, J. F. ATHERTON and C. SEYMOUR. Leadergear cable apparatus.
22 795 J. B. LANGLEY and J. R. SPINK. Coil-holders for wireless telegraphy.
22 799 A. V. TOMLINSON (WESTINGHOUSE AIR BRAKE CO.). Electric couplings for railway vehicles.
22 802 WESTERN ELECTRIC CO. (DEAKIN). Telephone exchange systems.
22 803 METROPOLITAN-VICKERS ELECTRICAL CO. Electric cells. (27/9/22 U.S.)
22 811 RELAY AUTOMATIC TELEPHONE CO. and F. M. WARD. Electric switching apparatus for telephony, etc.
22 812 RELAY AUTOMATIC TELEPHONE CO. and F. M. WARD. Electric selecting apparatus.
22 813 RELAY AUTOMATIC TELEPHONE CO. and F. M. WARD. Electric selecting apparatus.
22 817 W. J. HILLIAR. Electric condensers.
22 819 F. R. MCBERTY. Switching apparatus for telephone exchanges. (6/10/22 U.S.)
22 822 ENGLISH ELECTRIC CO. and T. ZWEIGBERGK. Electro-mechanically operated switch devices.
22 824 A. R. UPWARD. Voltaic cells.

September 12th.

22 869 W. S. WORTHINGTON. Wireless apparatus.
22 892 W. E. BLUNT. Supply of current to magnetic grabs of cranes, etc.
22 898 H. W. DRAKE. Crystal detector.
22 899 W. S. WORTHINGTON. Mounting fixed condensers and resistances for wireless circuits.
22 906 A. S. CACHEMAILLE (WESTINGHOUSE ELECTRIC AND MANUFACTURING CO.). Circuit-breakers, etc.
22 907 METROPOLITAN-VICKERS ELECTRICAL CO. Elastic fluid turbines.
22 913 H. J. HAMPTON. Separators for accumulators.
22 916 SOC. FRANCAISE RADIO-ELECTRIQUE. Wireless transmission of Morse code signals. (13/9/22 France.)
22 919 H. A. H. NIJLAND. Electric switch mechanism.
22 927 AUTOMATIC TELEPHONE MANUFACTURING CO. and C. GILLINGS. Telephone systems.
22 932 BRITISH THOMSON-HOUSTON CO. and A. T. STACE. Head telephone sets, etc.
22 935 H. BARON (ALDENDORFF). Electromechanical telephone switching systems
22 936 A. R. ANGUS. Detection of electromagnetic waves.

September 13th.

22 950 SCOTTISH GRAMOPHONE MANUFACTURING CO. and A. B. CAMPBELL. Electric motors for gramophones, etc.
22 977 BATTERIES, LTD., and M. DYBECK. Boxes for accumulators.
22 982 CIE POUR LA FABRICATION DES COMPTEURS ET MATERIEL D'USINES A GAZ. Wireless signalling systems. (14/10/22 France.)
22 985 P. D. TYERS. Electric signalling.
22 996 F. T. REID. Electric clocks.
22 998 BRITISH THOMSON HOUSTON CO. Electrical discharge devices. (13/9/22 U.S.)
23 000 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electrical discharge devices.
23 020 J. J. RATHBONE. Wireless telephones, etc.
23 021 E. B. ROGERS. Receivers for high-frequency electric signalling.

Arrangements for the Week.

FRIDAY, SEPTEMBER 28th.

BIRMINGHAM AND DISTRICT ELECTRIC CLUB.

7 *p.m.* At the Grand Hotel, Birmingham. Lecture by Major A. M. Taylor on "Underground Cables for High Tension Supply."

MONDAY, OCTOBER 1st.

THE SOCIETY OF ENGINEERS.

5.30 *p.m.* In the Apartments of the Geological Society, Burlington House, London, W. Ordinary meeting.

INSTITUTE OF TRANSPORT.

5.30 *p.m.* In the Lecture Theatre of the Institution of Electrical Engineers, Victoria Embankment, London, W.C.2. Ordinary Meeting. Presidential address by Sir Joseph G. Broodbank.

TUESDAY, OCTOBER 2nd.

ELECTRICAL SOCIETY OF GLASGOW.

7.30 *p.m.* "Wiring of Tenement Property." (Open Night.)

WEDNESDAY, OCTOBER 3rd.

INSTITUTION OF RAILWAY SIGNAL ENGINEERS.

6.30 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, W.C.2. Paper by Mr. W. J. Thorrowgood on "Automatic Telephone Switchboards at Waterloo, Eastleigh and Southampton."

FRIDAY, OCTOBER 5th.

ELECTRICAL POWER ENGINEERS' ASSOCIATION (SOUTHERN DIVISION).

7 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, London, W.C.2. Lecture by Mr. J. S. Atkinson on "Development in Powdered Fuel Firing on Steam Boilers and Metallurgical Furnaces."

The Editorial, Advertisement and Publishing Offices of "THE ELECTRICIAN" are at 8, Bouverie Street, London, E.C.4. Telegrams: Benbrotric, Fleet, London. Telephone: City 9852 (6 lines).

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THE ELECTRICIAN

VOL. XCI.—No. 2368. FRIDAY, OCTOBER 5, 1923. SIXPENCE

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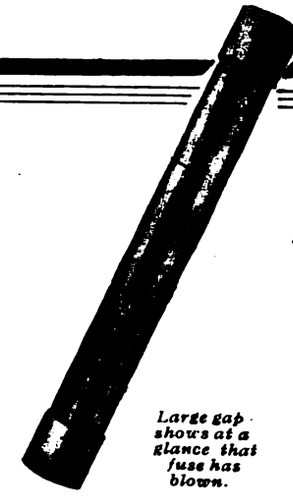

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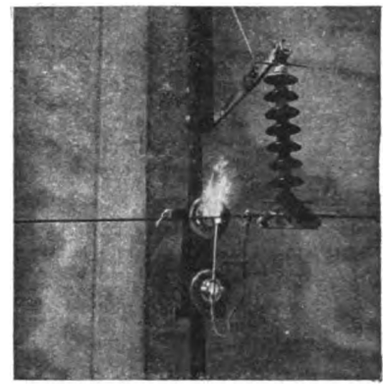

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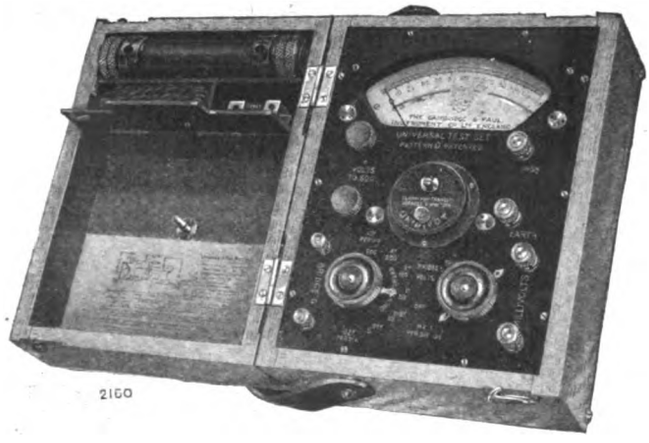

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THE ELECTRICIAN

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THE OLDEST WEEKLY ILLUSTRATED JOURNAL OF

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Notes of the Week.

Illumination and Production.

Recent experiments have shown that to secure increased production from and greater safety for the workers artificial lighting of higher illumination values than those usually employed at present is necessary. This increase carries with it the responsibility of avoiding glare which would make matters worse than they are now; or, in other words, of ensuring that the light is used as efficiently as possible. That illumination can be increased with advantage is evident from some figures given in a Paper on "Glare in Industrial Lighting," read by Dr. G. H. Miles of the National Institution of Industrial Psychology before Section J of the British Association. In one large firm three years' careful test showed that by increasing the illumination from 1·2 to 6·5 foot candles an increased production of 13 per cent. was secured. When the illumination was increased to 9 ft. candles the increased production was 17·9 per cent. and when 14 ft. candles was arranged for the increase was 25·8 per cent.; the increases being in all cases over the original figures. These tests go to support Mr. Bush's dictum that the public requires educating up to the desirability of using more and more light.

Glare and Accidents.

On the other hand the increased illumination carries with it the need for careful shading. Glare, even if it be momentary, cuts down production and exposes the person to great risk of accident. Large variations in light and shade must be eliminated for the same reason owing to the intermittent stimulation of the retina which they cause. This stimulation and its after effects may increase the liability to error by as much as 25 per cent. These are matters which have, of course, also been investigated by illuminating engineers, but Dr. Miles made the useful suggestion that the least ratio between the intensity of the source of illumination and the average light reflected from the surroundings was most suitable for average working conditions. For instance, a room is often better illuminated by a number of comparatively small units than by one larger one, though the aggregate intensity might be less because the ratio of the intensity from any of the light sources to the average intensity received from the surroundings would be less; and the possibility of glare would thus be greatly diminished. We have no doubt that these points are being considered by illuminating engineers and we hope that the result will be that a greater use will be made of the light it is now possible to produce without injury to eyesight or risk of industrial accident. The psychological effect of good lighting is a wide subject; we hope it will be increasingly studied.

Smoke Abatement: A Solution.

Correlated to the subject of better lighting is that of smoke abatement. Artificial lighting will always be necessary, and there are some who argue that owing to its constancy and the ease with which it can be controlled it would be an advantage to use it exclusively for illuminating certain manufacturing processes. But if we succeed in reducing the amount of smoke emitted into the atmosphere, much artificial lighting would be no longer required, and conditions of existence in big towns would become pleasanter and healthier. In any event, electrical engineers need not tremble, for to bring this state of things about more and more electricity will have to be used and therefore what we lose in one way we shall more than gain in another. To bring about an abatement of the smoke nuisance, as Mr. J. B. C. Kershaw suggested rightly in a Paper which he read before Section G of the British Association, education of the factory owners and the community in the scientific principles of combustion is necessary. Propaganda with this end in view was started before the war,

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but is not now being conducted with any vigour; it should be started again. Another matter to which attention should be given is the education of stokers. But apart from all this, research must be conducted to see whether industrial processes which require the use of coal cannot be conducted in some other way. Whether, for instance, steel furnaces could not be heated by producer gas and pottery making conducted on cleaner lines. We need hardly add that in our opinion much more might be done by the use of electric power. This would not only reduce smoke, but would bring to manufacturers other benefits of which they are unconscionably slow to take advantage.

Education and Labour.

ANYONE who considers the net results obtained since education became compulsory in this country some fifty years ago cannot help experiencing a feeling of disappointment. As the writer of that provocative book, "English for the English," points out, the average product of the primary schools cannot write a simple letter, nor can he appreciate the printed word in anything but its lowest form. As was pointed out by another authority the other day, a second effect is to make our children bilingual, one form of speech being used in the school and another in the home, the street and the cinema. It will, therefore, be admitted that matters urgently require improvement if better results are to be obtained, and for that reason we are glad to see that Labour interests are beginning to realise that the movements with which they are concerned need more trained men with that broad outlook which a university education can give. But to complain, as Mr. ARTHUR GREENWOOD did recently, that those interests were not getting a fair share of the resources available, is to put the cart before the horse. The first thing to do is to train the Labour movement to receive higher education. The Universities are quite willing to help, but they can do little or nothing with the present unpromising material.

Equal Educational Opportunity for All.

FROM this point of view the solution lies with the Labour Party themselves. They, like all other political parties, take little or no interest in educational matters. They have great influence, and it could not be exerted in any better way than in insuring that every boy and girl has an equal chance and insuring that educational development is not wilted by bureaucratic ineptitude. In saying this we do not forget that the Labour Party has been investigating the subject of University education, and we hope that the result of their researches will bring forth abundant fruit. At present, however, they seem, as is too often the habit of politicians, to be concerning themselves with matters of detail. The great thing is the broad generality that there should be equal educational opportunity for all. If Labour can bring that about they will have done more for the development of civilisation than by propounding economic doctrines of which we have heard already too much.

Magnetic Fields and Submarine Cables.

TWO papers read by Dr. C. V. DRYSDALE and Mr. S. BUTTERWORTH before a recent meeting of the Physical Society should be of interest to electrical engineers seeing one direction in which electrical development is tending. The authors dealt with "The Distribution of the Magnetic Field and Return Current round a Submarine Cable carrying Alternating Current," and the first of the papers called attention to the importance of an exact knowledge of the magnetic field distribution in the neighbourhood of a submarine cable in connection with leader gear and the propagation of radio signals between submerged stations. Theoretical and experimental investigations on this subject have been carried out since 1918 at the Admiralty Experimental Stations at Parkeston Quay and Shandon, with the object of determining the magnitude and phase of the magnetic field in and above the surface, and of the return current in the water, as well as the velocity of propagation and attenuation of the electromagnetic waves in the water and the shielding effect of the cable armouring. Measurements were made with an alternating current potentiometer on horizontal and vertical search coils above and below the surface and on electrodes in the water at frequencies from 50 to 500 periods per second. The experimental results obtained confirm the values of the velocity of propagation and attenuation derived from theory, and the field distribution above the surface agrees fairly with the theory of Mr. BUTTERWORTH derived from consideration of the water as a conducting lamina.

Expressions for Various Fields.

IN the second part of the paper, contributed by Mr. BUTTERWORTH, expressions for the distribution of electric force due to a long cable carrying alternating currents and immersed in a sea of uniform depth which have been obtained in the form of Fourier integrals are given. From these integrals formulæ have been developed which cover the following cases: The field above the surface of the sea when the depth of the water is small, the field above the sea at large distances from the cable, there being no restriction in regard to depth, the field below the surface of the sea for points vertically above the cable, and the field below the surface of the sea at large distances from the cable when the depth of the sea is great. The results for points above the surface of the sea have been verified by tests in which the sea is replaced by a sheet of lead. The formulæ are also shown to be in substantial agreement with actual sea observations. From the practical point of view it is rather disappointing that more has not been done in using cables for the guidance of ships approaching harbours in fogs or at night. This is a development to which we hope attention will be given, and in working out the problem the authors' researches should prove most useful.

Magnetic Properties of Silver.

SOME years ago the magnetic properties of silver were investigated by Prof. O. E. FRIBOLD, of Christiania, and it was found to be faintly diamagnetic. But the material used on that occasion evidently contained traces of iron, for on repeating these experiments a short time ago it was found that the purest commercial silver gave a higher susceptibility (0·43 by 10^{-6} c.g.s. unit) than before, a figure which changed into $-0·08$ as the field intensity increased from 83 to 4 200 c.g.s. units. When the traces of iron were removed from the commercial metal, however, it showed a constant susceptibility of $-0·017$, which was independent of the field strength and did not change when the silver was fused in atmospheres of either nitrogen or oxygen. These experiments seem to show that silver is faintly diamagnetic and that the previously observed paramagnetism was due to the traces of iron. These traces, further experiments indicate, have a powerful influence when present in the uncombined state and when not forming mixed crystals with the metal. On the other hand, the ferromagnetic influence of iron comes out strongly when the iron is present as unbound metal and this is a point which must be carefully borne in mind.

Trade within the Empire.

ATTENTION is focussed upon the urgent necessity for fostering trade within the Empire by the Imperial Economic Conference which opened its session in London on Tuesday, and the practical problems which have to be dealt with in accomplishing this desirable object are discussed in the final report on inter-Imperial trade issued by the Federation of British Industries. This report merits the careful attention not only of the Conference, but of all British manufacturers and traders. It deals with Customs formalities throughout the Empire, and is therefore concerned rather with points of detail which, in themselves,

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may appear at first sight to be insignificant. A large number of these points, however, represent a distinct source of annoyance and hindrance to traders, and are at the same time comparatively easy of adjustment. Whatever else may be achieved, we share the hope expressed by the Prime Minister on Tuesday that the Conference will not separate before it has agreed upon the first steps to create an ample supply of those raw materials on which the trade of the world depends.

Broadcasting Redivivus.

Much of the uncertainty which has enveloped the future of broadcasting during the last few months will be removed by the two documents which were made public by the POSTMASTER-GENERAL on Monday evening last. One of these was the report of the Broadcasting Committee, which was appointed last April by Sir WILLIAM JOYNSON HICKS, to consider broadcasting in all its aspects, and especially the problem of contracts and licences, and the other was a statement by Sir LAMING WORTHINGTON EVANS outlining a scheme agreed upon by him and the British Broadcasting Company for the conduct of broadcasting between now and the end of 1924. This scheme, which is admittedly a compromise, and as such suffers from the disadvantages inherent in such arrangements, is necessary from the fact that the original agreement between the Post Office and the Company, can, of course, only be altered with the consent of both parties. This not unimportant point seems to be overlooked by the committee.

Some Past History.

To make the new scheme clear it is necessary to recall a certain amount of past history. When the Broadcasting Company was formed just over a year ago it was laid down that listeners-in should pay a fee of ten shillings, and should use only apparatus manufactured by members of the Broadcasting Company and approved by the Postmaster-General. The possibilities that those interested might listen-in without a licence, and might use apparatus that had not been approved, were tacitly ignored, though, as we pointed out at the time, this attitude might lead to trouble. In fact, it did lead to trouble. A large class of listeners-in, who had either made their own apparatus or had bought cheap home-made or foreign equipment, came into being, a class who, fearful of their own temerity, thought it well to enjoy the broadcasting service without troubling to take out a licence. At the time the Committee was appointed these unlicensed listeners-in were estimated to number 200 000, representing in the aggregate a considerable loss of revenue to the Broadcasting Company.

Impossible Operating Conditions.

It was obvious that the Broadcasting Company could not continue to operate under such conditions, and the position was made more complicated by the wholesale granting of experimenters' licences, a policy which meant a further loss to the Company on royalties from the sale of apparatus. Many suggestions were made for improving this unfortunate state of affairs, and we particularly commend to our readers the articles by Sir WILLIAM NOBLE and Mr. F. W. CHALLIS, which appeared in THE ELECTRICIAN for May 4th and April 20th last respectively, as representing the two main opposing views of the situation. Stated briefly, the former put forward arguments for the Broadcasting Company both providing entertainment and selling apparatus, while the latter wished to see the two activities separated.

In commenting on these two articles we supported Mr. CHALLIS'S views on this point, and we are glad to see that the Committee have made recommendations in the same sense. There is, we agree, much to be said on the other side. But though all things are possible, some are not expedient, and the practical difficulties of ensuring that the Broadcasting Company shall obtain a part of their revenue from the sale of apparatus are, as experience has shown, so great that it is better from the points of view both of the provider of entertainment and the user, to adopt other methods.

The New Scheme.

The Committee, therefore, recommend that though the licence fee should remain as at present at 10s., three-quarters instead of one-half of it should go to the Broadcasting Company, that the latter's licence should be extended for a period of two years, and that royalties should be dropped altogether. Unfortunately these recommendations ignore the existing agreement and also ignore the vast band of unauthorised listeners-in. The POSTMASTER-GENERAL has therefore decided, in agreement with the Company, to issue a licence for these people at a fee of 15s., of which 12s. 6d. will go to the Company to compensate them for the loss of royalties, and this licence will have to be purchased before October 15th. The case of those who construct or assemble their own sets is to be met by the issue of a constructor's licence at the same fee. It will be remembered that it was upon this point that the former deadlock occurred. But an important condition is that all the parts are to be British-made. The Broadcasting Company will continue to receive royalties on a reduced scale, and the existing experimenters' licences will remain in force, though we hope that great care will be taken to see that it is only granted to those who can be properly so described.

This arrangement certainly removes many of the difficulties which at present surround broadcasting development, or rather it will remove them if the listening-in public play the game. The Postmaster-General is optimistic that they will do so, and we hope that his optimism will be justified. At the same time, it must be pointed out that it will not be easy to detect the transgressor, though his excuse for transgressing will now be worse than it ever was.

Free Trade in Broadcasting.

It may be said that the whole tendency of the new arrangement is towards greater Free Trade in broadcasting. This is obvious from the hint that competing services may be allowed, in any case after the end of 1924, and before then if the service prove unsatisfactory or the Broadcasting Company is unwilling to erect additional stations if required. It may be necessary to reserve this right, but we hope it will not be exercised. The appointment of an Advisory Board and the restrictions as to profit will prevent the Broadcasting Company from becoming that much-dreaded organisation—a trust. On the other hand, to leave transmission in the hands of one body will prevent much confusion of more than one kind, a state of things which is worth the expenditure of some effort to attain.

The Chance of a Fresh Start.

On the whole, then, the Committee are to be congratulated on their report, and we hope their recommendations will be put in force as soon as practicable. They should certainly form the basis of any further agreement that may be entered into. There is no reason now why manufacturers should not set to work with energy to turn the slump which the uncertainty of the past few months has caused into a boom, and there is the more reason why this should be done in that the winter is a time when the entertainment which broadcasting provides has a peculiar attraction. During their first year of operation the Broadcasting Company have gained a great deal of useful experience in the arrangement of programmes. Both new and old listeners-in need have no fear that this experience will not be utilised to good purpose. The aim of manufacturers of wireless apparatus should be to insure that their experience is put at the disposal of the greatest possible number of persons. Though it would be too optimistic to say that the broadcasting problem is solved, there is no reason to suppose that it cannot be solved if the Company, the manufacturers, and, above all, the listeners-in, each perform their own duties to the best of their ability.

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The Calibration of Oil-Immersed Water-Cooled Standard Low Resistances.

By B. G. CHURCHER (Research Department, Metropolitan-Vickers Co., Ltd.)

In the accurate determination of low resistances or large direct currents, the measurement is made in terms of a standard low resistance. In the best types of standard resistance the resistance material is immersed in oil, and when intended for carrying large currents, water cooling is also provided. If it is desired to determine the unknown resistance or current to a high degree of accuracy, it is, of course, necessary to know the resistance value of the standard to a high degree of accuracy under the particular conditions of the experiment. Neglecting very gradual changes with time—*i.e.*, ageing, the direct-current resistance value of a properly designed standard varies with the temperature of the resistance material only. This temperature is, however, affected by a number of factors, such as surrounding air temperature, the current passing through the standard, the rate of flow and temperature of the cooling water, and so forth. Under ordinary laboratory conditions, these factors will have different values in different experiments. It is obviously impracticable to have the standard calibrated for every condition under which it is likely to be used. The following question, therefore, arises: Under what conditions must the standard be calibrated in order that its resistance value may be accurately ascertainable under any subsequent experimental conditions? This article is an attempt to settle this question, and it is hoped that the conclusions arrived at may be of value to those who use such standards.

Although the proposals put forward can, in general, be applied to any oil-cooled standard resistance, the kind of standard more particularly in mind is the Drysdale-Tinsley type. These instruments consist of concentric manganin cylinders arranged vertically in a case filled with oil. In the larger sizes a water cooling coil is fitted between the outer cylinder and the case. A mechanically-driven stirrer, placed inside the inner cylinder, causes the oil to flow over the surfaces of the manganin cylinders and the cooling coil. The temperature of the oil at a particular point near the manganin cylinders is measured by a thermometer located by means of a suitable pocket.

Conditions under which Standards are Used.

Low resistance standards are used, in general, under two conditions in the course of laboratory work. The first of these conditions arises when a sub-standard low resistance of small current rating is to be calibrated by the double-bridge method. In such cases ample sensitivity (1 part in 100 000) can usually be obtained without using a testing current greater than about 10 per cent. of the rated current of the standard. In this case the heat developed in the standard will be only about 1 per cent of that corresponding to the rated current. The temperature rise will therefore be very small, even if, in the case of water-cooled standards, the water cooling coil is not used. The heat developed being so small, the temperature of the resistance material (e.g., the manganin cylinders) may be assumed to be equal to that of the surrounding oil, provided the mechanical stirrer is used. For such tests, all that it is therefore necessary to know is the relation between the value of the standard and the oil temperature as measured by the thermometer located in a definite position.

The second condition under which a standard is used is when the testing current is not small compared with the rated current. This condition arises when it is desired to test a fairly large sub-standard resistance for change of value with current, or when accurate heavy current measurements are to be made in conjunction with a potentiometer. In these cases the heat developed in the standard will be considerable, and the temperature reached by the resistance material will depend upon a number of factors. These are dealt with in the next section.

Factors Affecting Resistance Value of Standard.

The factors which determine the temperature rise of the resistance material of a standard may be now considered. In what follows it is assumed that the cooling conditions remain constant and that a stationary temperature is attained. Taking the case of a water-cooled resistance with a mechanical oil stirrer, the heat will be carried away (*a*) by the cooling water, (*b*) from the outside casing to the surrounding air. For a given standard working at a given current, the equilibrium temperature reached by the oil will depend upon both (*a*) and (*b*). The effectiveness of (*a*) will depend upon the rate of flow and inlet temperature of the cooling water and the thermal transference and forced circulation of the oil. The effectiveness of (*b*) will depend upon the temperature of the surrounding air and upon the thermal transference and rate of oil circulation.

The temperature rise of the resistance material above the oil for a given current will depend upon (*c*) the thermal transference and speed of circulation of the oil. As we measure the value of the standard in terms of the oil temperature, we have only to consider the factors which influence the rise in temperature of the resistance material above that of the oil. Factors (*a*) and (*b*) do not, therefore, enter directly into the matter. To make the relation between resistance and oil temperature definite we must make the factors under (*c*) definite. The thermal transference depends upon the density, specific heat and viscosity of the oil. It will be important to use an oil, the thermal transference of which does not vary greatly with temperature. The constants of two common oils may be noted.

		Transformer Oil.	Paraffin Oil.
Density		0·86	0·80
Specific heat		0·497	0·457
Viscosity (Redwood)	20 deg. C.	145 secs.	31·5
	30 deg. C.	97 secs.	30·0
	40 deg. C.	71 secs.	29·0

Oil Properties Compared.

It will be seen that there is little to choose in the matter of density and specific heat between the two oils. It is also known that these properties do not vary appreciably with temperature. It will also be seen that not only has paraffin a much lower viscosity, which is good for thermal transference, but its viscosity varies very much less with the temperature than is the case with transformer oil. This means that the temperature drop between the resistance material and the oil will be nearly independent of the oil temperature for a given current and a stirrer speed. The uncertainty due to variation in the stirrer speed can be avoided by stating the speed at the time of calibration of the resistance.

At this point the constancy at which it is necessary to keep the factors affecting the temperature drop between resistance material and oil in order to attain the desired accuracy in the value of the standard may be considered. The total change over the working range of a good standard resistance due to current heating is not more than 10 or 20 parts in 100 000. Therefore, if we can keep the factors affecting the temperature drop constant to 5 per cent. it will be sufficient for obtaining an accuracy of 1 or 2 parts in 100 000. The temperature drop between resistance material and oil for a given current will vary as a small power of the stirrer speed, roughly as the square root of the stirrer speed. This factor will therefore be taken care of by keeping the stirrer speed constant to within, say, 5 per cent. The change in the viscosity of the oil (8·6 per cent. for a change of temperature of 20 deg. C.

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in the case of paraffin) will have an effect upon the thermal transference. This effect may be taken into account by conducting the calibration in the following manner :—

A curve of resistance at various temperatures from 15 to 30 deg. C., and with a testing current not exceeding 10 per cent. of the rated current is first taken. This will presumably be done by immersing the whole resistance standard in an oil bath. If the resistance has a constant

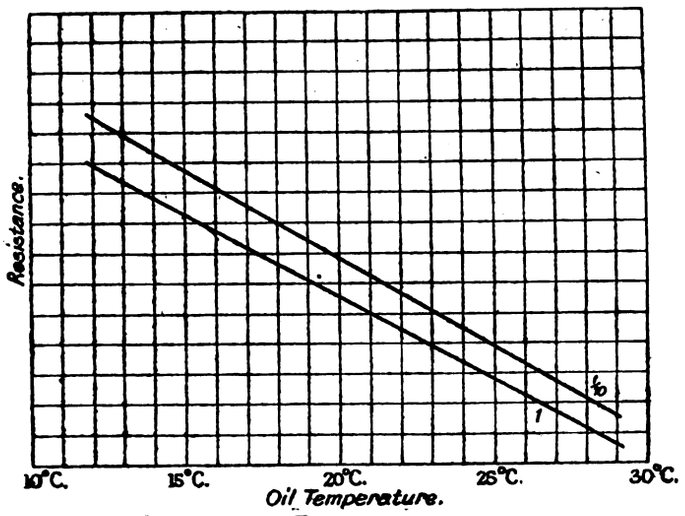

FIG. 1.

negative temperature coefficient the curve marked 1/10 will be obtained (Fig. 1). Under this condition, only 1 per cent. of the normal power will be developed in the resistance, and the resistance material will be at the same temperature as the surrounding oil. Now let the test be repeated with full rated current. The curve 1 will now be obtained, giving lower resistance values for a given temperature, owing to the combined effect of the temperature drop from resistance material to oil and the negative temperature coefficient. If the temperature drop is independent of the oil temperature, the two lines will be parallel. However, owing to the decrease of viscosity with increase of temperature, the heat transfer will be facilitated and the lines will tend to converge slightly. Since the temperature drop is proportional to the heat flow for a given oil temperature, it will be proportional to the square of the current. If, therefore, we have the two curves for one tenth and full rated currents, it is easy to interpolate for any other current at any temperature within the range covered. If the two curves are rather far apart—i.e., the temperature drop is large, an additional curve at, say, 71 per cent. of the rated current might be advisable. The actual temperature drop can, of course, be obtained from the displacement of the curves.

Let Ri be the resistance for a given current and oil temperature.
Ro be the resistance at the same oil temperature and for a small current (10 per cent. or less of rated current).
α the temperature co-efficient of the resistance.
t the temperature drop from resistance material to oil.

Then $Ri = Ro\,(1+\alpha t)$

and $t = \left(\frac{Ri}{Ro} - 1\right)\frac{1}{\alpha}$

The value of α can be obtained from the curve at tenth rated current.

Small standard resistances are sometimes fitted with a hand-operated oil stirrer in place of the mechanically operated stirrer. We have seen that the temperature rise of the resistance material depends upon the rate of circulation of the oil. If the hand stirrer is used at all, it must therefore be operated continuously until a stationary temperature is reached. This will take an hour or more with most standards. To obtain accurate results the experimenter would therefore have to operate the stirrer at a uniform and definite speed for an hour or so before observations are made and also during the observations. Very few experimenters would respond to this demand upon their patience, so the hand stirrer is best left unused. While omitting to use the stirrer results in a higher temperature of the resistance material, it allows a definite and constant temperature to be attained with cooling by natural convection. The intermittent use of the stirrer merely disturbs the natural convection and prevents the establishing of a definite relation between the temperature of the resistance material and that of the oil.

As a result of the foregoing considerations, a schedule of calibration tests is put forward for oil-immersed standards so that the resistance value may be deduced for any current or oil temperature within the working range from quite a moderate amount of calibration data.

Schedule of Calibration Tests.

The standard shall be filled with paraffin oil. If a mechanically operated stirrer is provided it shall be run at 1 000 revs. per min. and the direction of rotation stated. Hand-operated stirrers shall not be used. The following tests shall be made :—

(*a*) Resistance value at various oil temperatures from 15 to 30 deg. C., with a testing current not exceeding one-tenth of the rated current. Observations shall be made at a sufficient number of temperatures to obtain a satisfactory resistance-temperature curve. Water cooling need not be used in this test, but the stirrer should be in operation.

(*b*) Repeat the above tests with full-rated current. The stirrer speed is to be kept correct to within 5 per cent. The water cooling may be varied to assist in the regulation of the oil temperature.

(*c*) If the results of tests (*a*) and (*b*) differ at a given temperature by more than 20 parts in 100 000, a further test at 71 per cent. of rated current is to be made under the same conditions as test (*b*).

Results of a Typical Test.

In Fig. 2 are shown the results of a calibration of a 0·01 Ω standard carried out by the National Physical Laboratory in accordance with the above schedule. The N.P.L.

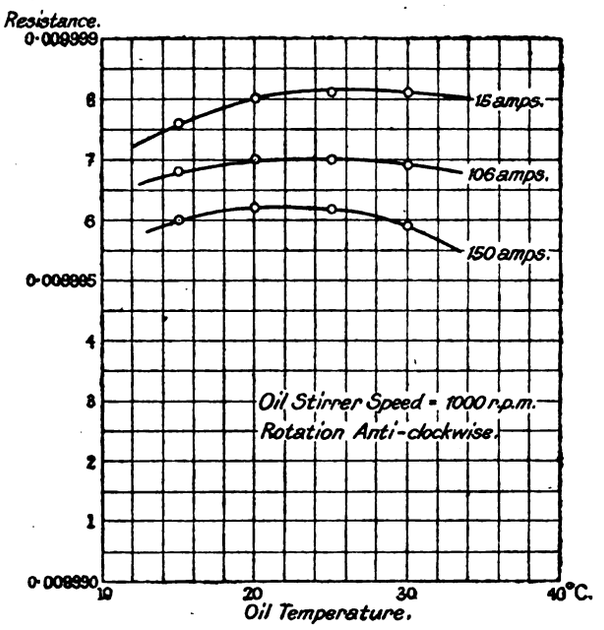

FIG. 2.

suggested that the direction of rotation of the stirrer might affect the cooling to a small extent and some observations were accordingly made on that point. It was found that the resistance values obtained with the two rotations differed by only two parts in 100 000. Some observations were also made on the effect of varying the speed of the stirrer. It was found that from 500 to 1 000 revs. per min. the resistance changed by five parts in 100 000. The limit of 5 per cent. fixed for the permissible speed variation gives a good margin. It will be seen that the performance of this resistance is remarkably good, the curves being very flat at ordinary room temperatures. The variation of resistance with current is also satisfactorily small.

The writer is indebted to the National Physical Laboratory for their ready co-operation in trying out the schedule of tests, and to the Metropolitan-Vickers Electrical Co. for permission to publish these notes.

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Improving the Shape of Alternator Voltage Waves.*

By Prof. E. W. MARCHANT and T. H. TURNEY.

In some cases it is necessary to secure an accurate sine shape for the wave form of an alternator. The best means of doing this is to design the machine in such a way that no harmonics of pressure are present in the curve. In some cases where machines have already been designed and it becomes important to ensure that the wave shape shall have irregularities taken from it, a method of eliminating the irregularities may be of use. The principle involved in the method herein described, is to short circuit each phase of the alternator for the frequency of the ripple which it is desired to eliminate, by introducing a shunt which is in resonance with the frequency of the ripple, and to cut down the short circuit current by introducing an additional inductance which may be called the limiting inductance. With this arrangement, the drop in pressure, due to the harmonic, is taken up in the limiting inductance, and the wave shape of pressure between the neutral and each phase becomes correspondingly improved.

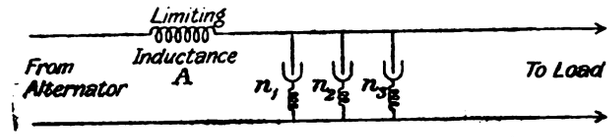

FIG. 1.—DIAGRAM OF CONNECTING CIRCUIT WITH ADDITIONAL INDUCTANCE.

Design of Shunts—General Considerations.

Each shunt consists of a condenser in series with a choking coil (Fig. 1), the values of capacity and inductance being so chosen that the shunt considered apart from the alternator is in electrical resonance with the frequency of the particular harmonic in the voltage wave which it is desired to eliminate. There is thus one distinct shunt for each harmonic dealt with. A current of the frequency of the harmonic will flow through any individual shunt; thus current will flow through the armature windings which have a considerable impedance, but the effect of the shunt will be to short circuit the machine for this particular harmonic, with the result that the p.d. variation due to it, at the alternator terminals, will be very much reduced. For the best results, the resistance of the shunt should be a minimum. It is clearly advantageous to have considerable impedance in the alternator, since this reduces the current passing through the shunt and thus lowers the amplitude of the harmonic in the wave of the terminal p.d. The inductance coil must be so designed as to have the greatest inductance with the smallest possible resistance. This result can only be achieved by using a coil having a very large section of copper, and the extent to which the harmonic of e.m.f. is eliminated depends almost entirely on the weight of copper that is used in the shunt coils. Currents may flow in one shunt due to a harmonic which is dealt with by another shunt but these currents will be negligibly small for two reasons. Firstly, when all the shunts are in, the amplitude of the harmonics is greatly reduced, and, secondly, the impedance of the shunt to any harmonic other than the one it is designed to eliminate is very great.

Results Obtained with Some Machines under Test.

Fig. 3 (a) shows an oscillogram of the open circuit phase voltage from a 200 V, three-phase, Swedish "Wenstrom" alternator. The machine runs at 720 revs. per min., 60 cycles, 10 poles. The full load current = 10 A. When the voltage wave in Fig. 3 (a) is analysed it is found to be given by $E = 132 \sin\theta - 37{\cdot}6 \sin 3\theta - 13{\cdot}6 \sin 5\theta$, neglecting phase angle of harmonics.

Triple frequency R.M.S. V = 26·6.
Fifth frequency R.M.S. V = 9·6.
D.c. res. per phase $R_A = 0.456$ O.
$L_A\omega = 1{\cdot}1$ O. per phase for 60 cycles.

When a shunt is connected as shown in Fig. 2, the triple frequency current flowing = 7 A. Five times frequency current flowing = 2 A. When the triple frequency shunts are placed in circuit the voltage wave for the phase alters to that shown in Fig. 3 (b), where it will be seen that the fifth harmonic remains, while the third harmonic is wiped out. Fig. 3 (c) shows the voltage wave for one phase when all three phases have shunts for the third and fifth harmonics and additional inductance is placed in the neutral.

A comparison of Figs. 3 (a) and 3 (c) shows that the method reduces the wave of p.d. to an almost pure sine shape. By adding inductance in the neutral the currents through the triple frequency shunts may be further reduced.

When an iron-cored coil is employed in the shunt circuit care must be taken that it has the right value of inductance when carrying the current which is expected to flow when the shunt is in use, or the inductance may decrease for large currents due to saturation of the iron, and diminish the effectiveness of the shunt. It follows, therefore, that iron-cored inductances are not very satisfactory for this service, since they will not give good wave shape correction for varying loads on the alternator.

Effect of Eddy Currents.

The energy loss in the shunt circuit depends on its resistance and the current flowing through it; by adding inductance, the shunt current is decreased and the loss correspondingly diminished. There is also a waste of energy due to iron losses in the cores of the inductances, and it is essential, therefore, to reduce these as much as possible. Eddy current loss in adjacent metal masses may cause serious increase in the effective resistance of the circuit owing to the high frequencies of the currents passing, and care should be taken to minimise this loss. In one case an iron slip on one of the inductance coils caused a large additional energy loss and excessive local heating. For power station purposes some of the additional impedance required might be obtained by using the air core reactances which are generally put in the circuit of the alternator to guard against excessive current due to short circuits. The limiting inductance is very necessary when it is desired to deal with a third harmonic on a three-phase alternator, for it has been shown* that the ampere turns due to the three triple frequency currents in the phases neutralise each other, and the armature inductance is, therefore, due only to the leakage

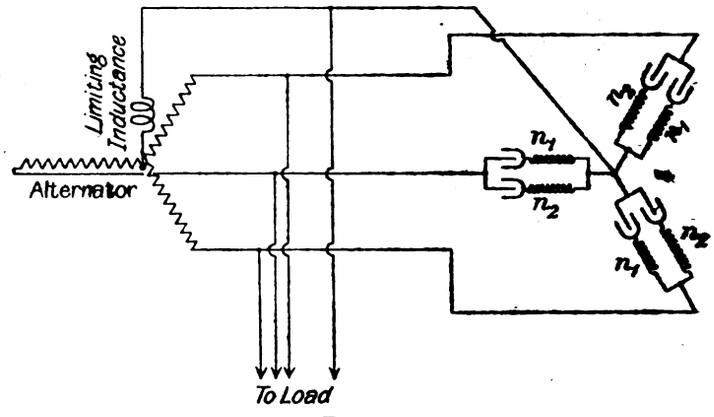

FIG. 2.

reactance. Consequently, the correction obtained is not so complete as it is with harmonics whose frequencies are not a multiple of three times that of the fundamental.

It was found with the three-phase machine tested that an increase of 60 per cent. in the current passing through the third harmonic shunt was recorded when all three phases were shunted as compared with the current passing when the circuit to the shunt in only one phase was closed.

Alternators on Load.

When an alternator is loaded the terminal voltage wave form is generally different from the open circuit voltage wave. This is due to distortion of the field produced by the armature ampere turns and it would be expected that if a machine on load developed a harmonic which was absent or nearly so at no load, that the amplitude of the harmonic in question would be proportional to the armature current at intermediate loads, and would not be affected by a change in the field exciting current. That this is actually the case is shown below. Fig. 4 (a) shows the o.c. phase voltage wave ot a 50 cycles, 200 V, three-phase alternator made by the A.S.E.A. of Sweden.

* Abstract of Paper read before Section G, British Association.

* THE ELECTRICIAN," 1908. Paper by Catterson Smith and E. W. Marchant.

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When working on full load of 58 A per phase, unity power factor, the terminal voltage wave alters to that shown in Fig. 4 (b). The o.c. wave is a fairly good sine curve with small third and fifth harmonics in it as given by the equation :—

$$E = 116 \sin \theta - 3{\cdot}45 \sin 3\theta - 1{\cdot}5 \sin 5\theta$$ (neglecting phase angles).

The load curve has the equation :—

$$E - 115 \sin \theta - 28 \sin 3\theta - 5{\cdot}6 \cos 5\theta$$ (neglecting phase angles),

showing that the third harmonic has increased enormously, and when a shunt is put in circuit to remove this harmonic,

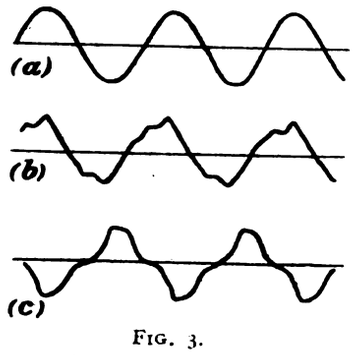

FIG. 3.

there is still a ripple which is due to another higher harmonic. When a second shunt is put in to remove this the curve shown in Fig. 4 (c) is obtained. On no load the wave form with the shunts in is given by Fig. 4 (d) and at intermediate loads the currents in the third harmonic shunts are proportional to the armature load current. Decreasing the field excitation does not diminish the value of the harmonic appreciably, if the armature load is kept constant.

Two Groups of Harmonics.

It is thought that in general the harmonics in the wave form of a loaded alternator may be separated into two groups—first, those which are produced directly by the field form and conductor grouping, and which, therefore, occur at no load

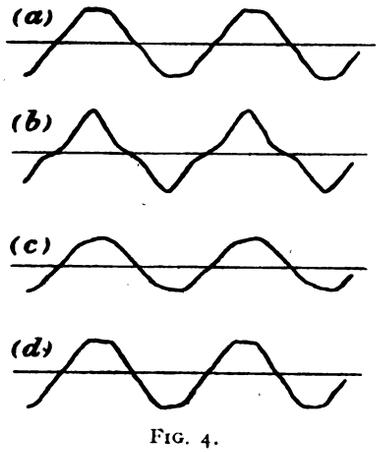

FIG. 4.

and do not alter with load ; and, secondly, those which are due to distortion of the field by the armature currents and whose values are proportional to the armature currents. If a machine has two opposing harmonics of the same order, one in each class, then it may happen that the resultant value of that harmonic may be a maximum at no load and a minimum or even zero at full load. In the case of the above machine the two harmonics are in phase and the value of the resultant harmonic grows as the load increases. This effect does not preclude the use of this method of improving the wave shape, for if a shunt is designed for the maximum value ever attained over the whole range of load for each harmonic in the voltage wave, that wave will be corrected successfully at all loads. As the load changes, the currents in the shunt, of course, will change, but there will always be a constant fundamental frequency current from the alternator. From the above it follows that the maximum value of any harmonic is likely to occur either at no load or at full load, and it would be sufficient to take an oscillogram at no load and one at full load, analyse both, make a list of the harmonics in each, design a shunt for each harmonic observed, bearing in mind that if the same order of harmonic occurs in both groups, it is sufficient to design a shunt for the one which has the greater amplitude.

In the design of each shunt, the order of the harmonic will determine the value of the product of the capacity and inductance and the amplitude of the harmonic will give the maximum current which will flow, and the inductance must be designed to carry this current. The ratio of the capacity to the inductance is determined by the fact that the current through the condenser must be such as not to produce a higher voltage than its safe working pressure.

From the foregoing analysis of the method it will be seen that under normal circumstances the correction of a wave shape may be affected by the arrangement described above, without altering the design of the alternator or decreasing its rating to any appreciable extent.

DISCUSSION.

Mr. W. M. MORDEY said a good deal of difficulty had been caused from alternators not being designed with sine curves. Prof. Marchant had rather underestimated the importance of the suggestion he had made in his paper, and it would be of great value in practice. People would not have to pay so much attention to getting rid of the departures from the most desirable form of curve, and it might actually cheapen construction as a whole.

Practical Importance of the Invention.

Prof. F. G. BAILY considered that though Prof. Marchant had underestimated the practical importance of his invention, on the other hand, he had rather overestimated the improvement in alternators, and had minimised the trouble which harmonics would produce. He had been running an induction motor and had put it on the oscillograph, because he had rather suspected it would be sensitive to harmonics. The alternator had a fixed harmonic, and the induction motor ran almost on a pure sine wave. The result was remarkable ; it was exactly like a condenser of very low resistance. The harmonics were accentuated, and the shape of the wave was almost unrecognisable.

Applications in Railway Electrification.

Prof. G. W. O. HOWE said that this was a matter of considerable importance in connection with the electrification of railways. One of the problems of the engineer was to design a machine which would not produce current which would interfere with the telephone lines, and anything that would contribute towards eliminating this interference was of value.

Mr. H. JACK said that his company had actually installed frequency filters. He believed there was one at Galashiels, one at Harringay and another on the south coast. They had been very effective in eliminating harmonics and seemed to be very similar to those described by Prof. Marchant. As a designer of machines, he said that it was very much easier now to get pure sine waves, and one method adopted was to use a fractional number of slots per pole per phase in the alternator—such as $3\frac{1}{7}$th per pole per phase.

Prof. MARCHANT, replying to the discussion, said he had not an estimate of the cost of installing the apparatus he had described and, therefore, could not give any information with regard to the cheapness of the method, but, judging from the cost of the condensers to-day, he did not think it would be very serious.

Public Street Lighting.

Formation of a New Association.

Dissatisfaction with the indifferent conditions which prevail in the public street lighting of the Kingdom has been manifested for some time past and, as has been indicated by letters in the municipal engineering Press, from some of the leading public lighting superintendents, these conditions could only be remedied by the formation of a separate organisation for the advancement of the study of the practice and science of street lighting.

At a meeting in Birmingham it was unanimously resolved that an association or organisation for officers concerned with public lighting be formed forthwith. Resolutions were also unanimously carried that Mr. Langlands (Glasgow) be appointed President, Mr. W. J. Liberty (London), Vice-President, with Mr. Crane Cooper (Wakefield) as Hon. Secretary. An executive committee was formed comprising Messrs. Langlands, Liberty, Cooper, R. Mason (Birmingham), E. F. Spurrell, C. Chambers-Smith and T. Wilkie (Leicester), and a sub-committee consisting of Messrs. Liberty, Langlands and Cooper, was appointed to draw up articles of association, by-laws, etc.

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Electric Ship Propulsion.*

By F. H. CLOUGH.

Electric ship propulsion involves many complex problems. The design of the propeller is based largely on empirical rules. Its area bears a direct relation to the sectional area of the ship. There is a limited amount of thrust which the water will stand without giving way and producing "cavitation." About 12 to 13 lb. per sq. in. is the maximum pressure which can be carried safely by the projected area of the blades. Pitch is also important. Multiple screws are more efficient than single ones, as each of them is smaller and can revolve at a higher speed.

Electric Transmission of Power.

Electric transmission of power may appear at first sight a roundabout way, but the weight and size of machinery does not differ greatly from that of gearing, and the system has many distinct advantages. In an electric motor there is practically no mechanical wear and much greater elasticity. A motor such as should be used for propelling ships is capable of exerting about 3 lb. tangential pull on every square inch of its surface.

Comparison Between Gearing and Motors.

Assuming that an electric motor has a rotational force of 3 lb. on each square inch of the rotor surface, and that a gear wheel has a rotational force of 600 lb. on each linear inch of face, a comparison of size can be made. If it is assumed that 3 000 H.P. is required to drive a propeller shaft at 100 revs. per min. the torsional force corresponding to 3 000 H.P. at 100 revs. per min. is 1·9 million inch lb. If d and l are respectively the diameter and length of the gear wheel on electrical rotor, then for the gear wheel the torque or torsional force will be $600 \times \frac{d}{2} \times l = 300\ dl$, and for the motor the force will be $dl \times \frac{d}{2} \times 3 = 4{\cdot}7 d^2 l$.

A suitable diameter for an electric motor of this capacity is 130 in. For this diameter the length from the above expressions will be 24 in. for the electric motor, and 49 for the gear wheel. Thus the electric motor is smaller than the gear wheel. If two pinions are fitted to the gear wheel, its length will be halved, but two pinions mean either two turbines—an expensive and not very efficient arrangement for an equipment of this size—or else a double intermediate wheel—an arrangement in which it is difficult to ensure that the pinions share the load equally. Further, the diameter of the gear wheel would probably be reduced somewhat with a corresponding increase in length. The example shows, however, that electrical motors compare in size with gear wheels.

In ship-propulsion three-phase alternating currents are mainly used. The method of control and reversal is as follows :—

The steam turbine is fitted with a governor by means of which the speed can be varied over a wide range. For starting up, the governor is set to run the turbine at slow speed, about 20 per cent. of normal. The main switches between the motor and alternator are closed and the motor and alternator are then excited, and immediately currents and force are produced which cause the motor to rotate at its corresponding speed. Finally, the speed of the turbine is increased to full value, and the motor speed increased correspondingly.

In some ships direct current is used, but this is only suitable for comparatively small installations.

Direct Current Disadvantages.

The difficulty with direct current machines is that the current has to be reversed by means of carbon brushes in the commutator, and this is only feasible with currents of moderate amount; further than that, owing to the commutator being exposed, it is not feasible to use very high voltages, and consequently the powers that can be used with direct current machinery are usually limited, and such as would be suitable for small ships. The advantage of direct current machinery is that the ratio of speeds between the generator and motor is variable.

Efficiency of Electrical Transmission.

The efficiency of electric transmission is very closely the same as double reduction gearing. Mr. W. J. Belsey, in a paper before the Institution of Engineers and Shipbuilders of Scotland worked out some examples showing that the losses on turbo electric equipment were 8·2 per cent., with double reduction gearing 10 per cent., and with single reduction gearing 8 per cent. From the standpoint of efficiency there are advantages in the electrical equipment which cannot be obtained with the gearing. In general, a single turbine can be used instead of two which saves a considerable amount of loss in the glands, piping, etc. Much higher superheat can be used, which becomes impossible with the geared turbine on account of the reversing blades, and finally the loss associated with the reversing blading is eliminated.

Reliability and Repairs.

Apart from the bearings which, of course, can be oil film lubricated, there are no wearing parts in the electrical equipment, and providing the equipment is properly designed it should have an almost indefinite life.

If repairs are necessary they can readily be carried out, and generally a repair will consist in replacing some of the electrical conductors on which the insulation may have become damaged. This is comparatively a simple matter and can be carried out easily, in fact in most cases, such repairs can wait until the ship reaches port.

Ventilation.

The losses which occur become converted into heat, and this heat must be carried away by means of suitable ventilating air, the air may either be drawn from outside, and expelled outside again, or the same air used over and over again, and cooled by means of water-cooled radiators. In naval vessels it is often desirable to run at full power or at cruising speed. With electrical transmission this can be carried out by arranging that the motor shall have two sets of poles, which is equivalent to changing the gear ratio, thus: the turbines can be run at full speed when the ship is travelling at a reduced speed, and as the power is very much lower at the reduced speed of the ship some of the turbines may be shut down. This gives a very great gain in economy. This practice has been adopted on most of the American naval vessels.

Electric Propulsion and Diesel Engines.

Although the Diesel engine runs at approximately the same speed as the propeller, electric transmission can nevertheless be usefully employed, even on Diesel ships. The advantages are that the engine can be sub-divided into smaller units, and can probably be run at higher speeds. The engines can also be started up light, and once started may be left running even when the ship is standing still. The engines also do not require to run in the reverse direction, as reversing can be done with the electrical equipment.

In the case of the ships being built by Cammell Laird and the B.T-H. for the United Fruit Co., a large amount of power is required for the refrigerating plant in addition to propelling the ship. In this case the Diesels are fitted with two sets of generators, one set being used for propelling and the other for supplying power to the freezing plant. By using direct current machinery the engines can run at full speed, whatever speed the ship is running at, and therefore full power is always available for the freezing plant.

A very successful example of an alternating current ship is the "San Benito," which also belongs to the United Fruit Co.* This ship was built about two years ago by Workman, Clark and Co. and equipped by the British Thomson-Houston Co., and has been running between Boston and the West Indies very successfully. The engine room staff are delighted with the control and would be very loth to go back to any other form of propelling machinery.

* Abstract of a Paper read before the Section G (Engineering) British Association.

Books Received.

"The Poulsen Arc Generator." By C. F. Elwell. (London: Ernest Benn, Ltd.) Pp. 192. 18s. net.

"La Radiotéléphonie." By Carlo Toché. 2nd ed. (Paris: Gauthier-Villars et Cie.) Pp. 118. 10 fr.

"Science Abstracts. September 25th, No. 309, Sections A and B, Part 9. (London: E. and F. N. Spon.) 3s. net.

"Popular Fallacies Explained and Corrected." By A. S. E. Ackermann. 3rd ed. (London: Old Westminster Press.) Pp. 984. 12s. 6d. net.

* See THE ELECTRICIAN, Vol. XCI., p. 86, July 27th, 1923.

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A Squirrel-Cage Induction Motor with High Starting Torque and Low Starting Current in the Line.*

By T. F. WALL, D.Sc., Eng.

An outstanding problem in heavy current electrical engineering is the production of a squirrel-cage motor having the requisite cheapness, robustness and simplicity, but also capable of developing a large starting torque without drawing an unduly heavy current from the line. In this country starting of such motors by switching direct on to the line is usually forbidden by supply authorities owing to the heavy starting current. Hence a reduced pressure is commonly supplied to the stator, a special auto-transformer or " star-delta switch "

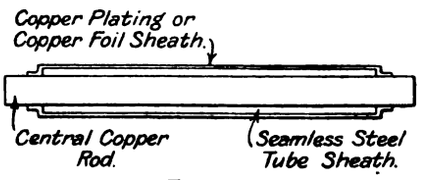

FIG. 1.

being used, which limits starting current to 2½ to 3 times normal, but also reduces the starting torque. Various means of overcoming the difficulty have been suggested, such as the Boucherot double-wound motor and the utilisation of the " skin effect " in iron conductors. But none have completely solved the problem.

Principle of the New Type of Squirrel-Cage Motor.

In the new type of squirrel-cage motor devised by the writer to meet the double requirement of high starting torque and low starting current, the resistance of the rotor conductors is proportional to the frequency of the alternating current flowing in them. At starting, the full supply frequency flows in the rotor bars and the resistance is high. At full speed the currents in the rotor winding are of the low frequency of slip and the resistance is practically the same as that of the standard squirrel cage motor. The method is based on the familiar property of the transformer, in which the effective resistance of the primary, with secondary closed, depends on the frequency of the currents flowing in it.

An obvious way of applying the principle is to make each conductor in the form of a central copper rod surrounded by a seamless steel tube, electrolytically copper-plated. A layer of insulation is inserted between core and sheath. The arrangement is essentially a very simple form of transformer. Hence

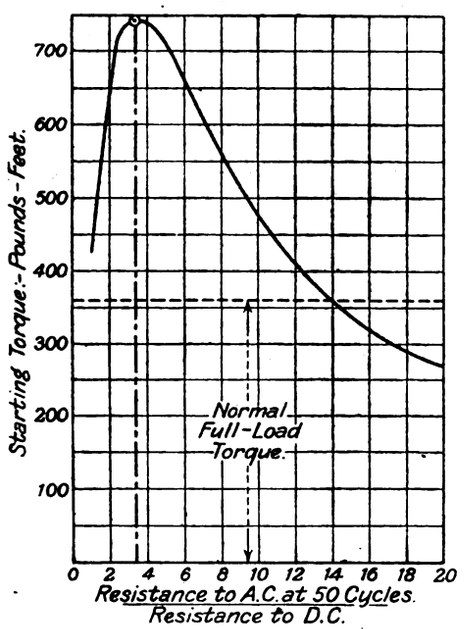

FIG. 2.

the effective resistance of the rod will increase with the frequency. Tests have shown that the relation is as follows :—

Resistance to a.c. = resistance to d.c. [1 + 0·06 (frequency)].

The power factor was found to be practically unity at the higher values of the frequency.

Method of Construction.

However, this simple form of construction is not an ideal arrangement. The inside copper covering of the steel sheath is awkward to apply and the introduction of the insulating sheath adds to the cost of construction. Further, the copper plating is only effective during the starting period and will not carry an appreciable current during normal running. Hence the space factor for the motor slots is relatively low. The method illustrated in Fig. 1, which involves no insulating layer and no copper coating on the inside of the sheath, is preferable.

The central copper rod is fitted with a sheath of seamless mild steel and the outer surface of the tube is copper-plated, care being taken that this coating extends so as to make good electrical contact with each projecting end of the central rod.

A great advantage of this method is that the copper plating is effective in carrying the rotor current during normal running, and the space factor is substantially the same as when standard methods of construction are employed. Hence

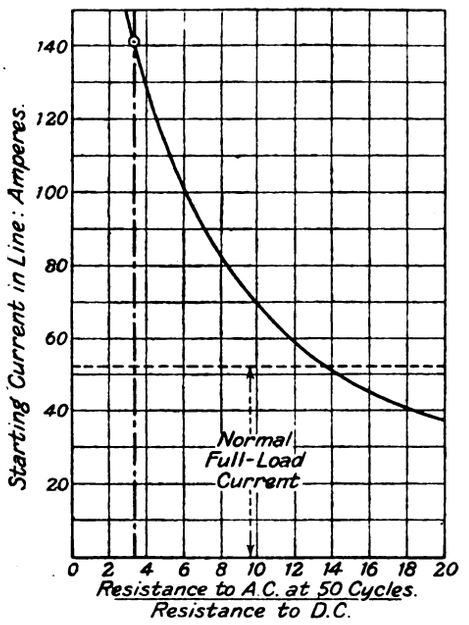

FIG. 3.

motors of the new design need not be larger than those of the ordinary type, for the same output.

Some tests were made on a bar with a central copper core 17·5 sq. mm. in section, a steel sheath 2·36 mm. thick, and a thickness of outer copper foil sheath of 0·01 in. It was found that the resistance to a.c. at 50 ~ was 3·4 times the resistance to d.c. for a wide range of current values.

Example of Performance.

The results now given were obtained with a motor having the following characteristics :—50 H.P., 8 poles, 50 frequency, 3-phase star-connected stator, supply pressure 500 volts—that is, 289 volts per phase.

Resistance of the stator winding per phase.. $r_1 = 0{\cdot}129$ O.
Reactance of the stator winding per phase.. $x_1 = 0{\cdot}605$ O.
Resistance of the standard rotor winding per phase when reduced to the stator number of turns ..... $r_2^1 = 0{\cdot}242$ O.
Reactance of the standard rotor winding per phase when reduced to the stator number of turns and the stator frequency..... $x_2^1 = 0{\cdot}231$ O.

In Figs. 2 and 3 are given respectively the starting torque and the starting line current as functions of the ratio

$$\frac{\text{effective rotor resistance at starting}}{\text{effective rotor resistance at synchronous speed}}$$

* Abstract of a Paper read before Section G (Engineering) of the British Association.

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when the supply pressure to the stator is reduced by means of an auto-transformer to 1·1·25 times the main supply pressures.

Reference to these Figs. shows that if the effective resistance of the rotor winding at starting is 3·4 times the rotor resistance at synchronous speed, the starting torque of the motor will be just over twice the full-load torque and the starting current in the line will be 2·75 times the normal full-load current.

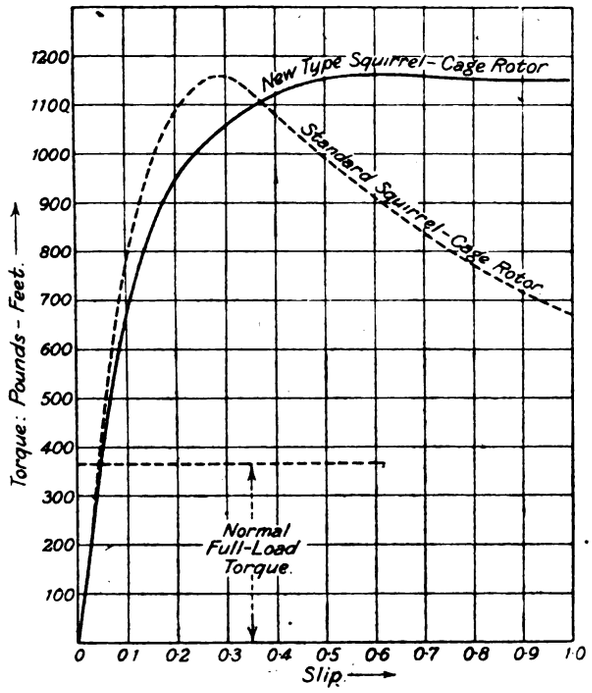

FIG. 4.

It is of interest to consider the torque-slip and the line current-slip curves of a squirrel-cage motor of which the rotor winding is formed of composite bars as illustrated in Fig. 3.

Assuming that the value of the reduced effective rotor resistance $R_2^1{}_s$ at any slip s is given by the expression (see Fig. 2):

$$R_2^1{}_s = r_2^1 + (k-1)\, r_2^1 s,$$

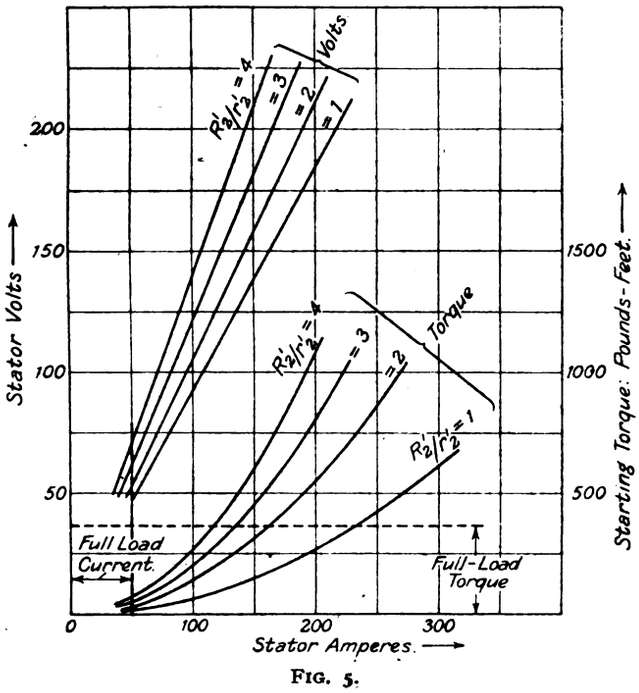

FIG. 5.

where r_2^1 is the reduced effective rotor resistance when the rotor is running at synchronous speed, and

$$k = \frac{\text{effective rotor resistance at starting}}{\text{effective rotor resistance at synchronous speed.}}$$

At starting, that is for $s = 1$, the expression reduces to

$$R_2^1 = k \,.\, r_2^1.$$

In Fig. 4 are given the torque-slip curves for the ratio $k = 3$ for the new type of rotor and the standard squirrel-cage rotor. It will be observed that whilst the starting torque of the new type of rotor is about 1·7 times the starting torque of the standard rotor, the two curves fall into practical coincidence at about full-load conditions.

Another useful method of illustrating the results is given in Fig. 5. In this Fig. the starting torque and stator volts are shown as functions of the stator current for the following values of the ratio k, viz.: 1, 2, 3, 4.

Conclusions.

The following is a summary of the advantages which may be expected from the new type of squirrel-cage motor as described in the foregoing, viz.:—

1. High starting torque with low starting current in the line.

2. Reduced cost as compared with the combination of a standard squirrel-cage motor and the necessary centrifugal clutch or other starting device to enable the standard squirrel-cage motor to start up light.

3. Retains the inherent characteristic advantages of the standard squirrel-cage motor as compared with the slip-ring motor, amongst which are:—

(i) Absence of any possibility of sparking at the rotor and therefore permitting its use in explosive atmospheres.

(ii) Reduced cost of upkeep due to absence of slip-rings and brushes.

(iii) Increased efficiency, better power-factor and increased stalling torque.

DISCUSSION.

Prof. F. G. BAILY expressed his high appreciation of the ingenuity displayed in solving this old problem. The squirrel-cage motor was the best machine, except that it had the unfortunate property that starting was hopelessly bad. Dr. Wall's work represented one of the most important improvements in the induction motor which he (Prof. Baily) had heard of for a long time.

Mr. H. JACK also congratulated Dr. Wall on his work. Someone else had been working on these lines in America, and had evolved a similar arrangement. He had come across it in connection with the starting up of synchronous motors, but could not be certain as to details. There was a big field for it, because squirrel cage motors were probably the most robust of machinery, and anything which would widen their application would be of great advantage. Dr. Wall had improved the starting torque considerably, but had not brought down the starting current; the use of an auto-transformer was still involved.

A Great Advance.

Prof. Sir JAMES B. HENDERSON said it was one of the greatest inventions in synchronous motor design made during the last 20 years, and was a great step in advance.

Mr. C. RETTIE said that the regulation of induction motors was very important, especially with reference to ship propulsion but Dr. Wall had referred to a fixed voltage. He would like to point out, however, that there was a difference between ship propulsion and land work. On a ship they had fixed voltage; they could bring the voltage up with the generator, and could start the motor slowly, so they had an advantage which they had not on land.

Prof. G. W. O. HOWE said there was one defect of the induction motor which had not been mentioned, namely, the low power factor. People at the present day were clamouring for a good power factor, but he was afraid that that was an impossibility so long as they expected the three-phase supply to produce the magnetic flux as well as the torque.

Dr. Wall's Reply.

Dr. WALL, in reply to Mr. Jack, said that there were a large number of proposed solutions of this problem in America, but he had searched available records and could find nothing in any of them corresponding to his own. Some eminent American engineers had visited his laboratory, and had referred to work which was being done in America in this connection, but in that case they had a central coil, and, instead of a steel tube, they used a copper tube. With regard to power factor, the squirrel cage motor had a very much better power factor than the slip ring motor, and he imagined that, when the results of tests on his machine were given, it would be found that the power factor would be considerably better than the slip ring motor, but not quite so good as the standard squirrel cage.

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Eliminating Glare in Industrial Lighting.

Better Methods of Illumination Facilitate Increased Production in Factories.

The subject of "Glare in Industrial Lighting" was discussed before Section J (Psychology) of the British Association, when Dr. G. H. Miles (of the National Institute of Industrial Psychology) said that a number of very interesting experiments carried out by large industrial concerns had proved conclusively the importance from a commercial point of view of increasing the amount of light in industrial works. In one large firm the following three years' test of the lighting was carried out, and careful records taken, in order to compare the efficiency of the lighting as gauged in terms of output. When the experiment began the factory was lighted by lamps giving 1·2 ft. candles, suspended from drop cords. The first change was to replace these by 100 W lamps with overhead reflectors giving 6½ ft. candles intensity. With this alteration an increase of 13 per cent. in production was obtained. This encouraged a still further increase, and 150 W lamps were put in, giving 9 ft. candles, which led to an increase in production of 17·9 per cent. Finally, 200 W lamps with overhead reflectors were installed, giving 14 ft. candles, and the result was an increase of 25·8 per cent. production over the original installation. The increase from 1·2 to 14 ft. candles represented a very big step in intensity, and the increase in production was sufficient to warrant similar alterations being carried out in other factories. In fact, the general tendency of to-day was to increase illumination.

Glare and Blind Spots.

The effects of glare were so obvious that in the majority of cases the worker was able to take steps to prevent accident. In a comparatively short time, however, the unpleasant immediate effects of such glare disappeared and a person was apparently free from the effect, but careful observation showed that, although not directly conscious of any blinding, there was left behind, for some considerable time, a visual area in which the vision was distinctly impaired, although the person might not be aware of this defect. There was present in the eye a blind spot similar to the actual blind spot, though it was no more realised than was the presence of the blind spot itself. Experiments showed conclusively that the effects of exposure to a bright light persisted in the form of a temporary blind spot for some considerable time after the effects of exposure appeared to have passed off. This was really the dangerous period, when there was actually a centrally situated blind spot of which the person was not aware, and it was far more likely that accidents would happen when this was the case than when the person was definitely aware of the temporary blinding.

Dangerous After-Effects.

In addition to the presence of this temporary blind spot there were other after-effects, due to the influence of the central stimulation, which gave rise to distraction under certain conditions. If, for instance, there was a rapid change in the intensity of light entering the eye, caused either by a shadow passing over the surface at which one was looking, by a temporary blinking of the eyes, or by a temporary increase in intensity of illumination of the surface looked at, a distinct image of the original glare of light would be produced. In a workshop where there was a centralised and intense source of illumination there were necessarily great variations in the intensity of the work illuminated, and as the eye passed over these differences, or as shadows, due to the movement of the worker's hand or parts of machinery, passed across the work, the whole retina was stimulated intermittently. If the worker had, during the course of his work, glanced at the source of illumination, or had received the glare from some bright surface of tools or machinery, projected images of varying degrees of intensity would be revived. The author had recently carried out a number of simple experiments in order to determine whether the presence of any unrecognised projected images had any effect on the accuracy of movement, and the results showed that the after-effect of the light stimulus had a considerable influence over the accuracy of work. In some subjects as much as 25 per cent. increase in error was noticed. Naturally, there were individual differences, and in one case only 4 per cent. increase was shown.

Some Conditions to be Avoided.

There were in industry countless instances in which existed conditions favourable to the formation of artificial blind spots by direct glare, or to the production of projected images, which both irritated the worker and reduced the accuracy of his work. Such conditions were (*a*) the presence of a light centre relatively bright to the surroundings, and (*b*) variations in light intensity caused either by flickering light, shadows or irregularities in the illumination of the work. A revival of such projected images was noticed in one of the Institute's investigations on the miner's lamp. The investigators reported that the projection of such images on the coal face must undoubtedly interfere with steadiness of regard, power of discrimination, accuracy of aim, etc.; in fact, with any process dependent on good vision. The experiments showed conclusively that this inference was supported by actual results.

A Field of Investigation.

There was a field for a considerable amount of research in order to determine what ratio between the intensity of the source of illumination and the average light reflected from the surroundings was best suited for average working conditions A room might be sufficiently illuminated so far as physical standards were concerned by one very powerful centre light. The value of the ratio between the intensity of this light and the average intensity of light received from surroundings would be large. Under such conditions, direct light or light reflected from a polished surface of metal tools would most certainly give rise to immediate glare effects and objectionable after-effects. If, however, instead of one powerful central light, a larger number of lights of less intensity, but giving in the mass equivalent surface illumination, were used, then the ratio between the intensity of any one of them, or the light reflected from polished surfaces and the average intensity of light received from surroundings would be much less, and the possibility of glare effects would be greatly diminished. The points emphasised were (1) that the use of high powered sources of light, especially when of small area, such as an unshaded filament or too small a frosted globe, increased liability to accident through direct temporary blinding, or the even more dangerous formation of unrecognised blind spots; and (2) that unless well distributed they gave rise to too big a difference between the source of illumination and the average intensity of the light reflected from surroundings, causing liability to the formation of projected images which produced unnecessary irritation and distraction and impaired accuracy of work.

British Engineering Standards.

Three New Electrical Specifications Issued.

Three new British Standard Electrical Specifications have been issued by the British Engineering Standards Association. They comprise: No. 116–1923, "Specification for Oil Immersed Switches and Circuit Breakers for Alternating Current Circuits"; No. 157–1923, "Specification for Moulded Flat Top Insulating Bushes"; and No. 160–1923, "Specification for Slate Slabs for Electrical Purposes." The specification for Oil Immersed Switches and Breakers completes the series of switchgear specifications, of which there are now seven published. The ratings standardised range from 660 to 165 000 V and 30 to 6 000 A.

Research on Breaking Capacity.

Much consideration has been given to the question of breaking capacity, and early in their deliberations the committee responsible for the preparation of the specifications found it necessary to arrange for extensive experimental work to be undertaken, as there was no information available to enable them to lay down definite specifications for breaking capacity for large sizes. As soon as the British Electrical and Allied Industries Research Association was properly organised this work was referred to them, and research on a large scale has been put in hand. This should prove of the greatest value to the industry, and it is hoped that results will be available in time for the next revision of the specification.

Specifications Nos. 157 and 160 (moulded flat top insulating bushes and slate slabs respectively) are principally dimensional specifications and have been prepared by a committee which is engaged on the standardisation of assembled switchgear as a whole and switchboard equipments. It is hoped that the whole industry will adopt these sizes as soon as possible in order that the full benefits of standardisation work of this nature may be felt quickly. Copies of these publications may be obtained from the offices of the B.E.S.A., 28, Victoria Street, London, S.W.1, price 1s. 2d. each, post free. Specifications for "Switchboard Busbars and Connections" and the "Arrangement and Marking of Busbars" will be issued shortly.

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Electricity Supply in Blackpool.

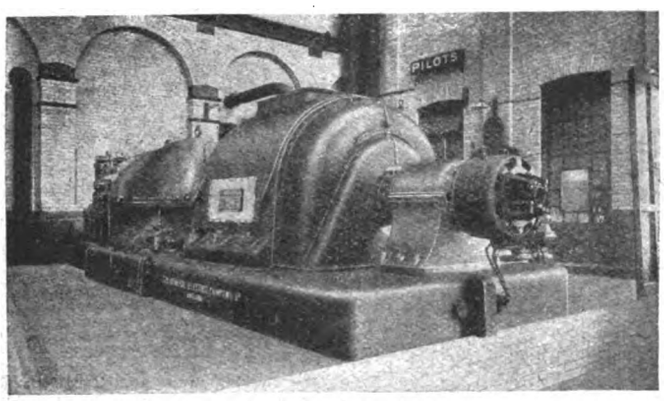
New Plant Extensions at West Caroline Street Power Station.

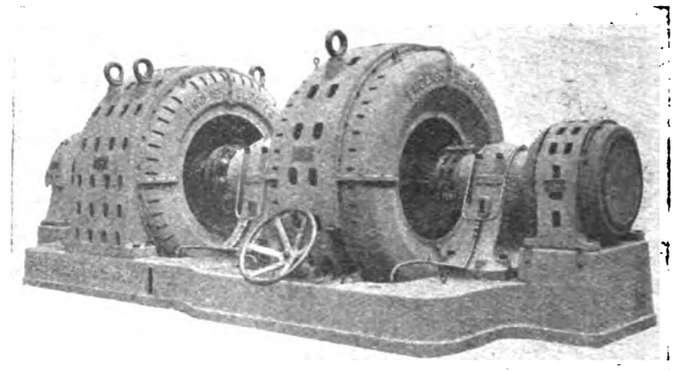
At a time when electricity supply undertakings were very few indeed, and chiefly run by private enterprise, Blackpool Corporation formed its first Electricity Committee in 1891, and within two years the town received its first supply of electricity. This was given from three 55-light Brush arc machines for public street lighting; two 50 kW and one 100 kW lighting machines, all rope-driven, with a total capacity of 350 kW. At this stage there were 30 consumers, their demand being for supply to 3 000 8 c.p. lamps, but now the Corporation has 6 190 consumers with a total connection of approximately 8 000 kW.

Development of the Undertaking.

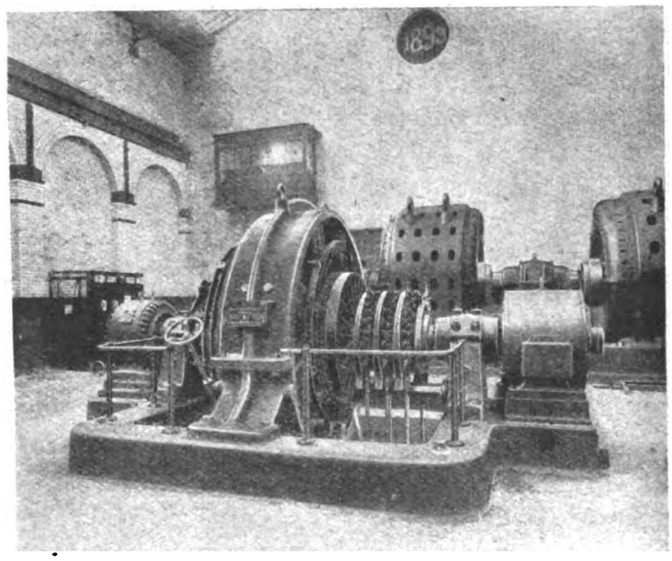
The original plant was replaced in 1898, since which time there have been no fewer than nine extensions of the plant to keep pace with new demands and modern practice. The latest extension which was formally opened last week is by far the largest which has been made, and increases the total plant capacity to 15 750 kW, as compared with 6 550 kW at the end of 1913.

Following the amalgamation of the Bispham-with-Norbreck Urban District with the county borough of Blackpool the electricity works of the former were taken over by the Blackpool Corporation in April, 1918. During the war period the generating plant became dangerously overloaded, owing to the war restrictions on non-industrial undertakings, and it was not until 1922 that the present scheme of extensions was sanctioned following upon a report by the borough electrical engineer, Mr. Charles Furness. This scheme was subsequently modified to enable the Electricity Department to supply electricity in bulk to neighbouring authorities, and to permit of the closing down of the old tramway generating plant at

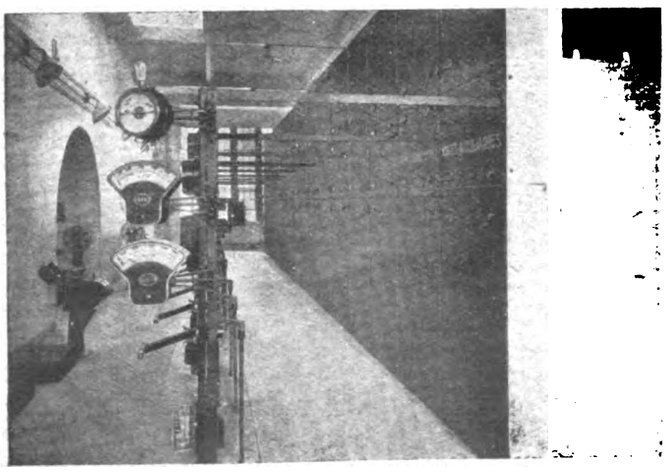


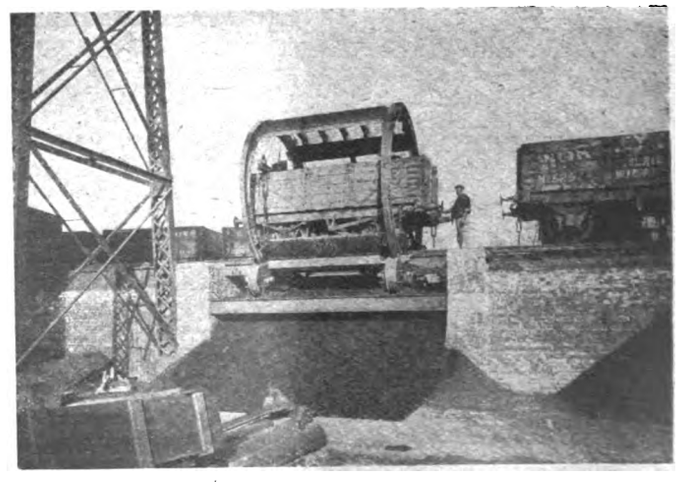


The illustrations above show (left) a 6 000 kVA G. E. C.-Fraser and Chalmers' Turbo-Alternator Set, and (right) an "English Electric" 2 500 kVA Phase and Frequency Changer Set. The centre picture illustrates a 1 000 kW G. E. C. Rotary Converter.



In the lower pictures are seen (left) the back of the operating board showing the front of the G.E.C. Stonework Cubicles, and (right) a view of the Truck Tippler which forms part of the new ash-handling plant.





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Bispham taken over in the purchase of the Blackpool and Fleetwood tramroad property.

The estimate prepared in November, 1921, for the larger scheme of development amounted to £220 000, but upon tenders being actually received some six months later, due to a reduction in the cost of plant and machinery, this was reduced to £169 000, plus the cost of two new boilers, amounting to £42 000, which were provisionally sanctioned by the Electricity Commissioners in November, 1920, to enable the Electricity Department to meet the increasing demands upon the undertaking.

Generating Plant.

The new equipment consists of two 5 000 kW G.E.C.-Fraser and Chalmers turbo-alternator sets running at a speed of 3 000 revs. per min., and there is a 1 000 kW G.E.C. rotary converter running at 750 revs. per min. There have also been installed two 2 500 kVA phase and frequency changer sets, comprising a 2 200 V, 83 cycle, single phase alternator, a 6 600 V, 50 cycle, three-phase synchronous motor, and a 440 V induction starting motor and exciter. The set has a running speed of 500 revs. per min.

New Switch Room Annexe.

Modern e.h.t. switchgear and controlling apparatus by the General Electric Co. has been installed in the new switch-room annexe, and the auxiliary plant includes two condensers and steam turbine circulating pumps by Hick Hargreaves; new feed water pumps; forced and induced draught motor driven fans; air filters for the two 5 000 kW turbo-alternators; and steam pipes, valve gauges, and steam recording apparatus.

Boiler House Equipment.

The new boiler house equipment consists of four new water-tube boilers, of 250 lb. working pressure, with a combined steam duty of 150 000 lb. per hour. Of these, three were supplied and erected by the British Niclausse Boiler Co., and one by Vickers-Spearing and Co. A new coal storage hopper has been provided by Edward Wood and Co., and a wagon tippler supplied by Bennis and Co.

For the expeditious handling of large consignments of fuel an overhead telpher equipment by Strachan and Henshaw has been installed, together with new railway track, with special junctions and crossings on private sidings to meet the altered conditions of fuel handling; the contractors for this work were Thomas Summerson and Sons. An additional cooling tower, to deal with 290 000 gallons of circulating water per hour by Peter Brotherhood, and a new overhead 25-ton electric travelling crane by Higginbottom and Mannock, complete the West Caroline Street additions.

New Mains.

In addition to the new steam and electrical plant erected at West Caroline Street, there is on order sub-station converting plant for the Bispham Tramway power house, to enable the old steam boilers and engines to be closed down entirely, and the electrical energy to be taken from the main power house at West Caroline Street, and for this purpose two e.h.t. feeders have been laid between Redbank Road, Bispham, and West Caroline Street, Blackpool, to enable a supply to be given at an early date.

Bulk Supply for Lytham.

The Corporation has recently entered into an agreement with the Lytham St. Annes Corporation to give a bulk supply of electricity from West Caroline Street, and in the near future it will be possible for the neighbouring local authorities to obtain a supply from the new plant.

The Institute of Metals.

Comprehensive Programme for 1923-24 Session.

The Institute of Metals has just issued its programme of meetings and lectures for the Session 1923-24. There are over thirty lectures and addresses to be given before the Institute's local sections in Birmingham, Glasgow, London, Newcastle-on-Tyne, Sheffield, and Swansea, as well as at meetings of the parent Institute, one of the latter including a lecture by Dr. F. W. Aston, which is to form part of the proceedings of next year's Empire Congress of Mining and Metallurgy.

The subjects of the lectures include "Extrusion Problems," "Nickel Brasses," "Some Impressions of American Non-Ferrous Metallurgy," "Metals for Lamp Manufacture," "X-Rays and Metallurgy," "General Scientific Brass Foundry Work," "Alloys for use with Superheated Steam," "The Density of Alloys," "The Annealing of Non-Ferrous Metals," "The Action of Molten Brass on Nickel Steel," "Propeller Brass," "Large Metallic Crystals and Some of their Properties," "The Cold Working of Metals," "Electric Resistance Furnaces," "Substitutes for Platinum," "The Metallurgical Microscope," and "Influence of Casting Temperature on the Physical Properties of Metals."

Correspondence.

THE ELECTRICITY AGE.

To the Editor of THE ELECTRICIAN.

SIR,—Mr. Bowden's interesting speculation in THE ELECTRICIAN of September 28th as to the effect of 100 per cent. load factor illustrates a point upon which there still appears to be some confusion and misunderstanding. I refer to the item stand-by coal, which is given as 4 000 tons, both for existing conditions and 100 per cent. load factor.

Stand-by coal is usually understood to mean the coal used to keep the plant *running*, ready to meet the maximum demand at any moment. This, of course, would be the case with 100 per cent. load factor, but in existing conditions—viz., 30 per cent. load factor, it is not usual to keep this amount of plant *running* continuously.

The tests of any steam plant show about 10 per cent. of the full load steam consumption to run the plant idle. It follows, therefore, that at least 10 per cent. of the total coal used must be stand-by coal.

Mr. Bowden has evidently some other conception of stand-by and running coal, and it would be interesting if he would explain his view in detail.—Yours, etc.,

J. RUTHERFORD BLAIKIE.

29, Stanley Street, Bedford.
September 29th, 1923.

THE ELECTRON THEORY.

To the Editor of THE ELECTRICIAN.

SIR,—Probably many others like myself still await some explicit proof of the correctness of the view that currents in conducting circuits can properly be defined simply as drifts of electrons. Mr. Sayer's article in your issue of September 21st voices this feeling.

Whilst it may be felt that a resultant drift of electrons does occur in a current-carrying conductor, may it not be viewed rather as a consequence of the current flow than as a cause?

The difficulties in reconciling the electronic view with the propagation of electric waves through space—or even along conductors—I have found too hard to assimilate. Moreover, these are not the only difficulties.

It is not easy to forget that a few years ago it was not even an "electronic drift" but a flashing of myriads of electrons through the mass of the conductor that we were asked to believe constituted the electric current. That view had perforce to be abandoned.—I am, etc.,

Wokingham, J. E. TAYLOR.
September 28th.

SHOULD BRITISH ORDERS BE PLACED ABROAD.

To the Editor of THE ELECTRICIAN.

SIR,—Mr. Wuthrich makes the best of his case, but the best in this instance is not good enough. Taking his revised arguments seriatim:—

(*a*) is disposed of by Mr. Wuthrich's own admission under (*b*); it is indeed in every way probable that a much larger proportion of the raw materials (if not all) would be ordered in this country if the order were placed with a home manufacturer. A definite clause in the contract would make it absolutely certain. In any case, finished products absorb more labour than raw and semi-manufactured materials.

(*c*) Granted that British electrical engineering concerns are "quite busy," it cannot be denied that other branches of British engineering are seriously under-employed, notably the marine engineering shops. Is it not desirable that electrical engineering firms should become busier still, and thus help to absorb the skilled engineering workers who are out of work in other lines and who would be quite at home in heavy electrical engineering shops? Further, such engineering work involves a considerable proportion of semi-skilled and unskilled labour as well.

(*d*) and (*e*) In these paragraphs (also in paragraph *f*) Mr. Wuthrich seems to assert that the difference between home and Swiss prices is either due to greed or inefficiency, or both. While this is as it may be, Mr. Wuthrich seems to forget that there is one great burden which British industry is carrying and from which Swiss industry is largely free, i.e., the cost of the war—heavy taxation for interest on war loans, for pensions and the like.

With regard to wages, Mr. Wuthrich says that these are as high in Switzerland as in England. Are the working hours and other conditions there those which would be acceptable to British trade unions?

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(*f*) Mr. Wuthrich suggests that the "saving" should be spent on local relief works, presumably only those on which no part of the money can be spent abroad. The inefficient results of employing mechanics, clerks, etc., on navvy work of this kind are notorious: they are in most cases quite unsuited for it, and naturally find no incentive to acquire such skill in it as they might. Instead, let us utilise not the "saving" only but the whole of the expenditure in employing both skilled and unskilled labour at its own job. If Bradford (for example) in this way provides work for Rugby workpeople, its "local" unemployment is in turn relieved (again by work at its own job) owing to the purchases of clothing, etc., which Rugby is thus enabled to make, and which Rugby is more likely to buy from Bradford than Switzerland would be. Can Mr. Wuthrich see no sense in this?

Both free trade and protection have their own protagonists; it may be remarked, however, that the world-wide free trade which made Great Britain the world's workshop is gradually ceasing to exist, and that Switzerland herself is not a free trade country.

Mr. Wuthrich is anxious that we should do nothing to impair our position as an exporting country. If our manufacturers can secure orders at home, this helps to keep their overhead charges down and assists them to compete abroad. On the other hand, to send orders abroad is obviously detrimental to the prestige of British industry—a good advertisement for the foreigner and a bad one for ourselves—whereas the very fact of preference being given to a British firm at a higher price inspires confidence abroad in the "value for money" reputation of British goods.—Yours, etc.,

JOHNSON AND PHILLIPS, LTD,
H. S. SHEPPARD, Secretary and Manager.

Charlton.

SIR,—In spite of his professed sympathies, Mr. Wuthrich's letter under the above heading in your issue of September 21st can only be regarded as an insidious attack upon the British manufacturer of electrical plant. That Mr. Wuthrich should use his utmost endeavours to further his company's interests in this country is only to be expected, but the thinly veiled inferences to be drawn from his letter are hardly such as will appeal to the average Britisher. Mr. Wuthrich is apparently very upset at having lost an important municipal contract for electrical plant (presumably the Bradford contract), but he should not let that irritate him—he is going to lose many more if only British buyers and manufacturers co-operate still more closely, as, fortunately, there appears to be every indication of their so doing. In those cases indefinitely cited by Mr. Wuthrich where British orders for electrical plant have been placed in Switzerland, one might easily inquire why the raw material has been ordered in this country. Purely as a *quid pro quo?* I very much doubt it! The true reason, doubtless, is because the materials in question were better or cheaper than could be obtained elsewhere, or perhaps both these reasons were deciding factors, in which case presumably such orders would continue to be placed in Great Britain. Mr. Wuthrich rightly reminds us that our prosperity is largely based upon our activities in the overseas markets, though at the same time he would, so far as possible, prevent our designers and manufacturers from gaining the necessary experience in connection with heavy plant supplied in Great Britain which would fit them for competing in the export markets. Surely Mr. Wuthrich does not really imagine that responsible British buyers and manufacturers are quite so foolishly shortsighted as evidently he would like them to be.

The life of this country depends upon its ability to maintain its manufacturing industries and to barter its products in exchange for foodstuffs and raw materials. For the maintenance of British industries it is obvious that all work which can be carried out economically within this country should so be done. It is not so obvious, however, that certain key industries must be maintained, no matter at what economical disadvantage. The dye industry in connection with chemical warfare is a leading example where the very existence of this country may depend at any time upon the possession of a large and well-organised chemical (chiefly dye stuffs) industry. The same position obtains with many less important industries, but which, while less important in themselves, are nevertheless essential to the safety and welfare of the country. The magneto trade in connection with aeroplanes is an outstanding instance of such. It is not too much to claim that all engineering trades are of the nature of key industries, as the existence of a manufacturing nation depends upon the skill and experience of its engineers. In the broad economical sense, therefore, no orders for goods should be placed abroad unless the home manufacturers have been given opportunities to reconsider their offers in the light of any foreign offers which may have been received, and even then orders should not be placed abroad unless the differences in prices exceed the amounts that would accrue to the State by way of direct and indirect taxes.—Yours, etc.,

Blackheath. S. AUSTEN STIGANT.

[Copies of Mr. Sheppard's and Mr. Stigant's letters have been forwarded to Mr. Wuthrich, who replies to them below.—ED.]

SIR,—Referring to Mr. H. S. Sheppard's letter:—(*a*) and (*b*), Mr. Sheppard has apparently not read the writer's letter in THE ELECTRICIAN of February 2nd last. The latter and the letter in your issue of September 21st must be read conjointly. Is he able to rebut the former, which largely deals with (*a*) and (*b*)? (*c*) We are glad to note that our statement to the effect that the big electrical manufacturing concerns are quite busy is not contradicted.

(*d*) and (*e*). Mr. Sheppard, in common with many people, imagines that Switzerland, as a neutral country, had no war expenses, and overlooks the fact that the whole of the Swiss army, and for a long period of time also the men over age, were mobilised and at the frontier, and that the burden of taxation reduced to a comparable status for both countries is in Switzerland just as heavy as in Great Britain.

Will Mr. Sheppard kindly inquire from British travellers who have studied Swiss manufacturing and labour conditions, and will then deny that the Swiss workman all-round lives under conditions which would be eminently acceptable to the British workman? The working conditions as imposed by the British Trade Unions are very much on a par with those existing in Switzerland. Socialist emissaries see to it that in the world of labour frontiers disappear more and more.

(*f*) If there were no unemployment in this country, and the same price difference between the Swiss and English tenders existed, the order would in all probability have gone to Switzerland. Unemployment is consequently the principal argument for retaining the order in this country. The saving which, therefore, would be effected by sending the order to Switzerland should consequently be employed exclusively to mitigate unemployment—we agree. This must be read in conjunction with the above statement to the effect that the number of orders which the Swiss factories could execute for the British market is extremely limited.

The Free Trade which made Great Britain the world's workshop is gradually giving way to the pronounced tariff items. Quite so! Such as the Overseas Trade Credits and Insurance Act, 1920, the Safeguarding of Industries Act, 1921, the Overseas Trade Credits and Insurance Amendment Act, 1921, the Trade Facilities Act, 1921, the resolutions by Government Departments, Railways, Public Bodies, etc., etc., that orders are only placed with firms who are on the King's National Roll, the intervention of the British Electrical and Allied Manufacturers' Association and of the Federation of British Industries and of the Institution of Electrical Engineers, etc., demonstrate that—and unemployment is still rising! Switzerland is to-day more a Free Trade country than Great Britain, and only closes the door to the avalanche of goods from valuta-poor countries, the duties otherwise imposed being extremely small.

We maintain our previous argument; most decidedly nothing should be done to impair Great Britain's position as an exporting country. Without a prosperous Great Britain, Switzerland will always suffer. The status of a prosperous Great Britain and a poor Switzerland could not possibly exist for any length of time. The interdependence of countries and the necessity of more and more equalising things in the various countries is unfortunately not yet widely appreciated. A British home market strongly protected against the foreigner would quickly deteriorate the skill of the British workman, the efficiency of the British machine, the capacity to compete in foreign markets both of the producers of this machine and of the users of same in the home country.

With regard to Mr. Stigant's arguments, in the introduction, of which he assigns to the writer a position something like that of a twentieth century Loyola, we have already stated that we consider a prosperous Britain to be a fundamental necessity for progress in Switzerland. This replies to every innuendo on the score of the "insidious" intentions of the writer, and we leave it at that.—Yours, etc.,

OERLIKON, LTD.
G. WUTHRICH, General Manager and Chief Engineer.

London, October 1st, 1923.

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Pushing Sales of Osram Lamps.

New Publicity Campaign Introduces the Osram Baby.

The annual Osram publicity campaign has always been characterised by some outstanding feature. We all remember the Osram elephant, the Osram bird, the Osram lion, and so forth. This year the human element has been introduced in the form of the Osram baby. This strapping youngster first made its appearance in the new Osram poster placed on the hoardings during the early days of September. This poster, illustrated below, possesses many obvious merits, not the least of which are its simplicity and pleasing colour effect.

This poster is already the subject of some controversy, the public being concerned as to whether the child is a boy or a girl; the publicity value of such discussions will readily be appreciated.

Twenty Thousand Posters.

We are informed that no fewer than 20 000 of these "Ray of Sunshine" posters are being used by the G.E.C. on their present campaign. These posters have been produced for the hoardings in two sizes, viz.:—16 sheet double crown (120 in. by 80 in.) and 8 sheet double crown (80 in. by 60 in.), and are now being shown in 250 different towns in Great Britain.

Reproductions of the same design have also been provided in the form of window bills and showcards for the use of resellers. By making the fullest use of these small reproductions the dealer has in his own hands an excellent means of linking up with the national posting scheme.

Another important feature of the Osram advertising for this season is a very comprehensive and far-reaching daily and weekly newspaper campaign, designed to carry the Osram story into the houses, shops, offices and factories of the whole nation. As with the posters, all these Press advertisements recommend their readers to purchase from their local dealers. Other means of publicity adopted in the new Osram campaign include displayed advertisements in magazines and society weeklies, on railway stations, in tubes and tramcars, on theatre programmes, by lantern slides exhibited at innumerable cinemas and theatres up and down the country, huge electric night signs in the West End of London and in provincial towns. No single avenue of approach has been neglected, and those responsible for the campaign seem likely to realise their object of reaching the public at every moment of its day, and in every change of its mood.

A very interesting campaign within a campaign was carried out on the eve of the change in daylight hours, when over half-a-million electric light consumers received from the G.E.C. a reminder to put their clocks back. This intimation was accompanied by a useful little souvenir in the form of an attractive blotter incorporating the new Osram baby design on the cover.

Assisting the Retailer.

The appeal to the user is but one feature of Osram publicity. Another with which we have to deal is the assistance which is rendered to the retailer, to enable him to turn the effect of the national advertising to his own account. Amongst the material supplied to the trade this season the most important item is probably the new complete Osram illustrated catalogue. This publication, a copy of which we have before us, is an entirely new departure in G.E.C. catalogues, not only by reason of the new method (litho off-set) which has been used for reproducing the very beautiful illustrations contained therein, but also because the catalogue itself contains a wealth of information and data regarding electric lamps and lighting, the like of which has probably never before been contained within the covers of any lamp catalogue issued in this country.

Overprinted Folders.

Following its normal practice, the G.E.C. have provided a variety of attractive folders, upon which they print the retailer's name and address without charge. These sales aids include a folder dealing with standard type Osram gasfilled and vacuum lamps, one dealing with the "White Osram" lamp, another describing the Osram Daylight Lamp, another dealing with Osram candle and Striplite lamps, and other special types, an attractive general propaganda folder illustrating the colours of well-known racehorse owners, and one of similar nature illustrating the colours of well-known football teams.

An Attractive Window Centre Piece.

There are, in addition, a large number of silent salesmen, amongst which is a window centre piece in the form of an attractive box sign showing a cut-out figure of the Osram baby in the act of switching on the light. We understand that these are supplied to dealers complete with lampholder attached, and with three yards of flexible cord and adaptor. The G.E.C. state that the best effect is obtained by the use of a 60 W "White Osram" lamp, and if a flasher is added, a most realistic impression of the Osram baby switching on and off is obtained. These pieces will be distributed to retailers upon application.

Attractive showcards and window bills in different shapes and sizes are available in almost bewildering variety, and enamelled iron swinging signs, enamelled window letters, cut-out coun ter

Our illustrations show (top) The New Catalogue; (centre) An Enamelled Iron Swinging Sign; (below, left) A Selection of Osram Literature, and (right) The "Osram Baby" Poster.

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cards and other such-like material find a place in the Osram aids to sales.

A Novel Osram Publication.

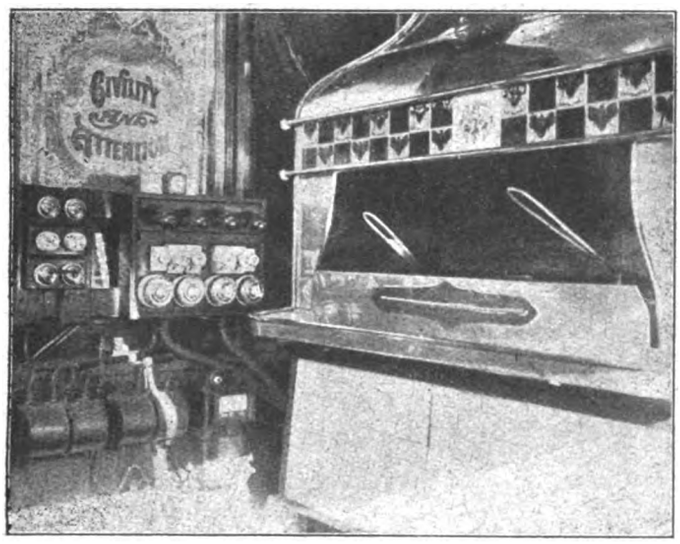
Reference may here be made to the "Osram Bulletin," a monthly paper full of interesting matter connected with the merchandising of lamps and lighting, which we are informed will be issued to all dealers in lamps throughout the lighting season, and which is intended to maintain the liaison between the makers of the Osram lamp and those who handle its sale. The first issue was published this week.

Novel Use for Electricity.

An Interesting Enterprise at Norwich.

In its supersession of other methods of supplying motive power, light and heat, electricity is frequently able to transform the frankly archaic to modernity and efficiency in a single step. Recently a London borough electrical engineer discovered in a corn chandler's establishment, a grinding mill operated by a horse in the approved mediæval fashion. An electrical installation quickly took the place of the horse to the satisfaction of all concerned.

From Norwich comes word of an electrically-operated chip potato cart, illustrated herewith, which affords municipal elec-



INTERIOR OF THE CART, SHOWING ELECTRIC RANGE AND SWITCHES.

trical engineers a further suggestion for increasing their load during the hours when little power is being used.

The chip cart stands in Norwich Market Place, where it is in operation from 7 p.m. to 11 p.m. daily, and from 11 a.m. to 11 p.m. on Saturdays. Fitted with pans supplied by the Jackson Electric Stove Co., this stall cooks between 28 and 29 tons of potatoes a year; the consumption of electrical energy being in the vicinity of 14 000 kWh. We understand that during the four years it has been installed only £1 has been spent on maintenance.

Concerts for Electrical Engineers.

Programme of the Electro-Harmonic Society.

As announced in the annual report recently, the Electro-Harmonic Society's concerts during the coming season will again be held in the Caxton Hall, Westminster, London. From the programme of entertainments just issued we learn that the season opens with a smoking concert on Friday, October 12th. Other smokers will be held on December 11th, January 11th, and March 14th, while ladies' nights have been arranged for November 9th and February 8th. For the benefit of members coming from a distance arrangements have been made for a limited number of cold meals in addition to the supply of the usual light refreshments—to be served on concert nights from 6.30 p.m. Intending new members may obtain particulars of membership from the hon. secretary, Mr. W. E. Lane, at 286, Finsbury Pavement House, London, E.C.2.

Japan's Duty-Free Imports.

Exemptions for Electrical Apparatus.

It is announced that up to March 31st next certain articles are to be exempted from Japanese import duties. The list includes materials for railway construction not specifically provided for in other parts of the Tariff; posts and other materials for suspending electric lines not specially provided for elsewhere; ampere meters and volt meters; watt meters; and telegraphic and telephonic instruments and parts thereof, not specifically provided for in other parts of the Tariff. Until the same date the duties on all motive machinery are to be reduced by half.

The Floodgates of Politics.

By Sir ERNEST J. P. BENN.

The political season has begun. The emporiums of the various parties have opened their doors and are busy announcing the special wares which they have provided for our delectation and consumption during the coming autumn and winter.

Political Influences on Business.

It used to be said that there were no politics in business, and there was a time when the business man could get along with his work, content to leave political questions until after business hours, but that day has definitely passed. It is now almost impossible to consider a business proposition without taking into account the political influences brought to bear upon it.

The next few weeks will witness a flood of political oratory destined to have its effect upon public opinion and upon parliamentary action, and every section of every political party has its own particular ideas for effecting changes in our commercial and industrial relations. In face of this avalanche of talk what is the business man to do, what is he thinking, what course should he pursue? These are questions which are causing great mental trouble to most of the business men of my acquaintance.

We can all agree that this discussion will do little immediate good to trade. A plant will not grow if its roots are dug up and examined every day of the week. The plant, however, will stand a better chance if the process is performed by someone with an elementary knowledge of gardening. That is the reason why business men must take more cognisance of political activity.

As there is no chance of banishing politics from business, the obvious and necessary, and indeed the only thing to do is to introduce a little more business into politics. Many business men make a deliberate boast of avoiding politics and refraining from reading political articles or listening to political speeches. Their reason—and it is good enough in its way—is that so much nonsense is talked that it is hopeless to deal with it. A bishop on the wages system for instance, is a thing you cannot argue with. But the trouble is that the general public listen to the bishop, and being almost as ignorant as he is, accept his conclusions.

A Task for Business Men.

I hold that for the present state of affairs the business man is very largely responsible. The public ignorance on business matters is abysmal, and will so continue as long as business men decline to apply the only remedy. They must come out into the world and into society and talk business. Business is an uninteresting topic. It concerns practical things. It involves practical work. It has none of the intellectual delights of a theoretical Utopia. But if the politicians insist on talking about it, then there is no alternative—they must be taught something about it.

Notwithstanding the difficulties, there are one or two very simple things that the business man must do, and that without delay. He can start on his own workpeople and his own staff. Through works committees, welfare councils, social circles, and other such machinery the great masses of the wage-earning classes of the country can be reached, and can be given what they can secure in no other way—a few elementary ideas of practical economics as applied to the class of economic problem which arises out of our own day-to-day experiences.

The Remedy.

The widespread notion that the business classes as a whole are not able to justify their position is an inference which is not altogether unfair having regard to the studied silence of business people about business matters. Economics in the abstract, discussed by the half-educated, with imperfect knowledge of the practical, constitute an overwhelming menace. The most effective defence is in the hands of the business man, and the community has a right to expect that he will no longer decline to apply it.

Electricity and China Clay.

New Electrical Appliances Installed at Fowey.

Fowey, the Cornish port which is the exporting centre of the china clay industry, has now an electrically equipped jetty, provided by the Great Western Railway Co., in order to meet the increasing demand made upon the facilities there. The opening ceremony was performed last Thursday by Lord Mildmay.

A movable electric crane has been provided to deal with china clay in casks or bags and china stone, but the clay in bulk will be handled by an electrical conveyor (see illustration on page 379), fed from a silo or receiving chamber by an inclined moving belt which carries the clay to a sufficient height above the jetty to enable it to be shot down in any of the holds of the vessel at any state of the tide without the ship having to be moved. This is accomplished by an ingenious combination of horizontal conveyors which take the clay backwards and forwards to any part of the jetty and thence into the vessel. The capacity of the electrical equipment is 1 000 tons per hour, as compared with two to three hundred tons a day under previous conditions. The jetty and machinery have cost nearly £300 000. Speaking at the opening ceremony, Mr. R. T. Smith advised the china clay producers to go carefully into the question of a scheme for securing cheap electric power in bulk for the industry.

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Wembley's Giant Power Station.

Forty Firms Combine in Joint Exhibit.

Work has now been started on the electric power station which is to supply the British Empire Exhibition next year at Wembley with both motive power and light. A large amount of current will be needed for lighting the numerous great buildings that are being erected, and for driving the machines, lifts, general services, and amusements to be installed.

The power station is itself to form one of the exhibits in the Electrical and Allied Industries Section of the Palace of Engineering. Visitors will be invited to inspect the station, and see for themselves what British firms have to offer in the way of plant for generating and supplying electricity. A special gallery is being built from which visitors will be able at all times to view the machinery at work.

The requirements of the Exhibition demanded a highly efficient generating plant, and the British Electrical and Allied Manufacturers Association, decided that the products of these firms could most effectively be displayed if seen actually working. The Association has accordingly assisted the consulting engineers in planning the power station on lines that will make it representative of some forty electrical manufacturing firms.

Power Station Equipment.

The power station will be situated on the Northern side of the Palace of Engineering. The main features will be three 1 500 kW turbo-generators of the most recent type, supplied with steam from two different types of water-tube boilers. Each of these generators will be the work of a different firm, and in the same way the condensing plants, air filters, rotary converters, transformers, cooling towers, switch-gear, batteries and so on, will be of varying makes. Never before in the history of electricity has there been installed in a single plant so heterogeneous a collection of machinery and apparatus. In spite of the variety of the makers participating, the whole will work together with perfect precision.

Additional Demonstrations.

For purposes of demonstration, a very important section of the industry is showing other forms of power producers. In the main hall, though not actually in the power station, there will be exhibited a slow speed steam set and a horizontal internal combustion set, each generating 300 kW. These will be run under load on stands, and will be coupled up to the body of the plant through panels on the main switchboard.

As our readers are aware, the whole of the electrical and allied engineering section has been organised by the B.E.A.M.A., and the area which it covers is the enormous one of 4½ acres. Into that space will be crowded exhibits forming a complete catalogue of the industries represented by the Association. With very few exceptions every branch of the industry is exhibiting, each branch being represented by a number of firms. Some concerns have taken as much as from 4 000 to 8 000 sq. ft. for their stands.

Electricity in the Home.

Over two hundred firms in all are participating in this section, and the result will be a spectacle full of interest and fascination to every class of visitor. Great engines of commerce involving the use of thousands of horsepower will be seen side by side with the most delicate forms of apparatus. The uses of electricity in the daily life of the average citizen will be demonstrated in a number of small exhibits of absorbing interest. Householder and housewife will both find endless little ways of economising, or of adding to their comforts in the home.

Municipal Tramway Accounts.

Improved Results at Ipswich.

The total revenue on the IPSWICH tramways for the year ended March 31st last was £43 299, compared with £44 528 in the previous year, working expenses were £39 420, against £44 735, and, after providing for interest and repayment of loans, the net result was a deficit of £3 193, against £7 367. Passengers carried were 5 541 339, against 5 552 849, and car-miles run 577 493 (550 703). Total revenue per car mile was 17·995d. (19·405d.) and working expenses, including power, were 16·383d. (19·495d.). The reduction in the last mentioned figure has doubtless done much towards bringing about the reduction of more than £4 000 in the net deficit, in spite of the fact that passengers were fewer and receipts lower.

Net Profit on Electric Cars and Motor 'Buses.

The ABERDEEN Corporation tramcars earned £184 868 during the year ended May 31st last compared with £184 618 in the previous year, and working expenses were reduced from £137 978 to £133 614, but interest, sinking fund, depreciation, renewals and special expenditure required £42 590, against £31 550, so that the net profit was reduced from £15 089 to £8 663. Passengers carried were 41 162 504, compared with 41 087 388 in previous year, and car miles run were 2 399 741, against 2 252 889. The motor omnibus department also showed an increased surplus for the year (£1 256, compared with £770), after providing for working expenses, interest, sinking fund and special expenditure. The surplus has been carried to renewal and reserve accounts. The motor 'bus revenue was £12 056, against £11 650.

Electrolytic Dynamo Regulation.

Automatic Control of Electricity on Automobiles.

The problem of fully and properly controlling the supply of electricity through the electrical equipment of a motor vehicle is a very complex one, and one which has hitherto not been solved in a completely satisfactory manner. The reason that the problem is complex is that the dynamo which supplies the current is driven by an engine, the speed of which is constantly varying, and at the same time has to deliver its supply to a battery which at one time may be fully charged and at another time almost completely discharged.

Evidently in the ideal system the rate of charge of the battery should be increased when the battery is in a discharged condition. The more fully the battery is charged the lower should the charging rate become, until, when the battery is fully charged, only sufficient current should be delivered to keep it in perfect condition. The problem is further complicated by the fact that practical considerations call for the elimination of delicate regulating mechanism which requires to be accurately adjusted and subsequently re-adjusted at more or less frequent intervals.

Faults of the Old System.

In the system now almost universally employed the problem of getting the dynamo to charge over the entire range of engine speeds has been solved. In current practice a dynamo is employed which has an auxiliary brush connected to a field coil. This gives the desired regulation at varying engine speeds without depending on mechanical contrivances which may get out of adjustment. Unfortunately, however, the three-brush dynamo, unless supplemented by some external controlling device, has a very bad fault. This is that when the battery is empty the charging rate is at its lowest, though it should be at its highest. When the battery is full the charging rate is at its maximum when it should be at its minimum. Thus, if the battery gets more or less exhausted, charging proceeds slowly instead of quickly. When the battery is full, current is wasted and the electrolyte is boiled away, the battery plates at the same time suffering deterioration.

Evidently what is wanted is a sort of electrical safety valve which will side-track the current when the battery is full, and as the battery becomes exhausted will gradually close until, when the battery is empty, all the current from the dynamo is being pushed through the battery and charging proceeds at a really good rate. This safety valve must also protect the system against the effects of accidental breakages or loose connections, which are dangerous because they have the effect of disconnecting the battery and sending a current of much too high voltage through the lamps, burning out the filaments.

The B.L.I.C. System.

The new B.L.I.C. system differs from any previous methods suggested as remedies for the fault explained above, inasmuch as it involves no mechanical contrivance requiring adjustment; it is in the nature of an electrical safety valve operating automatically. This electrolytic regulator consists of a number of small sheet steel compartments containing sheet steel plates immersed in an alkaline solution. The steel plates are connected in positive and negative groups, and the groups of plates in the various compartments are joined in series, exactly as are the plates in a battery. There are, for instance, six compartments in a regulator for governing a 12 V battery. The whole regulator weighs no more than a small fraction of the weight of the battery it controls.

When current is sent through a regulator of this kind, the effect is to decompose the water, liberating the hydrogen and the oxygen of which it consists. This process requiries a pressure of 2 V, so that six such cells in series require a pressure of 12 V.

The regulator is connected across the mains which lead from the dynamo to the battery. In other words it is in parallel with the battery. If the voltage of the battery is below 12 V, this is insufficient to start the regulator working and all the current goes to charge the battery. When the voltage rises above twelve the regulator begins to side-track some of the current, reducing the output of the dynamo and diverting some of this reduced output, so that the battery gets less current. When the battery is fully charged only a trickle of current passes through it, the rest of the reduced output of the generator being diverted through the regulating cells.

According to the claims made by the makers the only attention that the motorist need ever give to the regulator is to add water very occasionally. Even if the level of the water goes down considerably the regulator continues to function as long as a reasonable proportion of the surface area of the steel plates contained in it is immersed in the solution. The steel plates in the regulator are not acted upon chemically.

Electrical Power Engineers' Dinner.

The ELECTRICAL POWER ENGINEERS' ASSOCIATION (Southern Division) announces that the fifth annual dinner to the members of the National Executive Council will be held at the Hotel Cecil, Strand, London, W.C.2, on October 20th, at 5.30 for 6 p.m. Tickets, price 8s. 6d., may be obtained from Mr. P. Gordon Hieatt, 188, St. James' Road, East Croydon.

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Merchandise to Sell and Profit By.

***In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of* THE ELECTRICIAN.**

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

The "Steemkleen."

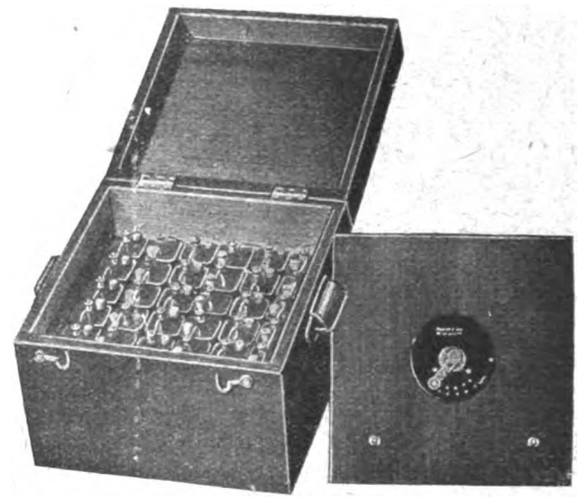
The meaning of the trade word "Steemkleen" is at once obvious. We illustrate an electric washing machine which will be welcomed by all who are interested in furthering the "electrical idea" in water boiling and electrical domestic labour-saving appliances. "You can save at least ten pounds of your housekeeping expenses every year by washing your soiled linen with a Steemkleen family washing machine. It washes quicker, cleaner, and you haven't any work to do yourself; the Steemkleen does it all for you." This is the message to thrifty housewives which forms the preface to an attractive folder published by the manufacturers, STEEMKLEEN, LTD. It is a message which will compel the attention of housewives

THE "STEEMKLEEN" WASHING MACHINE.

and the Steemkleen washing machine is a device which should be considered in a merchandising programme. Space prevents our quoting a full specification of many talking points and details. It will be an indication of the possibilities of the machine as a quick selling line if we mention that the complete outfit is listed at £10.

"Silvertown" Wireless Accessories.

It has been our deliberate purpose, through these columns, to inculcate in buyers the policy of "quality before price," and in no other department of electrical merchandising is this so necessary as in the "wireless" department. If any retailer makes the mistake of handling trumpery apparatus and accessories it will not be the fault of THE SILVERTOWN CO., who can offer the trade a comprehensive selection of parts built to a high standard of design. The price list which the Silvertown Co. recently published will reveal this. We illustrate the Silvertown No. 1700 high-tension primary battery. This unit consists of 36 No. 1638 small sack type Léclanche cells in ebonite containers, in a painted wood box with lid and commutator to bring into action 7, 14, 21, 28, and 36 cells, approximating 10, 20, 30, 40 and 50 V. The unit can also be supplied without the commutator, the cells being connected up to form one 50 V unit. The reputation of the Silvertown Co. enables them to claim that these batteries are thoroughly efficient. Dry cells hold the field in popularity for wireless work, but a good claim can be made for wet cells that they are cheaper in the end owing to their much longer life, which can be extended for many years. We



HIGH-TENSION BATTERY.

think, therefore, that in spite of the popularity of the dry battery a larger proportion of wet batteries could be sold to the public, resulting in increased turnover to the retailer.

Fuller Accumulators.

In another column announcing new catalogues published by manufacturers, we recently made mention of the new list No. 250A, published by FULLER'S UNITED ELECTRIC WORKS, describing in detail, and with prices, their "Block" type and standard plate type accumulators. This list is of particular importance to retailers of this class of merchandise and to other buyers of accumulators, because the list contains a variety of types which will practically cover every field. We referred recently to the possibilities of business in wet cells for h.t. wireless work, pointing out that while the dry battery was the first favourite, increased turnover could be secured by pushing and developing the sales of the wet cells. Fuller's offer a 30 V h.t. battery using their "Block" batteries at a list price of £1 10s. They claim that it will give approximately six months' service on one charge and can then be re-charged for a few pence. The further fact that Fuller's claim that with ordinary care the battery will last about ten years in normal service is a strong lever to justify the increased price.

A Novelty by Best and Lloyd.

We illustrate the No. 21 910 "Best" Quick Grip Fitting which is one of a range just placed upon the market by BEST AND LLOYD. The idea underlining the fitting is not new, because similar fittings

THE "BEST" QUICK GRIP FITTING.

in much cruder designs and with many disadvantages have been on the market for some three years. It is characteristic of Best

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and Lloyd that they have evolved a fitting that has all the atmosphere of the Best and Lloyd line of fittings. The design is novel, but it loses none of its practicability through being novel; further, both the fitting and the glass employed are artistic. Space will only allow us to illustrate one fitting; this particular fitting is made for 9-in. bowls, and these latter can be supplied in a number of variations such as an ordinary plain opal, and also more expensive bowls which vary in price according to the finish and design. Undoubtedly there are many situations where this fitting can be installed. Until a year or so ago this style of fitting was very popular but the market was spoilt by the crude designs of the fittings; the "Best" quick grip fitting is quite different.

A Tucker Line.

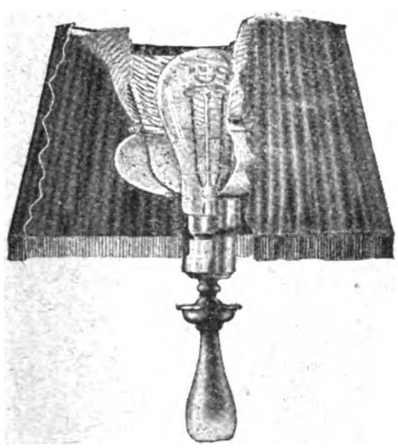
With the approach of the autumn and winter there will be a natural interest in business in the installation of fires and radiators. The choice of the fire must, of course, always be made by the domestic buyer, but so far as the necessary complement equipment

AN INTERLOCKED SWITCHPLUG.

is concerned buyers are very much guided and advised by the contractor. Particularly does this apply to the combination switch plug and it is on this detail of the installation that many contractors damage, or even lose, their reputation for good work. The usual argument put forward is that competition on the job is so keen that something must be "cut," but it is the most unsound practice to instal cheap switch plugs. The trade does not want for many good lines, and included in this category is the TUCKER 10A interlocked combined switch and plug which we illustrate. The switch portion of this combination is fitted with an earthing terminal which is important for radiator work because it enables them to be earthed, which is of vital importance when used in bathrooms, conservatories and other damp situations. The plug has a third pin, which, in addition to locking the switch effectively when in the "on" position, acts as an earth connection.

The B.T-H. "Eye-Restolite" Lighting Unit.

We may be forgiven for referring again to the "Eye-Restolite" manufactured by the BRITISH THOMSON-HOUSTON CO., because we feel that in this device the contractor and retailer has a business-pulling item of merchandise. It is not the purpose of this note



B.T-H. EYE RESTOLITE.

to enlarge on the technical details of the device, but rather on the fact that it is a necessity for every showroom to have a demonstration sample. So far as domestic lighting is concerned the market has nothing much to offer other than the usual commonplace range of electroliers and brackets, and the "Eye-Restolite" is undoubtedly a merchandising line "that is different." We should also mention a fact that is not at once obvious. That fact is that the unit is supplied separately, that is to say, without the floor standard or the table standard. Hence it can be fitted to any stock line without having to lock up further money in stock for the complete standard. If we could leave aside for the moment the turnover to be achieved with the "Eye-Restolite" the adoption of one in the showroom will make it the most up to date in the neighbourhood. The British Thomson-Houston Co. not only offer this excellent selling line to the trade, but they also offer to supply a quantity of overprinted folders (L. 272) which can be used for a sales boost. Our illustration shows a sectional view of the unit.

Shop Window Lighting.

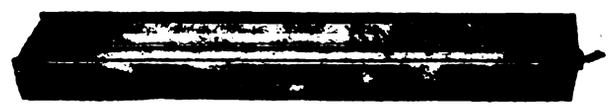
In hardly any branch is the growth of better lighting ideas so intense as in shop window lighting. All concerned are devoting particular attention to this field of development. Supply companies are doing their part by offering special rates for "after dark" window lighting, and manufacturers continue to place new

A "GECORAY" REFLECTOR.

apparatus upon the market or improve upon established and popular lines; and the E.D.A. continues to publish forcible publicity. It is of interest, therefore, for us to comment upon the new range of reflectors which the GENERAL ELECTRIC CO. recently placed upon the market. They have been christened "Gecoray." These reflectors are of best quality crystal glass with scientifically designed contours to give a correct distribution of the light, and they are fluted to aid diffusion. The reflecting surface is double plated with pure silver, backed with a heavy deposit of pure copper elecro-plated on by a special process which assures the permanency of the silver. The reflectors are green enamel on the outside and stoved at 200 deg. F., which gives a permanent finish. A reflector typical of range is shown above.

"Linolite."

We illustrate a "Linolite" portable showcase fitting which is manufactured by A. W. BEUTTELL, LTD. There are many situations where a compact fitting of this design will be found useful because many windows and showcases have narrow frames which prevent



PORTABLE SHOWCASE FITTING.

the adoption of any reflectors that have to be screwed to the woodwork. The fitting forms a complete unit consisting essentially of a stout metal casing with a fluted silver glass reflector. As a complete unit it is quite portable and four cushioned feet allow it to rest firmly and safely on a glass showcase or shelf.

Merchandising with Imagination.

The sale of such a "bread and cheese" line as lamps is so much a part of the daily routine that it becomes automatic and but little imagination is used to develop lamp sales. If at any time the contractor or retailer does pause a moment to visualise the future development of his sales, it can be accepted that, speaking generally, the vision is limited to the sales of the ordinary vacuum and gasfilled lamps with clear bulbs. Possibly this has been the fault of the manufacturers because until now there has been but little else to offer, although, of course, we are aware that frosted lamps could be supplied as an alternative. It has, however, been accepted that frosted lamps are not always satisfactory, and no doubt this is the reason why they have not been used much more extensively. With the advent of the White Mazda lamp there opens up a new field for sales, because this new style of lamp will undoubtedly make a great appeal to domestic buyers. We must make it clear that the White Mazda lamp is not an ordinary Mazda lamp with the well-known frosting. The process employed gives the lamp bulb a porcelain-like enamel and is quite permanent.

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The Broadcasting Committee's Report.

New Licensing Scheme to be Adopted: Constructors Not to Use Foreign Parts.

The Report of the Broadcasting Committee issued on Monday as a White Paper [Cmd. 1951, 9d. net] was accompanied by a statement by the Postmaster-General outlining a new scheme agreed upon by the British Broadcasting Co. and himself. Some of the main features of both documents are given below.

The Committee's Report.

The Committee's conclusions and recommendations are summarised as follows:—

(1) That broadcasting is of great value for purposes of instruction and entertainment, with great potentialities, and that it will be in the public interest to encourage its development, under adequate control, and to facilitate its use for a wide variety of services.

Existing Scheme.

(2) That the existing scheme was based on an arrangement between the manufacturing industry and the Government, under which the manufacturers were to undertake to provide and maintain a satisfactory broadcasting service, financed partly out of tariff payments on manufactured apparatus and partly out of licence fees to be paid by listeners and collected by the Post Office: in return for the liabilities thus undertaken it was to be a condition of the licence that apparatus of foreign origin (with certain exceptions) should not be available for use under the scheme—this to be insured by the use of apparatus marked "B.B.C."

(3) That the scheme was successful in securing the establishment of a broadcasting service of considerable merit—which, having regard to the many difficulties they have had to contend with, reflects great credit on the enterprise and ability of the British Broadcasting Co.—and partly successful in insuring that the demand for receiving sets during the initial period should mainly benefit British manufacturers who had established the service.

(4) That the scheme has broken down in certain respects, largely owing to the unforeseen facility, cheapness and popularity of the construction of home-made sets.

(5) That the consequent difficulties cannot be overcome by any system of marking component parts either "B.B.C." or "British Manufacture."

(6) That the system of marking apparatus and deriving revenue for the broadcasting service from royalties on such apparatus gave the company a privileged position; we have had no proof that they have made any improper use of it; but the system is open to objection from several points of view, and should be abandoned as soon as possible.

Recommended Scheme.

CONTROLLING AUTHORITY.—(7) That a Broadcasting Board should be established by statute to assist the Postmaster-General in the administration of broadcasting and to advise him on important questions concerning the service.

OPERATING AUTHORITIES.—(8) That the broadcasting service should not be operated by a Government Department, but that those entrusted with the service should work under Government licence.

(9) That it is desirable that the operation of the existing service by the British Broadcasting Co. should be continued for a definite period, subject to agreed modifications in the Company's licence, but that, subject to existing rights, the Government should keep its hands free to grant additional licences, and should consider various alternatives for the operation in the future, either by the Company or by other authorities, of local or relay stations in addition to large stations.

FINANCIAL PROVISIONS.—(10) That no part of the cost of broadcasting should fall on the taxpayer, but that the Government should not endeavour to make a profit on the administration of the service.

(11) That the bulk of the revenue required for the service should be obtained from the receiving licence fee, which should be retained at 10s. a year, subject to consideration of a reduction in the event of more revenue being received than is sufficient to carry on an adequate service.

(12) That instead of 5s. as much as 7s. 6d. out of the 10s. fee might be allocated under any new scheme to meet the cost of broadcasting, subject to a sliding scale under which the payment per licence would decrease as the number of licences increased.

(13) That certain supplementary sources of revenue should be the subject of early consideration.

CONDITIONS OF RECEIVING LICENCES.—(14) That in place of the present broadcast and experimental receiving licences a uniform and simple type of licence be issued and placed on sale at Post Offices without any formalities containing a clause forbidding improper use of back-coupling on pain of withdrawal of the licence, but no other limitation on the apparatus allowed to be used.

(15) That effective measures be taken to enforce such a licence, and that certain additional statutory powers be obtained to strengthen the Postmaster-General's hands.

Application of Recommended Scheme.

(16) That the immediate application of the recommended scheme is most desirable.

(17) That in consideration of the recommended modifications in the existing Agreement, the British Broadcasting Co. should be given an increased share of the receiving licence fees and a two years' extension of their own licence, on modified terms, if they will agree to the immediate application of the scheme, and to certain alterations in their Articles of Association, but with retention of the limitation of dividends.

(18) That the Committee is unable to make any recommendation on the desire which has been expressed for the protection of the manufacturing industry against foreign competition, feeling that, although it was an object of the existing scheme, it must be left to be dealt with by Parliament as part of the fiscal policy of the country.

Wave-Lengths and Hours.

(19) That arrangements be made for the greatest possible extension of the existing broadcast band of wave-lengths (350 to 425 metres), preferably by the allocation of a band from 300 to 500, excluding 440 to 460 metres.

(20) That all possible steps be taken to protect the band allocated to broadcasting from interference by other services.

(21) That the present restriction of the hours of broadcasting be removed, thus enabling additional facilities to be provided.

Programmes.

(22) That the British Broadcasting Co. have achieved a large measure of success in gauging the public taste and providing satisfactory programmes.

(23) That there should be a gradual extension of the broadcasting of news, under proper safeguards, and that more latitude should be given for the broadcasting of special events without regard to the hour.

(24) That the Postmaster-General should remain the final arbiter when any question is raised as to what kind of matter may or may not be broadcast.

The P.M.G.'s Statement.

After re-capitulating the causes of the wireless deadlock, the Postmaster-General's statement says that in order to recognise the Broadcasting Co.'s rights under its agreement, and at the same time to meet the views of the Committee as far as immediately practicable, the Postmaster-General has agreed with the Broadcasting Co. that a constructor's licence should be issued for a limited period at an annual fee of 15s. (as compared with the fee of 10s. charged for the B.B.C. licence). The additional 5s. for the constructor's licence is justified because otherwise the constructors would be obtaining the benefit of the Broadcasting Co.'s programme without making a proportionate contribution to the expense.

Foreign Parts Banned.

The company has agreed to this arrangement on condition that the licensee gives an undertaking that, in constructing his apparatus, he will not knowingly use parts manufactured elsewhere than in Great Britain or Northern Ireland. In all the circumstances, and especially having regard to the unemployment which at present exists, and which would be accentuated by the importation on any considerable scale of wireless receiving apparatus from abroad, the Postmaster-General has accepted this condition.

Interim Licences.

There are, however, probably 200 000 persons already in possession of unlicensed receiving apparatus, and, as the Committee point out, these persons are paying nothing towards the cost of the programme, because in the past there has been no licence applicable to them. A special interim licence will be issued at a fee of 15s. covering their present apparatus, whether made or purchased and wherever made or purchased, which will be granted to them provided that they apply for licences before October 15th. No charge will be made for past use, and no proceedings will be taken in respect of past use, if the licence is taken out before October 15th. Constructors' and interim licences as above will be placed on sale at all head and branch post offices and certain sub-offices on and from October 4th.

This system of licensing will be continued for an interim period expiring on December 31st, 1924, after which it will be possible for the single form of licence recommended by the Committee to be introduced, without any condition as to the marking or origin of the licensed apparatus, if it should be then thought desirable. Out of the fees of 15s. for the constructor's licence and 10s. for the B.B.C. licence, the company will, if the House of Commons agrees, receive 12s. 6d. and 7s. 6d. respectively, instead of 5s. per licence which they receive under the existing scheme.

Royalties to Continue.

The Postmaster-General is not satisfied that even with the increased contribution from licence fees the revenue of the company will, for some time to come, be sufficient to provide adequate programmes without a substantial contribution in the form of royalties on the sale of sets by the manufacturers who form the company. Hence he has stipulated for the continued payment of such a con-

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tribution, but on a reduced scale. The reduction will be approximately 50 per cent., except in the case of crystal receiving sets, where it will be considerably more. This reduction should enable a cut to be made in the cost of receiving sets.

The proportion of the licence fees receivable by the company will, after December 31st, 1924, be placed on a sliding scale, based on the number of licences on the one hand and the cost of maintaining an adequate broadcasting service on the other hand. Any surplus profit accruing to the company over and above 7½ per cent. on its capital and a necessary reserve for depreciation, etc., of plant and machinery will be surrendered to the Post Office; in other words, the profits of the company are limited to 7½ per cent. upon its capital.

The existing experimental licence, at an annual fee of 10s., will continue to be issued from the General Post Office to persons who are able to satisfy the Postmaster-General that they desire the licence for *bona fide* experimental purposes and are qualified to conduct experiments and who sign a declaration to the effect that they will not use the broadcast programmes except for experimental purposes.

The basis of membership of the Broadcasting Co. will be extended so as to include dealers, with suitable representation on the board of directors for the new membership if it becomes at all substantial; and the deposit of £50 now required from members will be abolished. The licence held by the company will be prolonged, on suitable conditions, to the end of 1926, as recommended by the Committee.

If the company supply a satisfactory service and are willing to erect additional stations where the Postmaster-General may consider them necessary, he will not license any other broadcasting service during the interim period up to December 31st, 1924.

Competing Services.

After that date, if the Postmaster-General should consider it desirable that additional stations should be established in any town or district where the company's service is not adequate, and if the company is not prepared to provide such stations, the Postmaster-General reserves the right not only to licence other organisations to do so, but also to give them an appropriate share of the revenue arising from new receiving licences in the district in question. He also reserves the right to licence other services (without regard to geographical area) without withdrawing from the company any part of the licence fees to which it may be entitled. In either case, he reserves the right to allot suitable wave-lengths to the new organisation, while taking all reasonable steps to avoid creating interference with the company's services.

An Advisory Board.

The Postmaster-General proposes at an early date to appoint an Advisory Board, as recommended by the Committee, to assist him in all important questions relating to broadcasting.

Electrically-Equipped Liners.

Installation on the S.S. "Minnewaska."

Electricity renders useful service in almost every branch of the interior working of the Atlantic Transport Co.'s new liner, the "Minnewaska," which has left London on its second trip to America. The electrical installation comprises four 400 kW turbo-generators, and there is an emergency 75 kW dynamo placed at the stern high above the water line. All the principal engine-room auxiliaries are electrically driven, and there is an electric lift from the engine room to the boat deck for the use of the staff. On page 379 we illustrate one of the turbo-generators, and a ½ H.P. electric cake-mixer, and there is also a view of the main switchboard.

Thirty-six electric winches deal expeditiously with cargo, and on the bridge, from which the electrically operated water-tight doors can be controlled, is an elaborate loud speaking telephone installation, in addition to the ordinary telephone system.

In the kitchens the electrical appliances include bread and pastry ovens, dough mixing machines, toasters, griddle plates, mincing machines, salamanders, potato peelers, knife cleaners and dish washers. The kitchen staff is firmly convinced of the many advantages of electricity, and a representative of THE ELECTRICIAN was not surprised to hear from the head baker that in a long experience he had never been able to find anything to compare with his electric oven.

Electricity Joint Industrial Council.

Fixing Rates for Grade 2 Undertakings.

A meeting of the Joint Industrial Council, No. 7 East Midland area, for the electricity supply industry was held in Nottingham on September 27th, Mr. W. H. Gilkes presiding. The question of fixing rates for grade 2 undertakings was referred to the anomalies committee for them to consider and report upon. The question of reprinting the schedule with revised rates was also referred to this committee. The names of Messrs. F. Hardy (Mansfield) and A. Lewis (Kettering) were added to the employers' panel of the anomalies committee.

The District Joint Board, dealing with technical staffs, also met. The board considered the report on the training of electrical power engineers, which it approved of in general, leaving it to their representatives on the National Joint Board to consider in detail.

Austrian Electrical Trade.

Possibilities for British Exporters.

During 1922 Austria imported most of her requirements of electrical machinery apparatus and parts from Germany, while the bulk of her exports under this heading went to Poland.

In his report on the industrial and commercial situation of Austria to August, 1923 [H.M. Stationery Office, 2s. net] Mr. O. S. PHILLPOTTS, Commercial Secretary to H.M. Legation, Vienna, shows that of the 2 075 tons—value £459 800—of electrical goods imported during 1922 only 1 ton came from the United Kingdom. Exports totalled 11 528 tons, valued at £2 172 300, of which 380 tons—value not stated—came into the United Kingdom. Our imports included 244 tons of electric lamps, etc., 12 tons of other electrical apparatus, 24 tons of telephones and microphones, and 59 tons of carbons for electrical purposes. An appendix giving the percentages of full production in various industries in May of 1921, 1922 and 1923, respectively, gives 50, 80-90, and 66-70 as the percentages of what is described as the electro technical industry.

The Stability of Austria.

Regarding the desirability of opening up trade with Europe and particularly with Austria, the report reiterates the views consistently set out in our contemporary "The European Commercial" during the last twelve months. It is hoped, states Mr. Phillpotts, that after reading the report, British business men will decide that the present Austria now affords a more secure basis for commercial operations than is found in a great part of the rest of Europe, and that they will make use of this to extend British trade not only with Austria itself but also with the much larger area which can be approached most safely and easily through Vienna.

Exploitation of Water Power.

Some progress has been made, the report states, with the exploitation of Austrian water power, which it is hoped will some day enable the coal imports to be much reduced. Ten large works yielding together 22 660 H.P. were completed by the end of 1922; 30 other large works with a total of 211 000 H.P. are being proceeded with. Of these, nine of a total of 34 000 H.P. were begun during 1922; 900 small stations of less than 500 H.P. each are also being built or planned. Lack of capital is delaying the progress of most of the larger works, which are being carried out under the patronage of the provincial Governments.

The electrification of the State railways in the west of Austria is also delayed for the same reason, but it is hoped that electric traffic will be commenced on the first stretch from Innsbruck to Landeck before the end of the year. The first of the new locomotives required have already been completed by local firms.

The attempts made to induce foreign capital to invest in the development of Austrian water power have so far not been successful.

Electrically Propelled Barges.

An Interesting Demonstration at Kidderminster.

The electrically driven barge at Kidderminster which was described in a recent issue of THE ELECTRICIAN, was inspected last Friday by the Executive Committee of the National Council for Inland Waterways.

The party, which included Mr. P. J. Hannon, M.P. (chairman), Mr. A. J. Butler, Esq. (Staffs and Worcs Canal and Severn Commission), Mr. Cyril Lloyd, M.P., Colonel Saner (Weaver Navigation), Sir S. Humphries (Port of Bristol), Colonel Mayner (Trent Navigation), General Long (Lever Brothers), Messrs. E. Manning Lewis (Sharpness New Docks and Birmingham Worcester Canal), C. F. Jones (Fellows, Morton and Clayton), W. H. Bowater, G. Fisher and others, were taken for a trip over the electrified length, and expressed their approval of the system, particularly with the flexibility (the reversal test from full speed ahead to full speed astern occupying 18 seconds). Demonstrations of the ease with which the barge releases itself from a mudbank after being driven on full power were witnessed.

On the return journey the departure was delayed for a few minutes to allow a heavily laden barge with a tinplate cargo to pass through the lock and accept a friendly tow over the whole length of the electrified portion, this procedure being heartily approved by the horse. The Committee later held a meeting in the Kidderminster Town Hall.

No Light Matter.

Amusing Experience of a Charge Engineer.

In an amusing article describing a visit to a power station at night, "W.C.S.," of the "Evening News," renders homage to the charge engineer, and offers the following anecdote as a specimen of the weighty problems with which he is apt to be faced:—

"I must see the engineer-in-charge!" said an agitated woman at the power-house door one evening.

"What do you wish to see him about?" asked the porter. But she was not to be put off, and, as her distress was very real and she appeared to be on the verge of tears, the porter begged the charge engineer to see her.

"You *are* the engineer-in-charge?" she asked. "I am," he replied. "Oh, you must come to 34, ——— Street, at once, please," she pleaded. "The sitting-room light has fizzled and the whole house is in darkness!"

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Prospects of the British Electrical Industry.

Mr. Hugo Hirst Peeps into the Future.

At the request of the Federation of British Industries, Mr. Hugo Hirst, Chairman of the General Electric Co., has broadcast from the London station of the British Broadcasting Co. his views on what the electrical industry is to-day, and what it is likely to become in days to come. The salient portions of his address are given below.

Some fifteen years ago the phrase " Electricity is in its infancy " was abolished. It was said that when an industry employs hundreds of millions of capital, some hundreds of thousands of workpeople, when it lights our cities, drives our trams, cooks our food, warms our houses, and is beginning to be used for every kind of industrial and domestic purpose, it is no more in its infancy. To-day I am more convinced than ever that electricity is still in its childhood. All the work we have done so far appears to me preparatory ; fresh signals flash up in all directions and illuminate new roads which we have to pace.

Are Lamps Essential for Lighting ?

When speaking of lighting, we still think of lamps. Why ? Just as the first steam engine was a stage coach driven by steam, and the first motor-car was designed to look as near as possible like a private carriage, so it has happened with the lamp. It is the outcome of an evolution which has brought us from the candle and the oil lamp to the gas lamp, and from the gas lamp to the electric lamp. Standards and fittings to hold these older forms of lighting were in existence, and we still continue to adapt the old form to the new medium. But the world does not want lamps ; it wants light, much more light. We want streets not lit with lamps that obstruct traffic, but supplied with a good substitute for daylight. We aim at better lighted shops to show the goods, but not to hide them behind glaring filaments which blind the eyes.

A Substitute for Daylight.

The electric lighting of vehicles, the lighting of houses, of theatres, of the stage, of picture galleries, of cinemas, of factories and churches, will all require individual study and development. Illuminating societies have been formed to solve this problem ; big electrical firms have created illuminating departments, manned by the best scientists, in order to develop these ideas, which are not purely an electrical problem. To light properly, say, a hoarding of posters or the front of a building, or the interiors referred to above, architects, builders, artists and scientists will in due course have to collaborate to obtain the effect aimed at, namely, a substitute for daylight. It may affect the style and construction of our buildings, the colours and materials which we are using, and all kinds of questions not yet thought or dreamt of. All these effects can be achieved by electricity, not necessarily by lamp bulbs ; it may be by tubes, it may be by lighting by gases without filaments or many other ways which the visionary can conceive, but which are still to-day in the realm of investigation and research, and many years will elapse before a definite solution is reached.

Cheaper Electric Power.

Equally revolutionary will be the development of power. We pride ourselves to-day on building 40 000 kW units for power stations, and it is encouraging to know that stations of this magnitude are being supplied by our manufacturers to-day even to the United States in spite of high tariffs and the strongest American competition. We pride ourselves on the application of electricity to every form of transport. Even motor-cars and aeroplanes could not have developed as they did but for the magneto. We use electricity below the surface to crush ore and cut coal ; by electric haulage we raise millions of tons to the surface, and electric pumps prevent the mine from being flooded. We pride ourselves on the progress made in many industries through the application of electricity. Electric current moves a 20 000 H.P. motor to roll a steel plate and hundreds of thousands of smaller motors to run tools of the most varied description, down to the domestic sewing machine or dentist's drill.

Task of the Electrical Engineer.

But what is being done is a mere tithe of what could be done. Until every farmer can tap the electric current and sow, reap, thresh and cut, the task of the electrical engineer is not completed, and this again is not merely an electrical problem. In my opinion two factors are required to bring us to this ideal state—cheap production of power and cheaper electrical distribution. As regards cheaper distribution, my hopes are running very high. It is only a few years ago that Dr. Fleming invented the electric valve, and to-day already the British Post Office has realised that by inserting this valve in its circuits throughout the country it can save from 70 per cent. to 80 per cent. in cables. What is to-day possible with small currents required for telephone service may conceivably, in some way or other, be possible some day in connection with big power plants.

As regards power, we pride ourselves on producing a unit at a farthing, and in some countries one-eighth of a penny, in certain big power installations, but it is produced by having steam, petrol, gas, or water power as its prime mover. Some day it should be practicable to harness the tides on a large scale or to transform coal more economically into electricity, and some day we shall understand better how to use the enormous forces released by high explosives, or by some new mixture of gases. Some engines may be constructed of immensely greater horse power and efficiency. That would indeed cheapen electricity, and make its service accessible to all, even the poorest.

Whilst some of these aims may seem visionary, we must not forget that only quite recently that great British scientist—Sir Joseph Thomson, of Cambridge—has revolutionised all our ideas regarding the universe by demonstrating that all matter consists of electrically charged particles held together by extremely powerful electrical forces, and that under certain conditions this energy can be liberated. To do this, however, requires the application of electrical forces of very great intensity. Before we can hope to succeed in devising means of liberating this energy for use on a commercial scale we must discover a method of producing really cheap power. True, in the present state of our knowledge, this may seem a fantastic dream. But should it prove practicable, it might mean the artificial production and transmutation of the elements. And who, on looking back over the amazing discoveries of the last century, will dare to say that this will never come to pass ?

The Universal Electric Home.

But long before this period arrives the electric home will be universal. The electric home has been kept back because power is still dear, and it can equally be said that power is still dear because the electric home has not yet come. I have lately read of an attempt to train domestic servants for their calling. I know of no better course for servants than a short engineering course to make them fit for the electric home. Already to-day the application of electric heating, cooking, driving of sewing machinery, washing machinery, and all sorts of domestic appliances has become widespread, but the time will come when, just as in the factory all manual work is being done by electrically driven machinery, so in the household all manual drudgery will be eliminated by the turning of a switch.

The Domestic Appliance Field

All this small domestic apparatus from the fan to the flat-iron and the vacuum cleaner consumes but little current. To-day there are millions of families in this country to be supplied, and the satisfaction of those demands would mean not only a prosperous electrical industry, but it would create such a demand for electric current that all power stations would have to be increased. This would not only give an impetus to the development of engineering, but by leading to a decrease in the cost of electricity would result in still greater development.

Wireless Possibilities.

From the transport of men and goods by electricity we come to the transport of words and thoughts. The telegraph and telephone service throughout the world, with the exception perhaps of America, has been retarded in its development owing to the war, but here the same evolution from one process to another is taking place. Before the ideal system of automatic exchanges is evolved I am certain wireless will step in, and all development will have to start afresh. All these improvements tend to quicken and cheapen communication ; but they all require time for research, courage for enterprise, and time and capital for development.

There is no reason why, in a very few years' time, a King's Speech, an important debate in the House of Commons, a patriotic appeal, or a good opera, market quotations, or sporting events, should not be simultaneously broadcast and heard in Australia, India, and all through the British Empire. Through electricity our hearts beat with one throb ; we share, in spite of the distance, the same pleasures and the same sorrows, the same ideals and emotions simultaneously. Electricity, like nothing else, provides the means to knit together our far-flung Empire, and to annihilate the handicap of distance between its various parts by shortening the distance of travel for men and goods, by transmitting quickly the thoughts of one part of the Empire to the homes of all.

Support Home Industry.

Electricity permeates every activity of our life, every industry, and every home. Is it worth while that such an industry should be supported ? Without strong British industry the material and moral forces of our Empire will suffer—with its help they will be strengthened. Every order that goes abroad strengthens the foreigner and weakens the home producer. Every article made abroad improves the skill of the foreign artisan and adds to unemployment at home. Every order going abroad cheapens the price of the foreign article and increases the price of the home-made article. Every order placed at home helps employment and helps industrial, social, and political independence.

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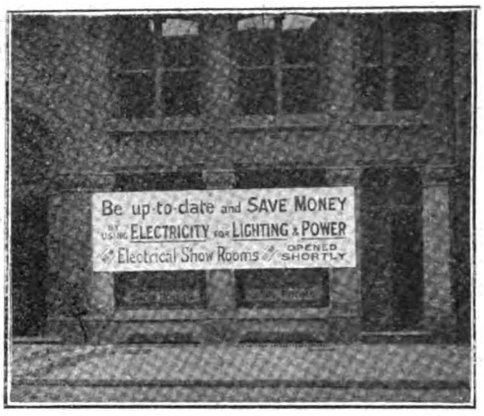
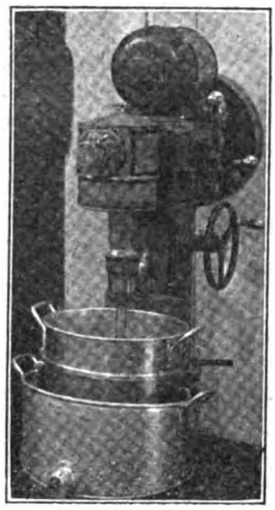
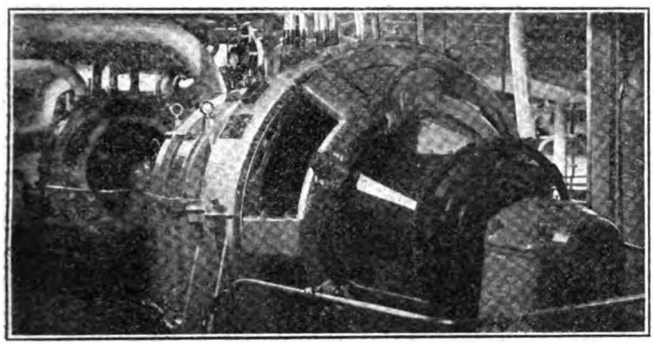
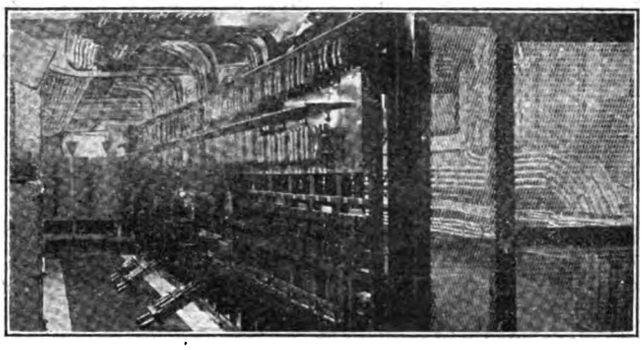
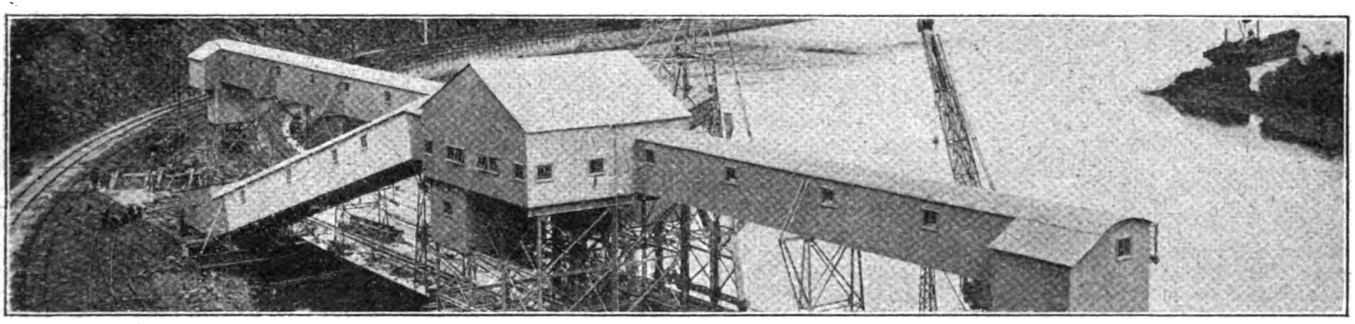
Electrical News in Pictures.

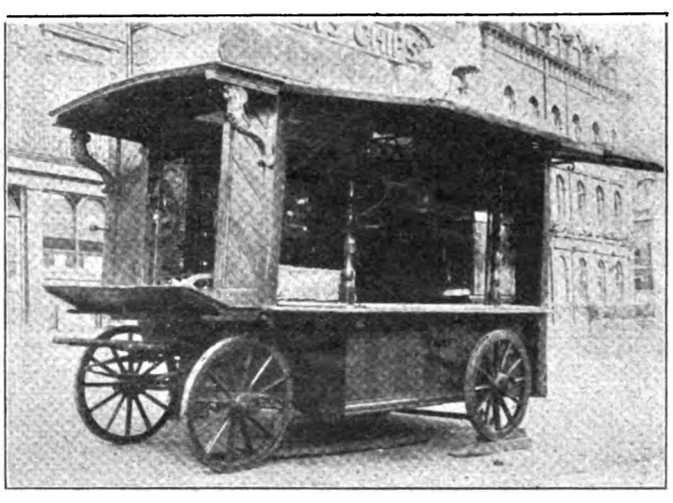












TOP: (1) *The late Mr. J. A. Phillips, of the B.T-H.* (*p.* 380); (2) *The opening of new electricity showrooms affords opportunities for publicity at Birmingham.* (3) *An electrical cake mixer on board the s.s. "Minnewaska"* (*p.* 377).
SECOND ROW: (1) *A turbo-alternator set and* (2) *the main switch-board in the engine-room of the "Minnewaska"* (*p.* 377).
BELOW: *A view of the electrically equipped jetty which has been installed at Fowey to facilitate the shipment of China Clay* (*p.* 372).
BOTTOM: (1) *Mr. Hugo Hirst broadcasting from 2LO on the Future of the British Electrical Industry* (*p.* 378). (2) *An electrically equipped chip potato cart at Norwich* (*p.* 372).

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E.D.A. Slogan Competition.

The Prize Winning Suggestions.

The special committee appointed by the Electrical Development Association to adjudicate in the recent Slogan Competition has now completed its work. Nearly 2,000 slogans were submitted by 194 competitors, and the following phrase has been selected as most closely meeting the requirements :

"Just Touch That Switch."

The first prize of £10 was awarded to Mr. E. A. Joyce, The Cherubs, 68, Englewood Road, Clapham Common, S.W.12, for "Just Touch that Switch." The choice of "Electrify and Troubles Fly" brought the second prize of £5 to Miss M. I. Dewdney, 3, Cranbrook Park, Wood Green, London, N.22 ; while the third prize of £3 went to Mr. A. C. Bostel, Electricity Showrooms, 3, Park Lane, Croydon, for suggesting "The Right Way—the Electric Way."

The task of arriving at these decisions was not an easy one, and the committee feel bound to state that on the whole the standard of literary ability, ingenuity and imagination displayed was very disappointing, and that a phrase containing all the essential elements of a good slogan has yet to be produced. It is not an easy subject by any means, and it may be consoling to competitors to know that this lack of ability to produce a really good slogan is felt as much by our contemporaries on the other side of the Atlantic as in this country.

The Perfect Slogan.

A slogan is neither the most nor the least important feature in advertising. Many thousands have been created for various commodities, but rarely one which can be regarded as an outstanding success. The committee adds that the electrical slogan which will most nearly approach the standard will contain a general reference to the industry and not to any particular application of it ; it will contain a word such as "electricity," "electrify," "switch," or something similar in order to make its meaning quite clear ; it will not suggest the curtailment of anybody else's business such as "gas," "coal," or even the "doctor" ; it will be brief, human and definite. We wait for the *immortal* who can produce it !

Birmingham and District Electric Club.

Lecture on Underground Cables for High Tension Supply.

The first meeting of the autumn session of the Birmingham and District Electric Club was held last Friday, when Major A. N. Taylor gave a lecture on "Underground Cables for High Tension Supply." The lecturer stated that the problem of the transmission of power in great bulk had been intensified by the growing size of power stations, the need of linking such stations, and the electrification of railways.

Major Taylor gave an interesting *résumé* of his paper read before the Institution of Electrical Engineers in which he claimed that by using a special cable consisting of a central core, and two copper intersheaths connected to the terminal transformers on an ingenious 6-phase system, cables of quite ordinary dimensions could be used safely to carry underground pressures in the region of 150 000 V and this without adding to the present insulation difficulties. He claimed that the saving of copper and lead sheathing on such a system would be such as to have a very appreciable effect upon the economic distribution of power over large areas.

Electrical Progress at Newport.

Statistics Show Remarkable Development.

Some milestones in the progress of Newport's electricity undertaking were pointed out to members of the Newport Rotary Club last week by Mr. A. NICHOLS MOORE, the borough electrical engineer.

Newport first generated its own electricity in 1895. The undertaking started on very modest lines, the total number of consumers in the first year being only 79 and the capacity 375 kW. By 1913, said Mr. Moore, this had increased to 7 000 kW and to-day it was 24 000. In 1913 their total production was 6 000 000 kWh ; during the past ten years this figure had been trebled. Gross revenue had risen from £41 000 in 1913 to £141 000 in the present financial year. While the former year's working showed a loss of £1 093 there was a net profit of £21 880 in the current year. The capital expenditure had risen in 10 years from £307 000 to £592 000 and a new scheme of extensions involving a further expenditure of £100 000, had been authorised by the Council and approved by the Electricity Commissioners.

Showrooms for Electrical Appliances.

Stimulating Domestic Demand in Belfast.

Steps for stimulating the domestic demand for electricity in Belfast were approved by the Electricity Committee last week when the City electrical engineer said that all concerned were of the opinion that one showroom for electrical appliances, however carefully handled, would not meet the requirements of the case nearly so well as a reasonable show with such of the electrical contractors as had showrooms. On the assumption that contractors and manufacturers developed their showrooms the committee approved a reduction of 25 per cent. on the domestic supply rate as the charge for current for demonstration purposes in connection with domestic appliances.

Obituary.

Mr. F. P. Wyeth.

MR. F. P. WYETH, who was the chairman of the Basingstoke Electricity Committee, has died, aged 52 years.

Sir H. B. Smith.

SIR HENRY BABINGTON SMITH, who died on September 28th, at Saffron Walden, at the age of 60 years, was Chairman of the Oriental Telephone and Electric, China and Japan Telephone and Electric, and a director of the Central London Railway, and other companies.

Mr. Arthur W. Heaviside.

We regret to record the death on September 22nd of Mr. ARTHUR WEST HEAVISIDE, aged 79 years. Mr. Heaviside, who was a member of the Imperial Service Order, became an associate of the Society of Telegraph Engineers in 1872 and a full member in 1877. A recipient of the Fahie Premium of the Institution of Electrical Engineers, he was at one time a member of the Council and also served as chairman of a local centre of that Institution.

Mr. John William Ullett.

One of the pioneers of the telephone in this country, Mr. JOHN WILLIAM ULLETT, of 27, Tavistock Drive, Nottingham, died suddenly at Bournemouth Station on September 24th, aged 64 years. Born in 1859 at Higney Grange, Huntingdonshire, Mr. Ullett was educated at the Merchant Taylors' School, and entered the service of the Telephone Co., London, in 1879. He was engaged on the construction of the first telephone junction lines in London and later the first trunk lines between London and the North of England. He was also responsible for the design of much of the early telephone apparatus.

In 1893 he laid out and took charge of the National Telephone Co.'s factory at Nottingham for the construction and repair of telephone apparatus. In order to cope with increased requirements, additional works were established at Beeston in 1901 under the direction of Mr. Ullett, construction work only being carried out there and the repair work remaining at Nottingham. Both factories were controlled by him until 1903, when the British Ericsson Co. was formed to take over the Beeston Works. Mr. Ullett was then transferred to this company as works manager, which position he held until 1918. Under his management the Beeston Works were greatly extended and improved.

During the war Mr. Ullett rendered valuable service as a member of the Advisory Committee established in connection with the Nottingham National Shell Factory, where his intimate knowledge of costing and organisation insured large and economical production. In recent years Mr. Ullett has acted as consulting engineer to a number of local companies and was a director of the Amos Tatham Needle Co., of Ilkeston.

Mr. Ullett became an associate of the Society of Telegraph Engineers and Electricians in 1883, and a full member of the Institution of Electrical Engineers in 1891. He was elected chairman of the East Midland Sub-Centre for the coming session.

Funeral of Mr. J. A. Phillips.

As briefly announced in our previous issue the death took place on Sunday, September 23rd, at his residence, York House, Clarendon Place, Leamington, of Mr. JAMES ALEXANDER PHILLIPS, manager of the Supply Department of the British Thomson-Houston Co., Rugby. Born on May 29th, 1864, and educated first at King Edward's School, Southampton, and afterwards at King's College, London, where he obtained a scholarship, he studied engineering and, after an apprenticeship course with a London engineering company, joined the British Alizarine Co. After further study in engineering at a London college, where he obtained a diploma in electrical engineering, he received an appointment with Crittals, Ltd.

Among other work for which he was responsible may be mentioned the installation of electric lighting and power to the estates of Ingestre, Welbeck and Balmoral Castle. In March, 1899, Mr. Phillips joined the British Thomson-Houston Co., and remained with this company till the time of his death, a period of nearly 25 years. Mr. Phillips was extremely fond of music and was an accomplished organist. He married in 1892 Elizabeth Sutherland who, with three sons, survives him.

Among those present at the funeral, which took place on September 27th, at Milverton Cemetery, Leamington, were Messrs. L. K. Phillips, K. McN. Phillips, M. F. Phillips (sons), Rev. A. J. Southouse, Mr. W. M. Thomas, Dr. S. Clayton, Mr. T. A. Wise, Dr. Clement Dukes, Messrs. W. Stoneham, V. Stoneham, G. Sutton, L. S. Hooton, T. Broadbent (representing the British Electrical and Allied Manufacturers' Association) E. G. Batt, W. Diment (representing the British Electrical and Allied Manufacturers' Association, D. & M. Section), H. C. Levis, W. C. Lusk, F. Fraser, H. N. Sporberg, R. Dumas, A. R. Everest, G. M. Campbell, W. J. Cusack, F. Hughes-Caley, B. F. McMurtrie, H. A. Price-Hughes, A. L. M. Ayers, W. J. Belsey, R. D. Given, F. W. Carter, H. C. Hastings, F. Coales, A. B. Race, G. E. Riley, E. Woodworth, H. C. Goodman, G. Ralph, C. C. Wharton, C. A. Martin, E. L. Beck, J. Harcourt Williams, A. Lucas, J. Miller, J. S. Ramsden, A. S. Wilson, E. M. Swift, J. N. Stephens, I. W. Beswick, R. A. R. Bottone, R. J. Chapman, P. B. Clarke, H. V. Eurich, W. Golden, R. F. Halliwell, C. A. Hall, G. H. Hardwick, A. F. Lane, F. A. Lovett, F. W. Steel, E. G. Taylor, H. W. Taylor, T. C. Thomson, C. Vandermin, H. J. Voss, J. H. Alexander and J. V. Partington.

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Electricity Supply.

Extensions and Developments.

MAIDSTONE Town Council has decided to carry out extensions to the plant at the electricity works at a cost of £47 000.

BATTERSEA Borough Council is recommended to provide a duplicate cable and plant at an estimated cost of £4 215.

HACKNEY Electricity Committee recommends the Council to expend a further sum of £10 000 on free-wired prepayment installations.

MAIDENHEAD Board of Guardians is considering a proposal to light the sick wards and the chapel electrically at an estimated cost of about £100.

Addressing the NEWPORT (MON.) Rotary Club, the borough electrical engineer, Mr. A. Nichols Moore, stated that there was every possibility of early extensions of plant being made at the electricity works.

The Electricity Commissioners have sanctioned a loan of £20 000 on account of the application for £43 000 in connection with the new electricity scheme for the area of LANCASTER, MORECAMBE and HEYSHAM.

MARYLEBONE Electricity Committee has entered into negotiations with the Central Electric Supply Co. for an emergency supply should any failure of the reserve plant necessitate their calling on the company for assistance.

ILFORD Urban Council has decided, subject to a satisfactory agreement being entered into, and subject to the approval of the Electricity Commissioners, that the linking up with West Ham for a bulk supply of electricity be agreed to.

NEWARK-ON-TRENT Town Council has decided to apply to the Electricity Commissioners for approval of the Council's own electric light scheme submitted by Mr. Worthingham, in preference to taking a bulk supply from the Notts and Derby Power Co.

AMMANFORD Urban Council has decided to acquire the local electricity undertaking from Mr. William Herbert with whom the Council has had a lighting agreement for thirteen years. The works will be taken over at once. The total cost will be £17 375.

The formal opening of the extensions at the DUNDALK Electricity Works took place last Friday. The addition to the power house is a new generating set, consisting of a 500 H.P. Vickers-Petter crude oil engine direct coupled to a 340 kW Metropolitan-Vickers dynamo.

ABERDEEN Electricity Committee reports that, with regard to its application to the Electricity Commissioners for sanction to the borrowing of £154 578 for the purposes of the electricity undertaking, the Commissioners have agreed to sanction the borrowing of £129 494.

YORK Town Council has received from the Electricity Commissioners sanction to a loan of £10 000 for mains extensions and £3 336 for the provision of converter plant. Providing there is a sufficient number of consumers guaranteed the mains are to be extended to the village of Copmanthorpe.

LLANDUDNO Urban Council has arranged terms with the North Wales Power Co. for a bulk supply of electricity. The charge is to be at the rate of 8s. 4d. per kW per month, plus ¾d. per kWh for all current supplied. The Council is to pay, in addition, during the year ending August, 1924, a sum not exceeding £1 000 in respect of the cost of the transmission line from the sub-station at Colwyn Bay to Llandudno.

Alterations in Charges, Proposed and Actual.

WARE Rural Council has decided to offer no objection to the application of the North Metropolitan Electric Power Co. for power to increase the charge for electricity to 8d. per kWh.

REIGATE Town Council has reduced the charges for electricity as under as from the next meter readings: Heating and commercial power to 2½d. per kWh; power for cinemas, from 4d. to 3½d.

BEDFORD Town Council has decided to supply electricity for shop window lighting between the hours of 6 p.m. and 11 p.m. at 1½d. per kWh, the consumer to carry out the work to segregate the window circuit and pay 3s. per quarter for the special rate meter.

WEST HAM Town Council has made the following reductions in the charges for electricity from October 1st:—Standard lighting, ordinary meters, 5d. per kWh, ditto prepayment meters, 6d.; standard power, first 40 kWh per H.P. installed per quarter, 3½d., beyond, 1½d.; standard heating and cooking, 1½d. per kWh; factory lighting, up to 10 per cent. of quarterly power consumption or 15 per cent. of monthly power consumption, 3½d.; all night public clocks, theatres, music halls and cinemas, 3½d.

Tapping New Areas.

HELSTON Town Council is considering an offer by the Cornwall Electric Power Co. to light the town electrically.

CREDITON Urban Council has been informed that Exeter Corporation is prepared to give a bulk supply of electricity on terms to be arranged.

ADWICK-LE-STREET Urban Council has decided to apply for powers to supply electricity in the district. It is proposed to take a bulk supply from the Brodsworth Colliery Co.

Inquiries and Orders.

A special order has been made by the Electricity Commissioners in connection with the PORT TALBOT U.D.C. electricity and lighting scheme.

Miscellaneous Supply Items.

BECKENHAM Council is experiencing an increased demand under the fixed price lighting system for small property.

The tenders which the GLASGOW Electricity Committee recommended last week in connection with the further installation of generating plant at Dalmarnock Power Station amount in all to £340 000.

Personal Items.

Wicklow Urban Council has appointed Mr. JOHN PLUNKETT, the Electricity Works, Cork, as engineer under the new urban electricity scheme.

Mr. JAMES DALRYMPLE, manager of the Glasgow Corporation Tramways, is visiting Detroit as the guest of the Detroit Street Railway Commission.

It is reported that Mr. W. W. GRIERSON, chief engineer of the Great Western Railway, is retiring from that position at the end of the year, and thereafter will act as consulting engineer to the company.

Belfast tramway motormen and conductors have presented Mr. J. S. D. MOFFET with an illuminated address and a silver tea and coffee service on his resignation from the managership of the city tramways.

Mr. E. CROSS, engineer and manager of the Rotherham Corporation Electricity Works, and chairman of the Sheffield Sub-Centre of the Institution of Electrical Engineers, has been elected as president of the Rotherham Technical Institute Engineering Society for a second year.

Miss PEARL SWAN, the only woman engineering student at Liverpool University, has recently gained a first class in the examination for the degree of Bachelor of Engineering with honours in electrical engineering (University of Liverpool), and has been accepted as a college apprentice at the works of the Metropolitan-Vickers Electrical Co.

The Mr. Robert Archer George Read, trading under the name of Read and Partners at 115, Baker Street, West, who recently met with an unfortunate death, has no connection whatever with Mr. HERBERT JAMES READ, the managing director of Read and Partners, Ltd., electrical engineers, of 53, Victoria Street, London, S.W.1, and of Reading, and Read and Partners, Ltd., have no connection with any other firm of the same name.

Swedish Electrical Industry.

Effects of the Post-War Slump.

Electrical engineering in Sweden dates from about 1880, states a writer in "Teknisk Tidskrift," when Stockholm witnessed the foundation of the two concerns which afterwards developed, respectively, into Luth and Roséns Aktiebolag and Allmänna Svenska Aktiebolaget. The technics of the low-voltage current had come into good hands somewhat earlier in the workshops founded by L. M. Ericsson. In 1888 the manufacture of transmission lines and cables was taken up by Max Sievert at Sundyberg.

After describing the crisis which interrupted the advance of the industry at the beginning of the twentieth century and the gradual recovery which was aided by the electrification of tramways and railways, the writer states that it was obvious by the autumn of 1914 that this progress would develop into a state of unique prosperity.

Electrifying Industry and Agriculture.

The extraordinary boom in the Swedish electrical industry during the war was caused by a combination of several favourable circumstances. Here the first place must be accorded to the disappearance of foreign competition, which had earlier made itself painfully felt. A great part was also played by the acceleration of the process of electrifying industry and agriculture in consequence of the shortage of fuel. In particular the electrification of agriculture progressed at a pace which would scarcely have been thought possible only a few years earlier; but industry also made considerable extensions of its electrical power equipment.

Under the influence of this enlargement of the possibilities of sale and the heavy fall in the value of money there followed a substantial increase in the share capital of the electrical industry; it appears to have been approximately quadrupled between the years 1914 and 1920.

Post-War Fluctuations.

After the conclusion of peace the favourable state of business wavered for the first time in 1919, after which there was an upward trend for a short time. Bad times began in earnest at the close of 1920; and since then they have been practically permanent, though not without hope of some improvement during the present year. The losses suffered by the Swedish electrical industry during the past few years, caused by deflation in combination with home and foreign competition, amount to about 35 per cent. of its aggregate share capital, and consequently represent a serious depletion of its funds. A fairly general writing down of the share capital has, therefore, become indispensable, and has already been carried out by some firms. At the present moment leading electrical firms in Sweden represent an aggregate share capital of about 140 million kronor.

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Tenders Invited and Accepted.

GREAT BRITAIN.

BLACKPOOL CORPORATION.—H.t. and l.t. paper insulated lead covered armoured cables. Specification, etc., from Mr. Charles Furness, Electricity Works, West Caroline Street, Blackpool.

HASTINGS CORPORATION, October 6th.—Wiring and fitting St. Clement's Caves for electric lighting. Specification from the Town Clerk.

PONTYPRIDD URBAN DISTRICT COUNCIL, October 8th.—One 500 kW rotary converter and transformer; and e.h.t. and l.t. switch cubicles for controlling same. Specification (£1 1s., returnable) from Mr. J. E. Teasdel, Generating Station, Treforest, Pontypridd.

ILKLEY URBAN DISTRICT COUNCIL, October 10th.—Three 250 kW rotary converters, with static transformers and switchgear. Specification (£1 1s., returnable) from the Engineer, Electricity Works, Ilkley.

KENT COUNTY MENTAL HOSPITAL, Chartham, near Canterbury. October 12th.—Telephone installation. Specification can be seen at the Hospital.

SALFORD GUARDIANS, October 16th.—Distribution boards and cables for 10 motors and 4 ventilating fans; fuses, switches and fittings for 56 lights; and 8 plugs for hand lamps. Plan, etc., from the Clerk, Poor Law Offices, Eccles New Road, Salford.

HARTISMERE GUARDIANS, October 17th.—Electric light installation at Union Infirmary, Eye, Suffolk. Specification from the Clerk, Union Offices, Victoria Road, Eye.

LEEK URBAN DISTRICT COUNCIL, October 17th.—One 400 kW d.c. generator and wooden, natural-draught, cooling tower. Specifications from the Engineer, Electricity Works, Leek, Staffs.

WEST DERBY GUARDIANS, October 19th.—Twenty electrically heated warming cupboards. Specification from the Guardians' Offices, Brougham Terrace, Liverpool.

NOTTINGHAM CORPORATION, October 19th.—One 25-ton overhead travelling electric crane. Specification (£2, returnable) from Preece, Cardew and Rider, 8, Queen Anne's Gate, Westminster, S.W.1.

COMMISSIONERS OF H.M. WORKS, ETC., October 19th.—3 000 V three-phase motor and compressor, etc., at National Physical Laboratory, Teddington. Specification (£1 1s., returnable) from Contracts Branch, King Charles Street, London, S.W.1.

BIGGLESWADE WATER BOARD, October 22nd.—Electric lighting installation for pumping station. Particulars from Mr. H. Carne, Waterworks Engineer's Office, Biggleswade.

READING CORPORATION, November 3rd.—Equipment of air-compressing station for sewage disposal works, including e.h.t. and l.t. switchboards, motors, transformers, air compressors, cables, etc. Specification (£5, returnable) from Mr. G. Midgley Taylor, of John Taylor and Sons, 36–38, Victoria Street, Westminster, S.W.1.

AUSTRALIA.

COMMONWEALTH OF AUSTRALIA, October 15th (in London).—Protective apparatus (schedule N.S.W. 61). October 16th (in London), porcelain insulators, g.i. wire and copper jointing sleeves. October 29th (in London), telephone and telegraph apparatus (schedule N.S.W.59). December 3rd (in London), telephone and telegraph apparatus (schedule N.S.W. 60). January 7th (in Australia), automatic switchboards (schedule N.S.W. 12). Particulars from the Supply Officer, Australia House, Strand, London, W.C.2.

SYDNEY CITY COUNCIL, November 5th.*—H.T. underground cables. January 21st.* H.T. split conductor feeder panels.

N.S.W. GOVERNMENT RAILWAYS AND TRAMWAYS, December 12th.*—Rotary converter units.

Adams Brothers' tender for electrical fittings has been accepted by BRIGHTON GUARDIANS.

ERITH URBAN COUNCIL has accepted the tender of Hadfields, Ltd., for a tramway loop, at £144.

GRIMSBY CORPORATION has accepted the tender of the New Switchgear Construction Co. for e.h.t. switchgear, £710.

The tender of Hadfields, Ltd., for 24 pairs of tramway points and special trackwork, £3 531, has been accepted by BRADFORD CORPORATION.

The tender of J. Brown and Co. for the supply of tramway tyres, at £3 8s. 6d. and £2 18s. 3d. each, has been accepted by LOWESTOFT CORPORATION.

The tender of Callender's Cable and Construction Co., for four feeder panels, £161 2s., is recommended for acceptance by SOUTHEND CORPORATION.

The COUNTY OF LONDON ELECTRIC SUPPLY Co. has placed the contract for building the Barking power station with the Consolidated Construction Co.

ILFORD URBAN DISTRICT COUNCIL has accepted the tenders of the General Electric Co. for e.h.t. and l.t. switchgear, and the Union Cable Co. for l.t. lead covered and armoured cable.

MARYLEBONE (LONDON) BOROUGH COUNCIL has extended the existing contracts with Chamberlain and Hookham and with Ferranti, Ltd., for house service meters until August next.

HAZEL GROVE AND BRAMHALL URBAN DISTRICT COUNCIL has accepted the following tenders: W. T. Glover and Co., cables; Ferguson, Pailin Ltd., sub-station switchgear; Ferranti, Ltd., meters.

* Particulars from the Department of Overseas Trade.

The following tenders for wiring schools have been accepted by RAWTENSTALL EDUCATION COMMITTEE: Clark, Crankshaw and Clark, for Cloughland school, and Executors of J. Birtwistle for Water school.

The tender of the Siemens and English Electric Lamp Company has been accepted by the GENERAL POST OFFICE for the supply of Siemens' vacuum and gasfilled type lamps during the year ending August 31st next.

The following tenders have been accepted by PRESTON CORPORATION:—British Insulated and Helsby Cables, Ltd., h.t. and l.t. cable, £3 088 4s. 5d.; and disconnecting pillars and boxes, £1 057; Ferranti, Ltd., transformers, £340 2s. 8d.

BERMONDSEY (LONDON) BOROUGH COUNCIL has accepted the following tenders: Venner Time Switches, Ltd., twelve B-type time switches, £64 12s.; Chamberlain and Hookham, six 5A and six 10A meters, £55 1s.; Ferranti, Ltd., 48 2·5 A slot-meters, £174.

DONCASTER CORPORATION has accepted the following tenders: General Electric Co., 1 250 kW rotary converter and switchgear, £6 020, and street lamp fittings, £212; Callender's Cable and Construction Co., cables, £774; British Mannesmann Tube Co., street lamp standards, £469.

The following tenders are recommended for acceptance by SALFORD CORPORATION:—Lancashire Dynamo and Motor Co., 15 H.P. motor, £115 12s. 6d.; Enfield Ediswan Cable Works, l.t. cable, £273; Ferguson, Pailin Ltd., e.h.t. switchgear, £1 355; Metropolitan-Vickers Electrical Co., 324 kVA transformer, £289 2s.; Hadfields, Ltd., tramway points and crossings, £622 10s.; Bolckow Vaughan and Co., 200 tons of rails, £10 7s. 6d. per ton.

GLASGOW CORPORATION is recommended to accept the following tenders in connection with additional boiler-house plant for Dalmarnock Power Station:—Babcock and Wilcox, eight boilers and six chain grate stokers; Underfeed Stoker Co., six chain grate stokers; and Green's Economiser Co. for economisers. The expenditure involved in these additional contracts amounts to £127 981, bringing the outlay proposed by the committee up to nearly £308 000.

ST. PANCRAS (LONDON) ELECTRICITY COMMITTEE recommends the acceptance of the following tenders: Chloride Accumulator Co., 864 Ah storage battery for King's Road power station, at £802 1s. 3d. (offers received, for batteries of various capacities, ranged from £696 to £826 6s.) G. N. Tanner (lowest tender), for exhaust pipe for King's Road power station, £138 (six tenders received, highest £425). British Thomson-Houston Co., additional cubicle to e.h.t. switch gear at Grafton Road substation, £385.

Telegraph and Telephone Notes.

TELEPHONE KIOSKS at Swansea are said to be giving satisfactory results financially.

UNDERGROUND CABLES are being laid in Sheffield streets for the telephone and telegraph services.

With a population of 540 000, TORONTO HAS 125 000 TELEPHONES, or practically one for every four persons.

The estimated expenditure during 1923–24 on the construction and extension of telegraphs and telephones in Australia is £3 200 000. Last year's expenditure under this heading was £2 173 653.

Work will be commenced shortly on A NEW ATLANTIC CABLE to connect New York with the West Indies and the East Coast of South America. The cable will be 5 000 miles long and will have a capacity of 1 800 messages a day.

A NEW TELEPHONE EXCHANGE has been opened at Kirkwall. Other developments in the county of Orkney include the opening within the next few days of an exchange at Stromness, and possibly the provision of call boxes at every telegraph office in the county.

Lambeth (London) Council have protested against the proposal of the Post Office to lay UNDERGROUND CABLES in Brixton Hill, on the grounds that warning was given when road repairs were undertaken last year. The Post Office cannot trace the receipt of any such intimation.

The Post Office SYSTEM OF PNEUMATIC TUBES, through which telegraphic messages are sent from one post office to another in London and from the Houses of Parliament to the Central Telegraph Office, is being enlarged by the addition of extensions from the Houses of Parliament to the various Government departments.

Within three months, states the F.B.I. Commissioner in Milan, the ITALIAN STATE TELEPHONES will all be turned over to private companies, and Italian engineers are at the present moment busy with foreign companies regarding estimates, etc., for supplies. This is such an important matter, he states, and American companies are so particularly active, that it calls for an increased and lively interest on the part of British suppliers.

Ivorine Tablets for Wireless Sets.

Apparatus Manufacturer's Disputed Account.

In the Mayor's and City of London Court recently, James H. and G. L. Stone, St. Paul's Buildings, 29, Paternoster Row, London, claimed £19 18s. 4d. from the British Radio Sales Co., wireless manufacturers, Stephens' Buildings, Gresse Street, Rathbone Place, London, for 3 000 ivorine tablets for use on wireless sets manufactured by the defendant firm. The defendants admitted owing £9 10s., but said that the goods covered by the rest of the claim were returned to the plaintiffs owing to a delay in delivery and to the fact that the defendants had had to purchase elsewhere. Judge Shewell Cooper found for the plaintiffs, with costs.

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Electric Traction.

Tramway Extensions and Developments.

NEWCASTLE-ON-TYNE Tramways Committee is seeking sanction to a loan for new tramcars.

The extension of the BIRMINGHAM tramway system from Bristol Road to Northfield was opened on Monday.

SOUTHAMPTON Town Council has decided not to proceed this autumn with the promotion of a Bill for extending the tramways.

MIDDLESBROUGH Tramways Committee is considering the possibility of opening up a circular route along Newport, Parliament and Linthorpe Roads.

Fares, Receipts and Passengers.

A review of the CARDIFF Corporation tramways scale of charges is to be made.

LIVERPOOL Tramways Committee is to be asked to experiment with a weekly season ticket scheme.

EDINBURGH Tramways Committee has decided to adopt the list of cheaper fares suggested recently by Mr. Pilcher.

The institution of a 2d. return ticket to be available on days other than that of issue is being considered at WORCESTER.

BOLTON Tramways Committee has decided to re-introduce pre-war fares from Monday morning to 1.30 p.m. on Saturday.

During the past 15 months 215 129 289 passengers were carried on Liverpool Corporation tramcars, the receipts amounting to £1 886 648.

BURNLEY Tramways Committee has agreed that children under five shall travel free, and that half fares be charged for children between five and 14 years.

The total number of electric car passes issued to disabled soldiers in Accrington from March, 1921, to September, 1923, was 273, equivalent in fares to over £102.

No fewer than 2 235 915 passengers—497 110 more than in the preceding year—were carried on BROUGHTY FERRY tramcars last year. Gross receipts were £212 more.

During the fortnight ended September 15th traffic receipts on the MADRAS electric tramways totalled Rs. 53 490, an increase of 2·1 per cent. on the corresponding period last year.

Traffic receipts on LONDON tramways controlled by the Underground group during the week ended September 22nd totalled £38 720, a decrease of £6 811 on the corresponding week last year.

GREENOCK and PORT GLASGOW Tramway Co. announces that a substantial reduction in fares will take place early this month. Ordinary passengers and workmen's fares will be affected and the reductions will apply to all stages of the route.

During the year ended March 31st last, 85 289 558 people were carried by 249 BRADFORD trams and 20 railless trolley vehicles. Reductions in fares are responsible in the decrease of the income from £673 898 to £655 329. The net balance of £57 671 is transferred to the reserve and renewals fund.

Electric Railway Items.

Further improvements in the company's train service were introduced by the METROPOLITAN Railway on Monday.

During the week ended September 22nd traffic receipts on the MERSEY RAILWAY totalled £4 434, bringing the year's total to date up to £171 307.

THE EAST KENT LIGHT RAILWAY Co. has applied to the Ministry of Transport for an extension of time to complete the work authorised by the orders of 1911 and 1920.

BOWLAND Rural Council is supporting the Longridge-Hellifield light railway scheme. It is hoped that work on the construction of the line will begin before Christmas.

BRIGHTON Town Council has appointed a deputation to wait upon the Southern Railway Co. to emphasise the desirability of the early completion of the electrification of the main line.

The electrification of the Pietermaritzburg-Glencoe section of the SOUTH AFRICAN railways is making good progress. The first two electric locomotives, of which 78 are being built by the Metropolitan-Vickers Co., have been tested in England.

Miscellaneous Traction News.

SUNDERLAND Tramways Committee has agreed to place letter boxes on several of its tramcars.

The ILFORD Urban Council has decided to obtain quotations from British firms only for the supply of 50 tons of tram rails.

Small electric motor cars to hold eight passengers are being tried as an experiment in BUCAREST. For a journey of about 2½ kilometres a charge equal to 2d. is made.

At an inspection of the Coplawhill Works of the GLASGOW Tramways Department it was stated that Glasgow had to-day the best, cheapest and most up-to-date tramway system in the United Kingdom.

The strike of BRITISH COLUMBIA tramway-men, which was to have begun last week at Vancouver, has been settled on a basis of 62 cents an hour (3s.) for motor-men and conductors, representing a 5 per cent. increase.

A correspondent of the "Northern Whig" makes some pertinent remarks regarding the Belfast tramways department. He says the Corporation has never been fortunate in its management of the tramways, and the cause is recognised by many to be undue interference with the legitimate functions of the general manager.

Wireless News.

Wireless Broadcasting in Sweden.

Information has been received from the British Legation at Stockholm to the effect that a wireless broadcasting company has been established in Sweden under the name "Svenska Rundradioaktiebolaget." The published prospectus of the company is signed by the following important firms: Allgemeine Elektrizitäts Gesellschaft, A/B Nordiska Kompaniet, Allm. Svenska Elektriska A/B, Allm. Telefonaktiebolaget L. M. Ericsson, A/B Radiokompaniet, Svenska Radioaktiebolaget, and Ahlen and Holm A/B. The capital will be at least Kr. 100 000, but not exceeding Kr. 300 000 in shares of Kr. 100 each. The dividend is limited to 7½ per cent. cumulative.

It is understood that the company will have exclusive rights for broadcasting in Sweden from 1924 to 1934 with a preferential claim to renewal on the expiry of these rights. Further, licences for the use of receiving apparatus are to be granted freely to the public, i.e. with as few formalities as possible. No restrictions are to be made with respect to the construction of receiving apparatus except that licences are not to be granted for the use of apparatus likely to cause disturbances to other receivers. Military and commercial secrets are to be protected by other means, such as cyphers. It was originally proposed that Swedish manufacturers should be protected by Customs duties, and against home competition by State control, but it is understood that these proposals have been rejected.

Trans-Atlantic Wireless Services.

Direct radio-telegraphic service between the United States and The Hague, Holland, and between the United States and Caltano, Italy, has recently been established. The opening of these services raises the total number of direct radio circuits radiating to European countries from New York City from six to eight, and not only affects Holland and Italy, but provides more direct routes between the countries adjoining them and the United States. The addition of these new circuits to the already existing channels of radio communication to many parts of the world, states "The Engineer," materially advances plans which are being worked out by the Radio Corporation of America to make the United States the centre of world-wide radio communication network. Because of the centralised situation of the United States, with Europe to the east, South America to the south and the Orient to the west, America enjoys a natural advantage which helps to make it possible to link the principal nations of the world by radio around New York as the pivotal centre. This plan is rapidly nearing completion, there being at present eight connections across the Atlantic, and one bridging the Pacific.

Broadcasting in the U.S.A.

A recent survey shows that of the 826 broadcasting stations licensed in the United States only 450 are still operating. The radio companies have 218 working out of 339 formerly owned by them, and the average decrease in the number of live stations owned by other interests is even greater.

Wireless News in Brief.

A broadcasting station of the GENERAL ELECTRIC Co., in Connecticut, U.S.A., was heard quite clearly on one valve by a Swansea experimenter last week.

It is reported that the licence fee contemplated in connection with the proposed inauguration of a broadcasting service in the Irish Free State will be £1 a year.

A new feature in the WIRELESS TRANSMISSION OF MUSIC was introduced on Monday, when a symphony concert in London was broadcast to all stations in the British Isles.

In his presidential address to the RADIO SOCIETY OF GREAT BRITAIN, Dr. W. H. Eccles said the contributions of the amateur had done vastly more for the science than had those of the commercial firms.

Forty Years Ago.

"The Electrician," October 6th, 1883.

ELECTRIC LIGHTING FOR RAILWAY STATIONS.—Experiments have recently been carried out at the Chemnitz railway station, in Saxony, with Pilsen and Siemens lamps. The current was supplied by Schuckert and Siemens dynamos respectively. The Siemens lamp is stated to have given the best results as far as candle-power is concerned. Each lamp required about one H.P.

* * *

ELECTRIC LIGHTING ON SHIPS.—The "Orontes" troopship sailed from Portsmouth on Monday last. She has been fitted with incandescent lamps by the Swan United Electric Light Co. The order for lighting the ship was received in June last, and in spite of some trouble occasioned by the new pattern of engines employed the lights were all running satisfactorily when she sailed.

* * *

DETERMINING THE MAGNETIC MERIDIAN.—M. E. Bisson has constructed a compass by means of which the magnetic meridian can be determined on board iron ships. The theory upon which he constructed this compass is given in the "Comptes Rendus" for September 24th. A compass constructed by M. Bisson has been submitted to the hydrographic committee of the French Admiralty, and is to be tested on board one of the ironclads of the French army.

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Companies' Reports, Dividends, etc.

STOTHERT AND PITT.—For the past year a dividend of 5 per cent. free of tax has been declared on the ordinary shares.

GENERAL ELECTRIC CO. (UNITED STATES).—Announcement is made of the declaration of a quarterly dividend of 2 per cent. on the common stock and a dividend of 15 per cent. per share on the special stock, both payable on October 15th.

BELL'S UNITED ASBESTOS CO.—On account of the profits of the current year the directors have declared an interim dividend on the ordinary shares of 6d. per share less tax, payable on October 22nd to shareholders on the register on October 6th. The ordinary share transfer books will be closed from to-morrow (Saturday) until October 19th.

SOUTHERN BRAZIL ELECTRIC CO.—At an adjourned general meeting of the holders of the company's 6 per cent. mortgage debentures, held in London last week, it was unanimously resolved that the net revenue available for payment of the debenture interest between December 31st, 1923, and December 31st, 1927, after paying the necessary expenses, should be paid by the company to Barclays Bank to the order of the trustees to be applied in paying the interest on the debentures as soon as the funds were sufficient for the payment of one complete coupon.

Supply and Lighting.

HENDON ELECTRIC SUPPLY CO.—The directors announce an interim dividend of 5 per cent. free of tax on the ordinary shares.

ISLE OF WIGHT ELECTRIC LIGHT AND POWER CO.—Announcement is made of the declaration of a dividend of 3s. per share on the ordinary shares.

MIDLAND CORPORATION FOR POWER DISTRIBUTION.—Payable on October 15th an interim dividend at the rate of 10 per cent. per annum, less tax, is announced on the ordinary shares.

YORKSHIRE ELECTRIC POWER CO.—In reference to the issue of 250 000 ordinary shares of £1 each made last April, a further instalment of 4s. 6d. per share was due for payment on September 30th.

LANCASHIRE ELECTRIC LIGHT AND POWER CO.—Holders of the 7 per cent. cumulative participating preference shares will receive a dividend at the rate of 7 per cent. per annum less tax in respect of the half-year ended September 30th.

EAST ANGLIAN ELECTRICITY, LTD.—Presiding at the annual meeting at Ipswich, Mr. W. R. Bradbrook said it was very satisfactory to find, after a further period of financial and industrial conditions which made it difficult to meet the ever-increasing demands for electricity, that the company had made steady and substantial progress. It was anticipated that a net profit of £5 000 would be made during the year ending March 31st last. Considering the difficulties met with during the past year, the actual net profit of £4 196, after providing for interest on debentures, loans, etc., and dividend on preference shares, was certainly noteworthy. During the year 561 consumers had been added to the company's mains, and additional sales of electrical energy totalled 149 646 kWh. The chairman referred to the appointment of Mr. B. G. Drummond as general manager, and of Sir Charles Bright and Partners as consulting engineers to the company. One of the members, Mr. A. H. Seabrook, had given special attention to the electrical work and plant of this company. The recommendation of the directors that the grant of a consumer shareholders' rebate should be discontinued met with dissent. The chairman pointed out that the results of this rebate had not been to the advantage of the general body of shareholders, the majority of whom were not within the area of the company's supply. The Board also felt that a principle of preferential treatment was involved. Eventually it was resolved that this recommendation be referred to the directorate for further consideration.

New Issue.

LANCASHIRE ELECTRIC LIGHT AND POWER CO.—An issue was made on Tuesday of 350 000 seven per cent cumulative participating preference shares of £1 each and 350 000 ordinary shares of £1 each.

Traction Companies' Results.

GATESHEAD AND DISTRICT TRAMWAYS.—The directors announce an interim dividend of 4 per cent. per annum, less tax.

CORK ELECTRIC TRAMWAYS AND LIGHTING.—Ordinary shareholders have received no dividend since 1914, when 3 per cent. was paid. The directors now announce an interim dividend of 3 per cent. (6s. per share).

MONTREAL TRAMWAYS.—A net income of $548 033 is shown in the accounts to June 30th. Out of this sum four quarterly dividends of 2½ per cent. each have been paid. To the balance has been added the surplus of $844 893 brought forward, and after appropriating $400 000 for reserve there is a general surplus to carry forward of $592 979.

Cable, Telegraph and Telephone Companies.

CHADBURN'S (SHIP) TELEGRAPH CO.—Preference shareholders are to receive a dividend at the rate of 6 per cent. per annum.

CUBA SUBMARINE TELEGRAPH CO.—Similar to that paid a year ago, an interim dividend for the six months ended June 30th has been declared on the ordinary shares at the rate of 5 per cent. per annum, payable on October 11th.

New Companies.

OSMOND KNIGHT AND CO., LTD.—Private. Cap., £1 000 in £1 shares. Electrical engineers, etc. Reg. office: 1, Broad Street Place, London, E.C.

BYERS AND SONS, LTD.—Private. Cap., £1 500 in £1 shares. Dealers in wireless apparatus, etc. Solicitors: Freedman and Morton Smith, 59, John Street, Sunderland.

S. B. SMITH AND CO., LTD.—Private. Cap., £1 000 in £1 shares. Electrical engineers, manufacturers of wireless and other apparatus, etc. Reg. office: 10, Savoy Street, Strand, London, W.C.

F. A. BOHM (LONDON), LTD.—Private. Cap., £100 in £1 shares. Manufacturers, importers and exporters of, agents for and dealers in wireless installations and accessories, etc. Reg. office: Premier House, 150, Southampton Row, London, W.C.1.

FOX AND OFFORD, LTD.—Private. Cap., £9 000 in £1 shares (6 000 ordinary and 3 000 deferred). Electrical engineers, manufacturers and repairers of and dealers in electrical and other meters, etc. Registered office: Victoria Works, Wiggin Street, Birmingham.

STRANGS, LTD.—Private. Cap., £1 000 in £1 shares. Makers and importers of and dealers in cabinets, boxes and cases for all kinds of scientific and mechanical instruments and appliances, wireless sets, etc. Reg. office: 27, Finsbury Square, London, E.C.

ABERAYRON AND DISTRICT ELECTRICITY SUPPLY AND POWER CO., LTD.—Private. Cap., £3,000 in £1 shares. To adopt an agreement with Elizabeth G. Richards for the sale of the business carried on by her as the "Aeron Valley Electricity Supply Co." and to carry on at Aberayron and elsewhere in Cardiganshire the business of an electric light company. Reg. office: Electricity Works, Aberayron, Cardiganshire.

B. BARNETT (ELECTRICAL ENGINEERS, LEYTON), LTD.—Private. Cap., £1 000 in £1 shares. To adopt an agreement with B. Barnett (Electrical Engineers), Ltd., and to carry on the business of electrical engineers and contractors, suppliers of electricity, manufacturers of and dealers in electric, galvanic and wireless telephonic and telegraphic apparatus, etc. Reg. office: 16 and 17, Devonshire Square, Bishopsgate, London, E.C.2.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER (Special Manchester Furniture Exhibition Number).—"Preliminary Review of Exhibits"; "Making Plywood at Silvertown"; "Woodworking Machinery in the Making"; "Raw Materials and Supplies—Plywood."

THE CHEMICAL AGE.—"Uses of Activated Carbon"; "Progress of British Cellulose Manufacture"; "Sir Max Muspratt on Chemical Triumphs."

THE EUROPEAN COMMERCIAL.—"The Commercial Development of Latvia"; "Review of the German Motor Trade"; "Turkish Regulations for Foreign Exchange Traffic."

THE FRUIT GROWER.—"Commercial Horticulture in Holland" (illustrated); "Imperial Fruit Show Conference Programme"; "New Scale of Nurserymen's Wages."

GARDENING ILLUSTRATED.—"Raising Plants from Seeds and Cuttings"; "Violet Culture Under Glass"; "Bee Feeding."

THE GAS WORLD.—"Conference of the British Commercial Gas Association in Birmingham"; "Future of Sulphate of Ammonia"; "National Gas Exhibition."

THE HARDWARE TRADE JOURNAL.—"Building Material Prices—The National Light Castings Association's Defence"; "Gas in Midland Industries."

Prices of Metals, Chemicals, etc.

TUESDAY, October 2nd.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£65 10 0	—	10s.
Electro Wirebars	„	£67 5 0	—	£1
H.C. Wire, basis	per lb.	9 11/16d.	—	¼d.
Sheet	„	10 1/16d.	—	¼d.
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 1 11/16d.	—	d.
Brass 60/40—				
Rod, basis	„	7¼d.	—	—
Sheet, basis	„	10d.	—	—
Wire, basis	„	10¼d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 2 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
Lead Pig—				
English	„	£27 10 0	10s.	—
Foreign or Colonial	„	£26 7 6	15s.	—
Tin—				
Ingot	„	£203 0 0	£0 7 6	—
Wire, basis	per lb.	2s. 8d.	—	—
Aluminium Ingots	per ton	£115 0 0	—	—
Spelter	„	£32 17 6	—	17s. 6d.
Mercury	per bottle	£9 5 0	7s. 6d.	—

Sulphur (Flowers)—Ton £8 10s. *Sodium Chlorate*—Per lb. 2¾d.
„ (Roll-Brimstone)—„ £8 10s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. „ £25 10s. per ton, £7 10s.
Boric Acid (Crystals). „ £48 *Sodium Bichromate*.—Per lb. 4¼d.
Rubber.—Para fine, 1s. 2d.; plantation 1st latex, 1s. 3⅜d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd, and the rubber prices by W. T. Henley's Telegraph Works Co.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

ATTRACTA SIGN AND ELECTRIC GLOBE CO., 16, St. Helen's Road, Swansea, electric accessories dealers. £11 10s. 3d. August 3rd.

BARNES, Mr. R. O., trading as FINCHLEY ROAD WIRELESS STORES, 160c, Finchley Road, electrical merchants. £26 18s. 2d. July 13th.

SHELDRICK, Mr. E., 16, The Broadway, West Norwood, electrical engineer. £43 11s. 5d., August 17th; and £15 9s. 7d., August 23rd.

Receiverships.

A. AND A. ELECTRICAL CO., LTD. G. E. Sendell, 36, Walbrook, E.C., has been appointed receiver on behalf of the debenture holders.

CROWTHER AND OSBORN, LTD. H. Terras, of 64, Cross Street, Manchester, was appointed receiver on September 21st, 1923, under powers contained in first mortgage debenture dated September 29th, 1921.

HOLBORN RADIO CO., LTD. A. V. James, of 30, Elm Grove, Crouch Hill, N.8, was appointed receiver and manager on September 24th, under powers contained in debenture dated August 25th, 1923.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

AERADIO, LTD. (late H. STANLEY PRINCE, LTD.), London, W.C., electrical manufacturers. Registered, September 24th, £125 and £125 debentures, balance of £500; general charge.

BONNELLA (D. H.) AND SON, LTD., London, W., electricians and ivory turners, etc. Registered September 13th, charge to Bank; charged on 46 and 48, Osnaburgh Street, N.W. *—— November 17th, 1922.

BOOTHROYD (H. T.), LTD., Bootle, electrical engineers. Registered September 22nd, charge to Bank; charged on land and premises at Akenside Street, Bootle. *£3 856 5s. 6d. September 15th, 1922.

ENGLISH ELECTRIC CO., LTD., London, W.C.—Registered September 4th, Trust Deed dated August 14th, 1923, securing £1 600 000 debenture stock; general charge. *£2 160 900 May 9, 1923.

FELLOWS MAGNETO CO., LTD., London, N.W. Registered September 13th (by order on terms), deed of agreement and charge securing certain moneys in respect of sewer rate to Royal Agricultural Society of England; charged on premises at Willesden. *£60 000. July 20th, 1922.

FULLER'S UNITED ELECTRIC WORKS, LTD., Chadwell Heath. September 14th, £260 000 income debenture stock (secured by Trust Deed dated September 5th, 1923); general charge (subject to £200 000 first debenture stock dated May 17, 1923). *£150 000. December 20th, 1922.

HOLBORN RADIO CO., LTD., London, W.C. Registered September 20th, £243 debentures; general charge.

RE-ECHO ELECTRICAL MANUFACTURING CO., LTD. (late RE-ECHO WIRELESS MANUFACTURING CO., LTD.), London, S.W. Registered September 24th, £300 debentures to W. Taplin, 187, Holland Road, Willesden; general charge.

RODD (R. J.), LTD., Walton-on-Thames, electricians. Registered September 24th, £500 debentures, balance of £4 000; general charge. *£3 500. June 6th, 1922.

SPENCERS (ELECTRICAL) LTD., London, E.C. Registered September 21st, £1 000 debentures to C. H. Fox, Pawslade, West Green, Harpley, Whitney, Winchfield (Hants); general charge.

TURNER (E.) AND CO. (MANCHESTER), LTD., electrical engineers. Registered September 21st, £200 debentures (filed under section 93 (3) of the Companies (Consolidation) Act, 1903), present issue £100; general charge.

WELLINGTON ELECTRICAL AND RADIO ENGINEERING WORKS, LTD., Aldershot. Registered September 14th, £600, debentures to N. Clinton, 4, Station Road, Aldershot, solicitor; general charge.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

HERD, William Mawdsley, 78, Duke Street, Liverpool, electrical engineer. This debtor has executed a deed of assignment for the general benefit of his creditors, to Mr. Parkin S. Booth, 2, Bixteth Street, Liverpool. This was confirmed by a meeting of creditors last week, when a committee of inspection was appointed, consisting of H. T. Collins and Son, Downes and Davies, and J. Airey. The statement of affairs submitted to the meeting disclosed unsecured trade creditors for £834 and a total deficiency of £864.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Winding-up Petition.

WIRELESS INSTALLATIONS, LTD.—A petition for the winding-up of this company has been presented by Rotax Motor Accessories, Ltd., of Rotax Works, Willesden Junction, London, N.W., and is to be heard at the Royal Courts of Justice, Strand, London, on October 16th.

Companies Winding-Up Voluntarily.

HOME RADIO AND ELECTRIC CO., LTD. J. H. Reed, 71, Kingsway, London, W.C.2, appointed liquidator.

YORKSHIRE AND DISTRICT ELECTRIC LAMP REPAIRING CO., LTD. H. Cawood, 68, Eyre Street, Sheffield, appointed liquidator.

Notices of Intended Dividends.

BARLOW, Alfred James, 9, Brunswick Place, City Road, London (trading as BARLOW BROTHERS), electrical and general engineer. Last day for receiving proofs, October 12th. Trustee, A. Willmott, 14, Old Jewry Chambers, London, E.C.2.

CARTWRIGHT, Thomas Stanfield, of 90, Wellington Street, Stockport, in the county of Chester, electrical contractor, carrying on business under the style of T. S. CARTWRIGHT AND CO. Last day for receiving proofs, October 13th. Trustee, J. G. Gibson, Byrom Street, Manchester, Official Receiver.

GRIFFIN, Douglas Henry, carrying on business at 5, The Mart, St. David's Road South, St. Annes-on-the-Sea, under the style of the MIDLAND ELECTRIC CO. Last day for receiving proofs, October 16th. Trustee, H. Parker, 11, Winckley Square, Preston, Official Receiver.

Edinburgh Gazette.

SILVER, Frank, electrical and mechanical engineer, sometime carrying on business at No. 40, Dublin Street, Edinburgh. Estates sequestrated on September 14th.

Bankruptcy Proceedings.

HOGAN, David William, 5, Leonard Place, Kensington, W. This debtor had acted as managing director of the ALLIES ELECTRIC LAMP REPAIRING CO., LTD., in which he had been closely interested, and under a receiving order made against him on September 12th, on a moneylender's petition, the statutory first meeting of the creditors was held on September 28th at Bankruptcy Buildings, Carey Street, W.C. It appears that in 1914 the debtor was acting as manager of the business carried on by the above-mentioned company and he continued in that capacity until 1919, when he acquired the whole of the shares in the company for £5 000 which he borrowed from friends. He was appointed managing director of the company, but the company's business since 1919 had not been a success, and although he has made protracted efforts to sell, he has been unable to do so. In December, 1921, the debenture holder appointed a receiver and the debtor was actively engaged in helping him financially and otherwise until his death which took place two months ago. The whole of the company's effects are still on its premises at Hammersmith. His liabilities, which he roughly estimates at £4 000, are almost entirely in respect of cash borrowed from, and guarantees given on behalf of, the company. His assets consist of his interest under his father's will and this he has charged to his solicitor for £250, while he also possesses a debenture for £6 000 in the company in respect of costs incurred. There is no surplus value attached to this. The debtor attributes his present position to the want of success of the company. The meeting was closed and the estate remained in the hands of the Official Receiver, who will delay applying for an adjudication in bankruptcy in order that the debtor may have an opportunity of submitting a proposal.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

202 056 A. BUSHELL. Electric light fittings. (15/5/22.)
202 062 EVERSHED AND VIGNOLES, and G. B. ROLFE. Magneto-electric generators and the like. (17/5/22.)
202 063 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electric control systems for arcing electrodes. (17/5/22.)
182 770 SOC. DES ACCUMULATEURS ELECTRIQUES ANCIENS ETABLISSEMENTS, A. DININ. Electric accumulator batteries. (6/7/21.)
185 090 BENJAMIN ELECTRIC, LTD. Connecting and supporting devices for electric fixtures. (22/8/21.)
202 086 W. BROADY. Electric incandescent and like lamp holders or fittings. (25/5/22.)
202 102 A. P. WELCH. Rheostats for controlling the filaments of vacuum tubes. (10/6/22.)
202 105 WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO. INC.). Electric wave filters. (14/6/22.)
202 111 L. G. PRESTON, and J. C. W. DRABBLE. Receiving arrangements for wireless telegraphy and telephony. (17/6/22.)
202 115 A. H. S. MACCALLUM. Electrical apparatus for use in high-frequency circuits. (20/6/22.)
202 117 BRITISH THOMSON-HOUSTON CO., and D. E. JEWITT. Electric ship propulsion systems. (21/6/22.)
202 127 P. R. KUENRICH. Electric furnaces. (1/7/22.)
202 163 CHLORIDE ELECTRICAL STORAGE CO. (B. FORD). Electrical storage batteries. (10/8/22.)
184 486 K. KNAPP, and F. NEUMEYER AKT.-GES. Electric lighting systems for motor vehicles, and more especially for motor-cycles. (15/8/21.)
202 175 A. H. RAILING, C. C. GARRARD, and A. F. SEARLE. Electric fusible cut-outs. (29/8/22.)
191 701 REINIGER, GEBBERT, AND SCHALL AKT.-GES. Electric motor-driven jet interrupter. (12/1/22.)
202 192 J. LUCAS, LTD., O. LUCAS, and W. H. EGGINTON. Electric switches. (22/9/22.)
202 198 C. BRANDES, INC. Chucks for use in winding wires on the cores of electro-magnets. (11/8/22.)
202 206 SULZER FRERES SOC. ANON. Combined internal-combustion and electric propulsion systems for locomotives and the like. (12/8/22.)
202 211 DAGOBERT TIMAR AND CO., and E. SCHRODER. Apparatus for heating forgings or the like by electricity. (13/11/22.) (Addition to 173 468.)
202 215 T. W. RUSSELL. Terminals for electrical cells. (28/11/22.)
190 168 C. A. A. HAIGHTON. Means for flattening the current waves of pulsating direct current. (10/12/21.)
190 728 J. M. SCHMIERER. Multiple safety fuse with rotary switch. (24/12/21.)

APPLICATIONS FOR PATENTS.

September 14th.

23 024 K. E. EDGEWORTH. Container for portable batteries.
23 029 J. GRISPIN, R. E. BUTT and E. H. EDWARDS. Adjustment of instruments for wireless apparatus.
23 043 J. T. RICHARDSON and D. ROSS. Tramway rail.
23 070 J. ALTHERR and A. FRISCHKNECHT. Shortening leads of electric irons.
23 082 C. S. LAMBTON and F. NELSON. Electrically controlled locking mechanism for railway carriage doors.
23 085 ENGLISH ELECTRIC CO. and T. ZWEIGBERGK. Control of electric motor.
23 090 C. E. HERBERT. Variable inductances.

September 15th.

23 107 J. FLESSATI and F. W. SELLARS. Cases for batteries.
23 115 W. A. DU BUISSON. Electric cut-off.
23 121 T. and V. M. CARTMEL. Panel insulators.
23 133 H. E. ASHDOWN. Electric condensers.
23 145 W. J. POOLE. Crystal detectors.
23 150 A. H. S. MACCALLUM. Valve-holders.
23 154 J. P. NORTHEY. Sound signalling installations.
23 163 H. BENVIC. Switches for electric irons.
23 168 E. W. TURNER. Brushes for timers of engine ignition systems.
23 170 F. SCHNEIDER. Apparatus for electrically operating secondary clocks.
23 172 C. H. VIDAL. Electric brake.
23 173 H. FRIEDLANDER. Rectifier for alternating currents.

September 17th.

23 183 A. H. BRIDGER. Wireless receiving set.
23 199 P. TABERNER. Electric terminal, etc.
23 203 HALL BROS. and J. H. AND S. E. HALL and H. H. RATCLIFF. Wireless detector.
23 207 W. R. GOTHARD. Panel construction of wireless apparatus.
23 208 W. R. GOTHARD. Frame aerial.
23 234 C. REUTER (STUDIENGES FUR AUSBAN DER INDUSTRIE). Separating components of a mixture of magnetic and non-magnetic properties.
23 244 F. S., J. H., AND R. N. PATTERSON. Electric furnaces.
23 245 F. R. MCBERTY. Selective switching systems.
23 247 A. V. RYDER. Commutators for ignition systems.
23 253 DR. E. F. HUTH GES. and L. KUHN. Transmission of electromagnetic waves by thermionic tubes. (16/9/22, Germany.)
23 260 T. S. L. MANN. Electric lamps.
23 262 A. G. L. MCNAUGHTON and W. A. STEEL. Radio direction indicating systems.
23 265 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Rotors for elastic fluid turbines.
23 266 BRITISH THOMSON-HOUSTON CO. Automatic control equipments. (29/11/22, U.S.)

September 18th.

23 272 C. H. CLARK. Coil-holder.
23 273 C. H. CLARK. Radio instrument.
23 281 E. TYSZKIEWICZ. Vehicle lighting. (21/9/22, France.)
23 288 COOKE AND WHITFIELD WIRELESS, LTD., and H. H. WHITFIELD. Circuits of wireless receiving apparatus.
23 295 C. K. BROUGH. Inductance coils, etc.
23 304 D. S. B. SHANNON. Apparatus for transmission of wireless signals.
23 312 F. A. CAMM and L. MANNING. Wireless receiving sets.
23 329 G. EVANS. Device for terminals for wireless apparatus.
23 336 A. H. SEABROOK. Transmission and distribution of electrical energy.
23 340 SIGNAL GES. Amplifier for electrical oscillations. (18/9/22, Germany.)
23 343 GRIMES RADIO-ENGINEERING CO. High frequency signalling systems. (19/9/22, U.S.)
23 347 METROPOLITAN-VICKERS ELECTRICAL CO. Electric protective systems for telegraph circuits. (29/9/22, U.S.)
23 362 STERLING TELEPHONE CO. and F. R. GRIFFITHS. Loud-speaking telephone.
23 370 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.) Electric arc devices.
23 377 AUTOMATIC TELEPHONE MANUFACTURING CO. and A. E. HUDD. Arrangements for operating electrical apparatus.
23 379 and 23 379 AUTOMATIC TELEPHONE MANUFACTURING CO., R. MERCER and F. TENCH. Telephone systems.

September 19th.

23 392 D. AND R. F. MACDONALD. Electrode for producing electric light.
23 419 W. S. WORTHINGTON. Wireless receiving apparatus.
23 421 C. J. COLEMAN. Telephone earpieces and means of attaching same to head-phones.
23 442 ENGLISH ELECTRIC CO. and G. SCHROEDER. Dynamo-electric machines.
19 445 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Methods of treating conductors.
23 451 G. L. WARD, T. N. COLE and R. P. RICHARDSON. Rheostats.
23 458 M.-L. MAGNETO SYNDICATE and E. A. WATSON. Current interrupters for ignition magnetos.
23 459 M.L. MAGNETO SYNDICATE and E. A. WATSON. Ignition magnetos.
23 464 AKT. GES. BROWN, BOVERI ET CIE. Apparatus for actuating high vacuum pumps for mercury vapour rectifiers. (25/9/22, Germany.)
23 466 H. L. WOOD. Coil-holder for wireless apparatus.

September 20th.

23 484 J. R. BEARD. Loud-speaking telephone.
23 488 J. H. BENNISON and F. PAPE. Electric fuses.
23 498 F. G. PARRETT. Electric perforator.
23 499 W. H. BEECH and H. SMITH. Clips for cables, etc.
23 501 W. E. BLADON. Electric battery lamps.
23 522 C. W. DENNY. Electric switches.
23 525 W. T. CARTER. Device for amplifying wireless signals, etc.
23 534 T. Y. AND W. E. ACKLAND. Transformers for telephony, etc.
23 541 P. F. W. BUSH and L. F. FOLEY. Lighting sets for motor vehicles.
23 547 METROPOLITAN-VICKERS ELECTRICAL CO. and H. G. BELL. Leading-in conductors.
23 552 H. W. PARKER. Electromagnetically operated sound producer.
23 566 J. SCHLUPEK. Electric heaters. (30/10/22, Czecho-Slovakia).
23 571 STRAND ELECTRIC AND ENGINEERING CO. (NORDEN). Electric signs, etc.
23 576 A. R. ANGUS. Wireless telephone apparatus.

September 21st.

23 585 G. C. CLARK. Wireless telephone leads.
23 592 T. CORCORAN and R. MAHON. Trollies for collecting electricity.
23 597 S. R. QUIGLEY. Wireless receiving apparatus.
23 616 G. T. SKELLEY. Wireless transmission apparatus.
23 626 A. R. M. SANKEY. Rotary current motors.
23 031 A. S. CUBITT and R. F. TUNMER. Electric terminals, connectors, etc.
23 650 IGRANIC ELECTRIC CO. Tuning stands for wireless apparatus.
23 655 UNDERFEED STOKER CO. Mechanical stokers.
23 656 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electric conductors.
23 665 E. J. H. WHYTE. Ignition timing devices.
23 680 A. GOTTLIEB. Hanger-straps for passengers in tramcars, etc.
23 683 AKT. GES. BROWN, BOVERI ET CIE. Method of regulating steam turbine power plants. (30/10/22, Germany).

September 22nd.

23 690 R. CRUST. Electric heating apparatus.
23 691 G. E. PEARSON and F. B. G. ELLIS (Voss). Electric hair waving appliances.
23 698 J. A. CRABTREE. Combined electric switches and couplings.
23 728 C. F. HALSALL. Inductance coils.
23 732 METROPOLITAN-VICKERS ELECTRICAL CO. Elastic fluid turbines. (6/10/22, U.S.)
23 735 L. E. RICHARDS. Holder for telephone headpieces.
23 752 F. E. BERRY. Transformers.
23 753 F. E. BERRY. Obtaining one-phase current from current of a different phase.
23 754 F. E. BERRY. Voltage regulators for a.c. circuits.
23 755 BRITISH THOMSON-HOUSTON CO. and A. S. FITZGERALD. Electric switches

Arrangements for the Week.

FRIDAY, OCTOBER 5th.

ELECTRICAL POWER ENGINEERS' ASSOCIATION (SOUTHERN DIVISION).
7 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, London, W.C.2. Lecture by Mr. J. S. Atkinson on "Development in Powdered Fuel Firing on Steam Boilers and Metallurgical Furnaces.
THE JUNIOR INSTITUTION OF ENGINEERS.
7.30 *p.m.* At the Institution, 39, Victoria Street, Westminster, S.W.1. Lecturette on "Design of Underground Cable Systems," by Major A. M. Taylor.

TUESDAY, OCTOBER 9th.

NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS.
6.45 *p.m.* At St. Bride's Institute, Bride Lane, Ludgate Circus, London, E.C.4. Lecture by Mr. J. L. Chaloner on "Present Day Heavy-Oil Engines."
THE INSTITUTION OF HEATING AND VENTILATING ENGINEERS.
7 *p.m.* At Caxton Hall (Room No. 13), off Broadway, Westminster, London, S.W.1.
THE INSTITUTE OF METALS (NORTH-EAST COAST LOCAL SECTION).
7.30 *p.m.* In the Electrical Engineering Lecture Theatre, Armstrong College Newcastle-on-Tyne. Chairman's Address, by Prof. H. Louis.

WEDNESDAY, OCTOBER 10th.

INSTITUTION OF HEATING AND VENTILATING ENGINEERS.
4 *p.m.* Visit to the London County Hall to inspect the Heating and Ventilating arrangements.
SOCIETE DES INGENIEURS CIVILS DE FRANCE (BRITISH SECTION)
6 *p.m.* In the Lecture Theatre of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2. Ordinary Meeting. Presidential Address by Mr. Roger T. Smith.
THE INSTITUTION OF ENGINEERS-IN-CHARGE.
7.30 *p.m.* At the St. Bride Institute, Bride Lane, Fleet Street, E.C.4. Presidential Address by Mr. T. Cooper on "Engineering Records and their Value to the Engineer-in-Charge."
THE INSTITUTION OF WELDING ENGINEERS.
8 *p.m.* At the Holborn Restaurant, High Holborn, London, W.C. Papers to be read on "Electric Welding" and "Gas Welding."

THURSDAY, OCTOBER 11th.

INSTITUTE OF METALS. (LONDON LOCAL SECTION).
8 *p.m.* At the Institute of Marine Engineers, 85/8, The Minories, Tower Hill, E.r. Chairman's Address by Mr. D. Hanson.

FRIDAY, OCTOBER 12th.

INSTITUTE OF METALS (SWANSEA LOCAL SECTION)
7.15 *p.m.* In the Metallurgical Department, University College, Singleton Park. Chairman's Address by Mr. E. E. Dendy.
INSTITUTE OF METALS (SHEFFIELD LOCAL SECTION)
7.30 *p.m.* In the Non-Ferrous Lecture Room of the University, St. George's Square. Lecture by Mr. A. G. Lobley on "Electric Resistance Furnaces."
THE JUNIOR INSTITUTION OF ENGINEERS.
7.30 *p.m.* At the Institution, 39, Victoria Street, Westminster, S.W.1. Paper by Mr. W. Yorath Lewis on the "Never Stop Railway."

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VOL. XCI.—No. 2369. FRIDAY, OCTOBER 12, 1923. SIXPENCE

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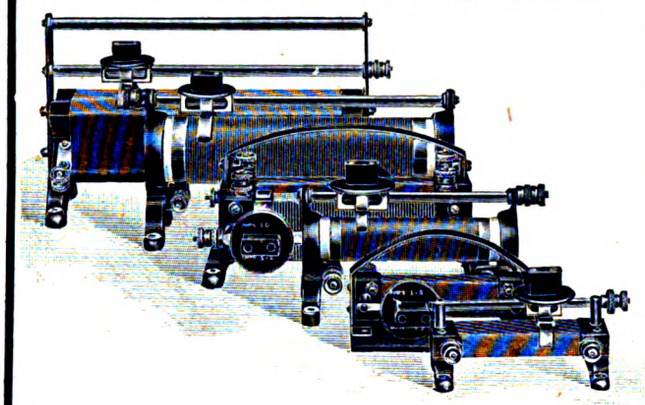

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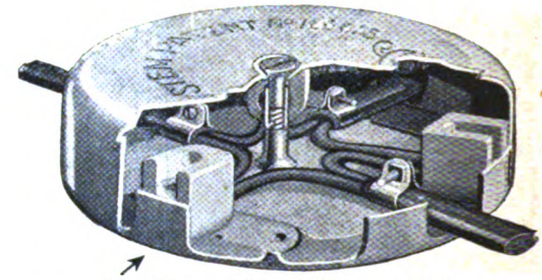

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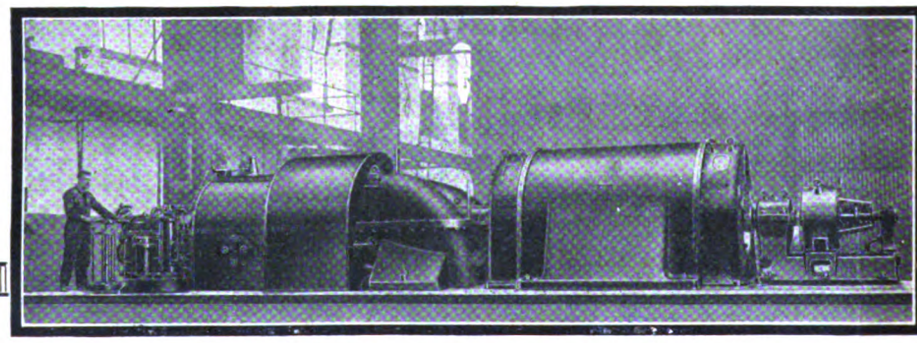

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THE ELECTRICIAN

ESTABLISHED 1861.

THE OLDEST WEEKLY ILLUSTRATED JOURNAL OF

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Notes of the Week.

A Broadcasting Problem.

On another page of this issue we give an account of some experiments conducted by Dr. H. W. Nichols and Mr. Lloyd Espenschied to enable any subscriber on the Bell system in the United States to communicate with a ship's wireless station. These experiments had the important result of indicating the enormous variation between the received field strengths in the day time and at night which occurs at distances of the order of 1 000 miles using wave lengths of 350 to 400 metres such as now employed in broadcast transmission. The curve which we publish elsewhere in this issue shows night to day variations of 100 to 1, or a power ratio of 10 000 to 1. This means that it would require 10 000 times more power to get through as well during the day as during the best times at night. In the trans-atlantic wireless telephone experiments which were described in The Electrician of January 19th, 1923, similar variations in received results were noticeable, though the longer wave lengths employed reduced their effects. Wide fluctuations also occur during the night, and these, though smaller than those between day and night, being of the order of 100 to 1 in power, are often so rapid as to make it impossible to maintain a regular service. But to British wireless engineers at the present time the most interesting result of these experiments is to show the need for wave lengths longer than those at present allotted to the British Broadcasting Co. It is a matter of general experience that the transmissions most reliably received in this country are those from the Eiffel Tower on a wave length of 2 600 metres. The present broadcasting wave lengths make "fading" a constant source of annoyance to the listener-in, and cause him to blame his apparatus rather than the short waves. Jamming from spark stations is in many districts usual, and the whole condition of affairs points to the desirability of employing a longer wave length at at least one British station. In the reorganisation of broadcasting, which is, we hope, about to take place, this point should certainly be considered.

Broadcasting—Some Complaints.

The Postmaster-General's compromise solution of the broadcasting problem has not met with universal acceptance. From the Broadcasting Company's point of view it is a little better than the Committee's Report, but they can hardly regard with equanimity the acquittal of 200 000 unlicensed listeners on the understanding that they do by October 15th something that they ought to have done months ago. But most of the opposition naturally comes from the wireless trade associations. The committee recommended that there should be released from contributions to the Broadcasting Co.'s revenue and freed from restrictions on the importation of foreign apparatus. The Postmaster-General, though he has reduced the royalities payable, has absolutely banned foreign parts, and an undertaking not to use such parts is one of the conditions of the issue of a licence. It is not, therefore, surprising to find that the Wireless Committee of the Electrical Importers' and Traders' Association notes with surprise the perpetuation of a system that stands condemned by the Committee, and protests against a Government department overriding the fiscal policy of the country. The Wireless Retailers' Association have passed a resolution in much the same terms, disapproving the rejection of the Committee's most vital recommendations. Both these resolutions lose sight of the fact that the Postmaster-General entered into a certain agreement with the Broadcasting Co., and that an agreement cannot be broken without the consent of both parties. The Broadcasting Co. do not, rightly or wrongly, see fit to allow the agreement

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to be altered so as to make it possible to carry out the Committee's scheme, and that for the time being is the end of the matter. With regard to the banning of foreign parts, the vital point, in our opinion, is not one of powers but of effectiveness. Licence-holders must agree not to use such parts; but what about those who still fail to take out licences. How many of the "200 000" are as innocent as they seem and how many of them will still remain unlicensed? And how can they be made to take out licences without more trouble and expense than the whole thing is worth? On this particular point the POSTMASTER-GENERAL shows a touching faith in the integrity of human nature which we only hope events will justify.

The Reaction Question.

THE genuine broadcaster has another complaint which is not specifically dealt with either by the Committee or the Post Office. The "200 000" have not only caused a loss of revenue to the Broadcasting Co. but have been a source of annoyance to the listeners-in. Many of the sets used have been constructed without any real wireless knowledge, and the result has been disturbances which have made "tuning-in" and listening difficult. Nothing seems to have been suggested for altering this, but we hope that the Post Office will set about the work of inspecting the sets forthwith, so that existing conditions may be improved for everybody's benefit. One of the best ways of doing this would be to proceed against the maker or seller of such sets, who at least has no excuse for not complying with the regulations.

The Neglect of Research.

THE business mind occasionally operates in mysterious ways. In this country it is customary for firms to increase their advertising appropriation when trade is good and their books are full of orders, which cannot be executed owing to congestion in the shops, and to reduce it when the order books are empty and men are being dismissed owing to lack of work. To the unbiassed lay mind an exact reversal of this policy would be an improvement. But the same policy, we learn from the report of the Committee for Scientific and Industrial Research, is also being adopted in that very important and interesting matter, research. In 1917–18, £1 000 000 was voted by the Government for making grants to approved trade research associations over a period of five years. Reviewing the results of this generosity during this period, which in the case of most Associations will shortly close, the report indicates that they fall far short of reasonable expectations. The grant was made on the condition that a certain minimum additional sum was subscribed by each industry, while further grants on a diminishing scale were only to be made when a second higher limit was passed. Only seven Associations out of twenty-two have exceeded this second limit, and the majority have done little more than reach the minimum. This is rightly described as disappointing.

Future Policy—An Awakening Necessary.

ON good evidence this condition of things is ascribed to industrial depression. Only four Associations were established before the Armistice. Seventeen came into being during the boom period, 1918–1920, but since then only one Association has been formed. Yet when trade is bad and shows little signs of improvement would seem to be the time to exert every effort to find better methods of manufacture and to obtain fuller information as to the properties of the materials used. We are glad to think that this has been done in the electrical industry. As, therefore, few of the Associations under review have succeeded in establishing themselves on an independent basis, and as the conditions have changed since the original contracts were made, the grants will be discontinued at the end of the quinquennial period, unless good reason is shown why different action should be taken. If a further grant is made it will only be for a period of five years and no more, and will not be made at all unless the industry can reasonably be expected to supply the necessary effective income at the end of that time. In other words, industries who wish their Associations to receive further support must show a continuously increasing effort to shoulder the financial burden of the Association until at last it is entirely supported by the industry. We hope that in the case of the Electrical Research Association this support will be fully and freely given. The Association has done good work and has saved the industry money. It will do more good work and save more money if it is given the chance.

The World Power Conference.

SOME further information regarding the first World Power Conference, which, it will be remembered, is to be held at the British Empire Exhibition from June 30th to July 12th next year, has now been made public. The Conference will conduct its business under the presidency of the EARL OF DERBY; committees have been formed in sixteen participating countries; Mr. D. N. DUNLOP is organising director, and Mr. ROGER T. SMITH is chairman of the programme committee. The programme will be arranged in five divisions, four of which will deal with the resources, production, distribution and utilisation of power respectively, while the fifth will comprise such important inter-connected matter as economics, finance, research, education, health and publicity. An international executive committee, on which each national committee will be represented, will be formed and will meet at convenient times during the Conference in order that the business may be conducted in a satisfactory manner. The scope of the Conference is wide and, as will be seen from the details which we publish elsewhere, the subjects to be dealt with in each section are of perennial interest and importance. A number of Papers have already been arranged for by the British Committee, and we hope that an equally well-balanced list will be forthcoming from the other participating countries, and especially that each country will expose its own particular problems to discussion and possible solution. In this connection we are glad to learn that each country is to give information about its water-power resources. This will bring together an amount of statistical and technical detail which should be of the greatest use in dealing with this important subject. The World Power Conference is the first of its kind. But there is no reason why it should be the last.

Cohesion.

THE discussion on cohesion and molecular forces which took place at a joint meeting of the physics, chemistry and engineering sections of the British Association did not add much to our knowledge of the subject. The problem was restated rather than solved, and we feel inclined to agree with Sir OLIVER LODGE that it is an astonishing thing that three sections of the Association should at this time of the history of science meet to answer the question why when one end of a stick was picked up the rest comes up also. Sir WILLIAM BRAGG, who opened the discussion, said that whereas in the past we had been content to investigate the forces affecting aggregates of atoms and molecules, it was now necessary to discover the forces affecting each individual molecule and atom. The trouble in the past had been not knowing the structure of the atom or the molecule or crystal, and, therefore, we had been bound to deal with aggregates. It had now been possible to investigate the properties of the crystal and from that we could continue and ascertain the forces at work in the individual atom. Only in that way should we be able to understand the real nature of cohesion and molecular forces.

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Electricity Supply Progress.

The third annual report of the Electricity Commissioners, which covers the period from April 1st, 1922, to March 31st, 1923, is a document which should be studied not only by every electrical engineer, but by everyone who is in any way connected with the electrical industry. High technical achievement, the design of apparatus, the sale of equipment, all have as their implied or avowed object the consumption of more and more electricity. In other words, the electrical profession and industry stands or falls ultimately, not on the disposal of a certain quantity or material product but on the amount of immaterial energy which it can provide for the use of the industrial and domestic public. The Commissioners' report is in essence an account of the success that is being attained in the latter direction, and it is therefore satisfactory to record that everything is going according to plan. In commenting on last year's report we described it as faintly apologetic. There is nothing of the *apologia* about the present document; and we fail to see any reason why there should be.

Progress All Along the Line.

In fact there has been progress all along the line. The Commissioners note as one of the principal features of the year under review the general improvement and rising curve of output of the supply undertakings in Great Britain as a whole. This improvement is rightly ascribed to the recovery of trade, the fall in the price of coal and materials and the adjustment in wages, all of which caused a great demand for electricity and lowered its cost. To state the position in figures, while in 1921-22 4 884 666 038 kWh were sold, this had increased to 5 738 718 485 kWh in 1922-23. These figures do not take into account the electricity generated in stations which do not give a public supply, but this, as will be gathered from the remark of the Commissioners that in one district the plant installed in collieries and other industrial undertakings largely exceeded the total capacity of the plant installed by the whole of the authorised undertakers, is no inconsiderable amount. The consumption of electricity is therefore large, though it is not large enough.

Development of the Domestic Load.

This increase in the demand for electricity is due in some districts entirely to the development of the domestic load. In others the domestic and power loads are equally responsible. All is grist that comes to the electrical mill, but we are glad to learn that the importance of a more extensive development of domestic load has been generally recognised, and that statistics point to the fact that active steps in this direction have already been taken by a number of supply authorities. We may be forgiven for once again insisting on the importance of this. Real progress in electricity supply, which means real progress in the electrical industry, can only come by closer and closer attention being given to this matter. It is everyone's duty to see that the domestic campaign is carried on with all the energy and resources at the industry's command.

Large Increase in Demand.

As is usual, the report contains a large amount of information regarding the routine duties of the Commissioners. We ask our readers to spend a certain amount of time in studying this. It will entirely remove the impression that this much maligned body is doing nothing. Fortunately, however, the impression may quickly be removed, if in a more negative way, by quoting certain figures regarding demand and generating plant given in the report. The fifteen electricity districts that have already been determined include the most important industrial areas in Great Britain, with the exception of the North-East coast. The inquiries held show the immense scope that exists for further development and the great economies that can be effected by joint action. The potentialities are strikingly illustrated by saying that in twelve of the districts the aggregate maximum demand amounted in 1920-21 to 1 146 860 kW with 2 632 million kilowatt hours sold. In 1926-27 these figures will, it is estimated, increase to 2 040 675 kWh and 4 990 million kilowatt hours, and to 2 937 090 kW and 7 356 million kilowatt hours by 1931-32. The last figures show an increase of 151 per cent. and 180 per cent. respectively over those for 1920-21. These results are, it should be explained, based on the figures put forward by the promoters in the schemes submitted at the local inquiries, and may therefore be taken as having a good deal of foundation in fact.

The Slump and Progress.

That they are not wholly chimerical is evidenced by an examination of the progress actually made since the Commissioners came into being. From January 1st, 1920, to March 31st, 1923, 1 279 088 kW of new generating plant has been sanctioned in the United Kingdom, of which amount 420 000 kW was sanctioned during the year under review, as against 169 000 kW in the preceding year. Of this total 840 845 kW was for plant in stations owned by authorised undertakers, and 582 750 kW of the latter quantity, or 68·5 per cent., was for extensions in principal stations which have been scheduled for retention in nine electricity districts. These figures show two interesting things: One, that the plant installed during the war to deal with the munitions load has failed to cope with the increased demands for electricity that have arisen during a period of trade depression; and two, that the Commissioners have been able to control development along lines which will accord with the engineering schemes for the different districts. Of these the former is by far the most significant. It shows that the estimates of future progress are rather restrained than too rosy, and it gives rise to the question: If this can be done during a slump, what may not be done during a boom? The correct answer to the question is: Anything.

Non-Technical Obstacles.

Nothing, however, that is worth obtaining is obtainable without some difficulty, and in the case of the reorganisation of electricity supply, there are certain well-known non-technical obstacles to be overcome. But it further appears from the report that these obstacles may prevent the realisation of the best and most efficient engineering scheme because "only in a few districts will it be found practicable to formulate and give effect to an *engineering* scheme of organisation dictated by electrical considerations alone." This requires a little pondering, but it is elucidated to a certain extent by the further statement that "the engineering problem has not proved capable of dissociation from the particular interests of the various authorities in a district," and by the very full account of the proceedings in the Aire and Calder District, which we recommend everyone to study.

Without making any exaggerated claims, it is certain that generation in modern stations of fair size, where not only is the plant efficient in operation but the general lay-out and design are better, makes for more economical working than in the older and smaller stations. To use modern plant means cheaper electricity, and cheaper electricity, as the Commissioners point out, means a greater industrial demand, because manufacturers are showing an increasing tendency to take a public supply where the rates are satisfactory. It will also mean an increased domestic demand, for one of the great obstacles to a further use of electricity in that field is undoubtedly its cost. Anything that prevents a reduction of cost and of selling price is therefore to be most heartily deplored. The industry, for the reasons we have already stated, should bear this fact in mind, and bring pressure to bear on the recalcitrant to ensure that not only the best engineering scheme is adopted in every district but that it is adopted quickly.

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Notes on Wireless Matters.

By Prof. G. W. O. HOWE, D.Sc.

The British Science Guild and Thermionic Valves.

The British Science Guild, founded in 1905 by the late Sir Norman Lockyer, "to promote the application of scientific methods to social problems and public affairs," has just issued a six-page pamphlet entitled "Thermionic Valves and their Uses," written for the purpose by Prof. Fleming.

The pamphlet gives an outline of the development of the thermionic valve from the Edison experiments in 1883 down to the promised 1 000 kW valve of the General Electric Co. of America. We do not agree, however, with Prof. Fleming's comment that "If this can be done, large thermionic valves will replace high frequency alternators entirely in long distance wireless stations." Similar obituary notices were issued with regard to the spark when Poulsen introduced his arc generator nearly 20 years ago. Enthusiasm is apt to affect one's critical faculties. The pamphlet is very clearly written in non-technical language and is admirably calculated to fulfil the object for which it has been published. A little more care devoted to proof-reading would have avoided "possibe" for "possible" and the "Steam Electric Lamp Works" for the "Stearn Electric Lamp Works."

Direction-Finding by Reception: Practical Systems.

A report recently published by the Department of Scientific and Industrial Research discusses practical systems of direction finding by reception. It is called Special Report No. 1 of the Radio Research Board, and it has been written by Mr. Smith-Rose and Mr. Barfield, who have carried out the investigations on behalf of the Directional Wireless Sub-committee of the Board at their station at the Admiralty Compass Observatory, Ditton Park, Langley, Bucks. The authors divide the direction finders in use at the present time into three distinct types, viz., the single frame coil, the Bellini-Tosi, and the Robinson type. The report contains a description of each type and a discussion of its theory and errors, an account of the experimental comparisons carried out, and a general discussion on the operation of the three systems.

The Single Frame Coil.

In theory the single frame coil capable of rotation about a central vertical axis is the simplest; it is merely necessary to rotate it until the signal received is zero, when the coil should be in such a position that the magnetic flux through it is zero, and the plane of the coil therefore broadside on to the direction of the transmitting station. Until the advent of the amplifier, the size of coil necessary to give an audible signal was so great that it was practically impossible to rotate it; this led to the development of the Bellini-Tosi system, in which two U-shaped aerial systems at right angles had each a coil at the centre of the horizontal part, these coils being also at right-angles; a secondary coil, arranged so that it could be rotated within these two primary coils, was connected to the detector, and rotated until the silent position was found.

The Robinson System.

In both these cases, however, the silent position may be very indefinite, that is to say, it may be possible to move the coil over a considerable angle without an audible signal. In practice it is necessary, therefore, to note the position in either direction when the signal becomes audible, or reaches a certain standard of audibility, and then bisect the two positions. The ear has a very poor memory, and it is necessary to swing the coil backwards and forwards several times to get the correct position. This is avoided in the Robinson system by the use of two coils fixed at right-angles and rotating together. If they are connected in series, they are equivalent to a single coil at some intermediate angle depending on the relative sizes and numbers of turns in the two coils. If now, by means of a switch, the connections of one of the coils are reversed, the position of the equivalent coil swings over to the other side of the unchanged coil, the position of which bisects the two positions of the equivalent single coil. The whole system is rotated until the signal is equally loud on operating the switch. A switch can be thrown backwards and forwards much more rapidly than a heavy coil can be swung into carefully noted positions, moreover, in the Robinson device the jump from one position to the other takes place suddenly without going through an intermediate range of sound, and thus enables one to match the sounds more accurately. It is claimed that this is specially helpful in the presence of large external noise.

Range of the Tests.

The tests cover a range of wave-lengths from 1·8 to 9·0 km. both for damped and undamped waves, and the results may be summarised as follows: Permanent errors due to location and the variable errors by day and night are the same on all systems, and the night errors greatly exceed the limits of accuracy of either system. With regard to ease of operation there appears to be little to choose. If the wave-length is fixed the Bellini-Tosi system is quickest to operate, but if retuning is required, one has two aerial systems to tune, and careful tuning is essential to accuracy; with untuned aerials, however, very rapid searching can be carried out with this system over a wide range of wave-lengths. "Where extreme rapidity is not, however, necessary, the single frame would appear to be just as efficient." The general impression left on

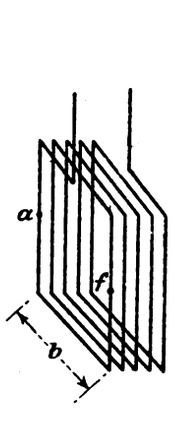

FIG. 1.

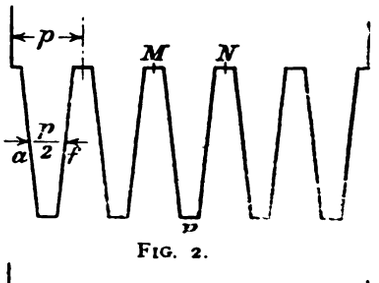

FIG. 2.

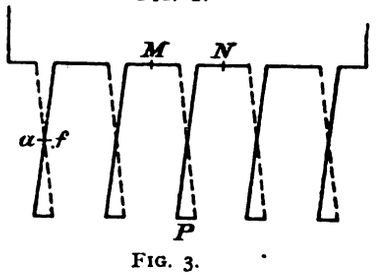

FIG. 3.

the reader when he gets to the end of the report is that there is little to choose between the three systems.

Plane of Main Coil Turns.

When explaining the theory of the single box-type coil, the authors say that "there is a possibility of obtaining an effective turn of wire whose plane is practically at right angles to the main turns of the coil." They speak of eliminating the error due to this, but in the opinion of the writer, the so-called error is due to a mistaken view as to the plane of the main turns of the coil. If a coil is wound on a box so that each side progresses a quarter of the pitch, one cannot say that the turns are in a plane perpendicular to the axis. Such a coil of five turns is shown in Fig. 1; Fig. 2 is an elevation viewed in the direction which the authors call the mean plane of the coil. It is obvious that magnetic flux in this direction will induce an e.m.f. in the coil, since each turn such as MPN offers a certain projected area normal to this direction. But in so far as a spiral turn can be said to have a mean plane it is certainly not the plane in which it has the elevation MPN of Fig. 2. If, however, the coil be rotated through an angle p/2b, the point *a* will come immediately behind the point *f* and the elevation will appear as in Fig. 3. Now we may say that we are viewing the coil along the mean plane of the turn MPN, and flux in this direction will not induce an e.m.f. in the coil since the total projected area is zero. If a pointer is to be fitted to such a coil its direction should be fixed with reference to the line joining the points *a* and *f*. A simpler method is to do as the authors suggest and wind the two vertical and bottom sides with no spiral, and then pass from one turn to the next across the top. If, however, the ordinary spiral is adopted, the above way of regarding it appears preferable to the calculation of the e.m.f. induced in the "equivalent extra turn" which only exists because one views the coil in a wrong direction.

Compensation of Antenna Effect.

The compensation of the antenna effect is also discussed in the report, the method recommended being the use of a compensating condenser connected between the grid of the first valve and earth.

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The President of the Institution of Electrical Engineers.

Dr. Alexander Russell: An Appreciation.

On Thursday next Dr. Alexander Russell, the new President of the Institution of Electrical Engineers, will enter upon the formal duties of his office, and deliver his presidential address.

It will be remembered that the long succession of presidents who were more or less closely connected with the supply industry was broken last year by the election of Mr. Frank Gill, and the tradition has been continued in the election of Dr. Alexander Russell.

Though Mr. Gill was not connected with the more spectacular side of the industry, he emphasised in no uncertain way the part which electricity can play in developing international communication, and the suggestion thrown out in his address of an International Telephone Authority has been taken up and seems in a fair way to be adopted. The apprehensions felt by many, therefore, that the appointment of a telephone engineer to the presidency at a time when so many problems in the supply section of the industry were urgently waiting to be solved was, in the event, unjustified, and any similar apprehensions that may be felt are equally likely to be without foundation during the coming session when Dr. Russell is in the chair. Indeed, we welcome Dr. Russell's presidency for one excellent reason. For important as both supply and telephony are, it will probably be agreed that they are both dependent for their success on the proper education of the recruits entering these fields.

DR. ALEXANDER RUSSELL, PRESIDENT OF THE INSTITUTION OF ELECTRICAL ENGINEERS.

A Lifelong Educationist.

It is hardly necessary to say that it is with this important duty that Dr. Russell has been connected for the whole of his professional life, and we may, therefore, hope to hear in his Presidential Address, and learn from the work which he will do on the Council, some interesting reflections not only on the part the Institution can play in imposing its educational ideas on Government and municipal authorities, but exactly what those ideas are. The matter is full of complications, and if Dr. Russell can see his way to bring about a little more clarity than at present exists, he will deserve the thanks of everyone connected with the electrical industry.

Some Biographical Details.

Turning to biographical details, Alexander Russell was born at Ayr in 1861, but without this fact being stated, anyone who has met him would realise that he is of Scotch extraction. He was educated at Glasgow High School and University, and graduated from the latter as M.A. in 1882. He had the advantage of studying directly under Lord Kelvin, and obtained the first prize in that master's Senior Natural Philosophy Class. He proceeded like many others have done, indeed like Kelvin himself, from Glasgow to Cambridge, where he obtained the fourteenth wranglership in 1885. He immediately took up teaching, and for two years was assistant lecturer at Caius College, and afterwards a mathematical master at Cheltenham College and the Oxford Military College.

One of the educational problems to which we have just referred, and which we hope Dr. Russell will deal with in full, is the amount of training, both practical and theoretical, that one student can undergo without loss of time and efficiency. One of the ways of doing this is by the "sandwich" system of training which it is interesting to note has always been part of the curriculum of the Faraday House Electrical Engineering College.

Connection with Faraday House.

It is probably well known that Dr. Russell has been connected with this college since its start in 1890, when he became senior lecturer and head of the physical laboratory. On the death of the late Mr. H. E. Harrison in 1909, he was appointed Principal, and a year before that Glasgow University had conferred the degree of D.Sc. upon him.

Theoretical Work.

As we have stated above, Dr. Russell's main interest has always been educational, but apart from it he has a decided leaning to theoretical problems, and the work that he has done in these directions is not only reflected in the various successes his students have gained, but in the number of books and papers which he has published. We may instance as examples of the latter an advanced treatise on "Alternating Currents," which was published in 1904. This was translated into French by Dr. Seligman-Lui. He has also written a treatise on the theory of cables and networks which contains a large amount of useful information which in these economical days is gradually being turned to practical use. His book may be looked upon as containing much authoritative information on this subject, and considering its importance at the present time, it is to be hoped he will have something to say upon this matter in his Presidential address.

Articles rather less profound in subject-matter included two lengthy serials for "The Builder," one on electrical engineering, and the other on electrical heating and lighting. He has also written a brief biography of Lord Kelvin which has been widely read, and translated into English Prof. Buchetti's work on "Engine Tests and Boiler Efficiencies."

The papers which he has written from time to time have been communicated to the Royal Society, the Institution of Electrical Engineers, the Physical Society, the "Philosophical Magazine" and THE ELECTRICIAN.

The Grading of Cables.

These papers included those on subjects connected with cables, especially their grading to resist electric stress. In this connection he was the first to point out the relations which exist between the various capacities of the cores and sheath of a polycore cable, and to give an accurate definition of the capacity between two cores. In 1901 he devised the method of measuring the insulation resistance of a live network, while in 1903 he described a rapid method of

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measuring the mean spherical candle-power of lamps. It is also interesting to note that in 1906 he verified a suggestion made by Lord Kelvin in 1860 that at very high pressures the maximum potential gradient at which the air-space between two electrodes would break down would be found to be constant.

He has devoted much time to methods of calculating the self and mutual inductances of coils of various shapes. He gave the complete solution of the problem of the skin effect in a concentric main. Kelvin gave the solution in terms of the ber and bei functions. To give the complete solution he found it useful to define new functions, which he called the "ker" and "kei" functions in honour of Kelvin. Complete tables of these functions have now been tabulated. His papers to the Royal Society have generally been in connection with Poisson's problem of two electrified spheres. A complete and greatly simplified solution of this problem he explained last year as part of his Presidential Address to the Physical Society. He has given formulæ for calculating the maximum potential gradient between spherical electrodes, and published simple methods for calculating the capacities between spherical electrodes and the capacity of a spherical condenser when the inner sphere is not concentric with the outer. He has also obtained a theoretical verification of Kennelly's experimental result that the convection of heat from a thin wire varies inversely as the square root of the radius of the wire and directly as the square root of the velocity of the cooling breeze. He pointed out that Newton's law of cooling—namely, that the heat-convected was proportional to the difference of temperature between the body and the cooling breeze—was very approximately correct in all cases. He has also devised novel methods for the graphical harmonic analysis of periodic functions. These methods are based on the evaluation of Fourier's solutions by means of the methods of mechanical quadrature given in books on the Calculus of Finite Differences.

Connection with the Institution.

Dr. Russell's connection with the Institution of Electrical Engineers has been a long one. He was elected a member in 1899, and has served more than one term on the Council both as ordinary member and as Vice-President. At the time of his election to the presidency, like Mr. Gill, he was serving as an ordinary member of the Council. He has also been closely connected with the development of the Physical Society of London, serving for many years on the Council, and being elected President in 1922, an interesting conjunction of events which we should think is unique.

He has been awarded an extra premium and several original communication premiums.

In the same year that Dr. Russell took up his appointment at Faraday House, he married Miss Edith Ince, daughter of Mr. H. B. Ince, Q.C., M.P., and has one son and one daughter.

Recent Developments in the Application of Wireless Telegraphy to Shipping.*

By CAPTAIN J. A. SLEE, C.B.E.

High Speed Apparatus.

On large transatlantic liners high speed automatic transmission and reception is necessary in order to avoid unduly monopolising the attention of coast stations by the heavy traffic. The method adopted is as follows:—

The aerial circuit is magnetically coupled to a closed circuit kept in a state of constant oscillation by the transmitting valve. The coupling between the closed and open circuits is arranged in two equal parts opposed to one another. Signalling is done by short-circuiting half this coupling so that the transfer of energy from the closed to the aerial circuit takes place through the remaining unbalanced portion. In order to keep the load on the transmitting valve constant an artificial resistance, short-circuited at the same moment, is inserted in the closed circuit. This allows of transmission at 60 to 90 words per min. without any trouble from sparking at the key contacts.

The standard nominal 1½ kW valve transmitting panel is used, the supply to the anode of the transmitting valve being approximately 1·2 kW. The aerial current for a prolonged dash is about 7A, and the effective range of transmission at 90 words a minute is about 700 miles. The high speed keying is carried out by means of a Wheatstone or Creed transmitter working from a perforated tape.

The receiving apparatus consists of the usual loosely coupled circuits tuned to the frequency of the wave to be read, the high frequency current being amplified by six high frequency valves working in a transformer-coupled amplifier of the "55" type. The amplified current is acted upon by an accurately tuned local oscillator, after rectification, the current, now at the beat frequency, is passed through a four-stage low frequency tuning circuit. This consists of a four-valve low frequency amplifier, each of the grid circuits being tuned to the pre-determined beat frequency, the anode circuit of one valve being loosely coupled to the grid circuit of the next.

The magnification to sounds of the pre-determined frequency is great, but is less than one-to-one for any signals differing by but a very small amount from the frequency of the filter. Hence a tangent screw is needed to give exceedingly fine adjustment of the local oscillator frequency.

After passing through the filter the signals are again rectified and applied to the grid of the valve operating the recording device. The anode current from this valve actuates the recorder, and is substantially a direct current of strength varying between practically zero and about 5 mA. Very satisfactory results have been obtained at sea with undulators of the McLachlan type, which are very reliable and completely proof against vibration and movement of the ship. Receiving speeds up to about 100 words per minute can be thus obtained when signals are strong.

The automatic recorder can also be used to record ordinary hand speed messages, such as press messages, while the ship's operators can be employed in reading messages on other wave lengths independently of the recorder. Such double reception, i.e., reception of signals on two different wave lengths at the same time in the same ship, is now a common practice in these very large vessels.

Note Filters.

The increase in the number of powerful wireless stations has made the reading of press messages in ships at sea very difficult. Two or more messages may be audible in the telephones at the same time. Although the beat notes may differ it is difficult for the human ear to pick out the weaker sound which he requires amidst louder sounds.

To overcome this difficulty two-stage note filters, similar in principle to the four-stage note filters described above, are now in use. Although the tuning obtained is less sharp such filters simplify the problem considerably. These note filters are only of use for reading continuous wave messages in which the pitch of the note received can be varied at will by an alteration of the frequency of the local oscillations. They are of no service for spark telegraphy when the note depends upon the transmitter only.

Wireless Beams.

"Revolving beam stations" have proved of great assistance to navigation. These stations transmit a wireless signal on an exceedingly short wave (about six metres) in the form of a fairly concentrated beam, and the whole apparatus of the transmitter can be rotated bodily on a turntable. Special receivers suitable for this short wave telegraphy can be fitted to receive signals sent out by the revolving beam transmitter. This abnormal form of telegraphy is entirely free from inter-

* Abstract of a Paper read before Section G (Engineering) of the British Association.

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ference from other signals. Hence simple signals, e.g., single letters, are easily read and the services of a skilled telegraphist are unnecessary.

In this beam transmitter signals fall to about half their maximum strength about 10 deg. on each side of the axis of the beam, diminishing to practically zero a further 10 deg. each side of the axis.

Signalling Bearings.

The method of signalling bearings by means of the beam is as follows:—

As the projector is rotated a contact finger passes over studs on the turntable, which are arranged to produce a different letter, selected from the longer Morse letters, at each two points of the compass. A ship at the normal working range of the beam would thus hear either two of these long letters fairly loudly, in which case the bearing would be between them, or one long letter would be faintly heard, then one loudly and a third faintly. This gives a rough indication of the bearing, but the arcs between long letters are split up by three equally spaced short letters, each of which represents a half point of the compass. A disc is provided marked in half points of the compass and fitted with two pegs which the observer can stick into the disc at the first and last sound which he hears; he then knows that the bearing will be midway between the points indicated by the two pegs.

One such station exists at Inchkeith Island and a second is being erected at the South Foreland Lightship. The use of this device should extend rapidly in the near future. At present bearings can be obtained with accuracy and certainty at a range of about 10 miles. Although range may be reduced by intervening obstacles, there is no distortion, and the method is not susceptible to electrical errors. The bearing is independent of the rate of revolution of the projector.

Receiving Arrangements.

The absorption of such very short waves is so great that it is not possible for a receiver fixed on the distant side of a ship to perceive the signals; therefore two receivers have to be fitted, one at each end of the bridge so that one at least will be operative under all conditions.

The receiver consists of two brass rods about a yard long fixed vertically and end to end, projecting from a small case which contains the tuning appliances. An amplifier and telephones are fitted in the chart house of the vessel. There is no difficulty in joining up a loud speaker, which would give audible warning should the vessel come within range of the beam.

It is necessary to decide whether true bearings or magnetic bearings are indicated, and also to standardise the use of the "long" Morse letters to indicate the alternate points of the compass. As the tuning is very sharp it should be permanent and accordingly the wave length of the beam transmitters should also be standardised. A distinction between two beam transmitters in the same neighbourhood is best effected by making use of various combinations of short letters.

Direction Finding.

It is also gratifying to note the steady improvement in the accuracy of long range direction finders, enabling a bearing of any vessel or coast station making use of their ordinary wireless transmitter to be ascertained. Their available range is nominally 100 miles, but accurate bearings are often obtained at three times this distance. Owing to interference, the services of a skilled telegraphist are necessary.

Error inherent in direction finders themselves are now understood and can be eliminated or compensated, and consequently reliance can be placed upon the performance. Causes external to the instrument itself such as arise if the line of bearing between the receiving ship and the transmitting shore station cuts the coast line at an acute angle, may also introduce errors. By careful examination of charts it is possible to mark out certain arcs in which direction finder bearings of some shore stations are liable to error, but the problem is complex and demands further research.

A direction finder, if mounted in a ship, can only measure angles relative to the keel line of the vessel and therefore bearings must be translated into "true" bearings (relative to the meridian) by the navigators. Hence good results depend almost as much upon the navigating staff as the telegraphist.

Developments in Telephony.

Advances in wireless telegraphy have allowed telephony to be carried out in accordance with the "duplex" method, permitting transmission and reception at the same time. There are two distinct methods, each station may transmit on one wave and receive upon another, differing so widely that the transmitter can be arranged to have little or no effect upon the receiving instruments of the same station. This method is simple, but is liable to cause and to suffer from interference due to the fact of two such widely differing waves being used. A second method is to use two waves near to one another, but so chosen that the beat frequency will be above human hearing. This method possesses many advantages, the only difficulty being that of making use of more than a very moderate amount of power. Experiments are in hand with a view to linking up vessels within a moderate distance of their terminal ports (say 50 miles) with the local Post Office Telephone Exchange System. There is no difficulty in maintaining good telephonic speech with the wireless telephone station on land. The real complexity occurs when the land telephone station has to be operated by subscribers at greatly varying distances from the exchange, as it is necessary that speech should reach the wireless telephone transmitter at some fairly definite intensity in order that distortion and faintness may be avoided. In order to work on an economic basis the land telephone apparatus should work unwatched. At present it is felt that the first objective is to obtain communication between a vessel say 50 miles at sea and a limited number of special subscribers at her home port. More ambitious schemes for extending the use of telephony between ships and the shore can be undertaken subsequently.

A Safe Method of Lighting Coal Mines.*

By Prof. W. M. THORNTON.

The remarkable increase in the number of cases of mystagmus amongst coal miners, known to be produced by the imperfect lighting at the coal face, calls for improved method of illumination. The direction in which this has been hitherto sought is by the use of more powerful portable low voltage electric lamps. The maximum voltage permitted at the face for signalling purposes is 25, direct or alternating, and with this unarmoured cab-tyre flexible cables may be used. An evident method of improving illumination is to use 25 V with fixed or portable lamps. The objections raised to any such scheme are solely those of ignition, since shock is impossible at such voltages and the circuits are non-inductive.

Recent observations on the influence of frequency on the ignition of methane (fire-damp) show that by use of much higher frequencies than those now employed for power purposes a higher factor of safety can be obtained. For example, by the break of a 200 V direct current circuit occurs at 0·5 A. At a frequency of 50 the least igniting current is 6·5 A, while at 160 it rises to 25 A. At a voltage of 20 and a frequency of 160 it is impossible to ignite this mixture with a clean break of less than 150 A. Now the currents taken by 15 W gasfilled lamps suitable for use at the face do not exceed 1 A. There is, therefore, a wide margin of safety possible.

A system now being tested consists of a 160 frequency supply at 15 V, each circuit having about twenty portable lamps. These have double filaments, the shorter of the two, connected to the battery contained in the lamp, gives 2 c.p., by which the miner travels. The larger one works at 15 V, by which, when connected to a plug housed in a heavy movable block, the illumination at the working face can be raised to 15 or more candle-power, the short filament then being cut out. In the case of failure of supply, work can be continued on the lamp battery. Each plug has a special interlocking contact by which a break of circuit is prevented until the lamp is switched over on to the portable cell. There is, therefore, no risk of open sparking. The plug box also contains a fuse, by which in the event of a short circuit in a lamp, that alone is cut out. The less likely case of a short circuit in the main heavy cab-tyre flexible cable which runs through all the plugs is provided for by a choking coil permanently in circuit, which limits the current to less than that which could cause ignition of a 9·5 per cent. mixture if broken in the open. The system is therefore protected by all the usual devices against excess current, but its chief safety is in the use of currents of such frequencies that, without any other change, the factor of safety is raised to a high value.

* Abstract of a Paper read before Section G (Engineering) of the British Association.

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The Electricity Commissioners' Report.

Progress Maintained—Some Comments on Factors Preventing Reorganisation.

The third annual report of the ELECTRICITY COMMISSIONERS, dealing with the period from April 1st, 1922, to March 31st, 1923, was issued by the Stationery Office at the end of last week. In some prefatory observations the Commissioners point out that the principal features of the year covered by the Report were the general improvement in the position of and the rising curve of output from the supply undertakings in Great Britain as a whole, and the enactment of the Electricity Supply Act of 1922. Improved industrial conditions, reduction in the cost of coal, plant and materials, and the adjustment in wages had the twofold effect of increasing the demand for electricity and lowering the cost of its production.

Domestic Load and Increased Demand for Electricity.

The domestic load was primarily responsible for this increase of output in many cases, while in others it was due partly to the domestic load and partly to the power load. The importance of a more extensive development of the domestic load has been generally recognised, and active steps to increase it have been taken by a number of supply authorities.

A general lowering of the charges for electricity is noticeable. This has operated as a direct stimulus to a wider demand. There is, however, much leeway to be made up before home trade generally, and the supply industry in particular, can be regarded as operating on a normal basis.

A Census of Generating Plant.

On March 31st, 1923, 544 electricity undertakings held statutory powers in Great Britain. This was 10 more than at the end of the previous year. During 1922-23 steps were taken by the Commissioners to prepare a complete record of places where public supplies of electricity were being given by undertakings without statutory powers. The Coal Mines Department furnished a substantially complete list of the owners of all generating plant in operation during the war, and this list may serve as a valuable basis for preparation of a census of the generating plant in Great Britain. Such a census would constitute a valuable asset in dealing with the question of the reorganisation of electricity supply and would indicate the potential demands for industrial purposes in the event of a public supply being made available at sufficiently favourable rates.

Reorganisation of Electricity Supply.

Over twenty pages of the Report are taken up with dealing with the question of the reorganisation of electricity supply. During the year no further electricity districts were provisionally determined, but the Commissioners published four draft orders, embodying approved schemes, two other draft orders had been prepared but not published by March 31st, and three further draft orders were in course of preparation.

The Commissioners held or commenced eight local enquiries during the year, four being first enquiries in respect of schemes submitted to them for the reorganisation of the supply of electricity in certain districts, and four being second enquiries in respect of approved schemes.

Procedure at Second Enquiries.

In dealing with the question of second enquiries, the Commissioners observe that with the objects of facilitating the preparation of approved schemes and of ensuring as large a measure of uniformity as possible they have devoted a considerable amount of attention to the framing of standard or model clauses dealing with various matters likely to be common to the various schemes. The draft orders embodying the approved schemes hitherto published all follow the same general form, and are, broadly speaking, framed in two main parts, the first of which comprises a draft order with a preamble reciting the statutory procedure observed by the Commissioners and with the necessary enacting clauses. The other part comprises a schedule with annexes, the former embodying the principal provisions of the approved scheme for the district, and the latter containing provisions either supplementary to or in amplification of those in the schedule itself.

After giving summaries of the schemes that had been approved during the year, the report deals with the approved schemes under preparation, and some very interesting remarks are made in connection with the scheme for the West Riding (Aire and Calder) electricity district.

Some Details of a Deadlock.

The reorganisation of the supply in this district is cited as a case where efforts not only of the principal parties but of the Commissioners to arrive at an equitable settlement on a matter vitally affecting the future economy and efficiency of the supply of electricity have involved very protracted negotiations. The district was provisionally determined in June, 1920, and the final date for the submission of schemes was February 28th, 1921. A local enquiry was held in May, and the Commissioners issued their statement of conclusions in October of that year. Each of the principal parties—the Corporation of Leeds, the Conference of Local Authorities and the Yorkshire Electric Power Co.—interviewed the Commissioners to discuss the statement of conclusions, and as a result it was agreed to appoint a committee of engineers to investigate the question of "agreed areas" and to report through their principals their conclusions and decisions to the Commissioners. In May, 1922, the Commissioners were furnished with a copy of the report of this Committee and intimated the necessity for an early decision on it so as to enable them to proceed with outstanding applications and other matters affecting the supply of electricity in this district.

The Yorkshire Electric Power Co. notified their favourable disposition towards the proposals of the Engineers' Committee, As did the Corporation of Leeds, but the Conference of Local Authorities were unable to recommend the acceptance of the methods of settlement proposed. During the next four months the Commissioners afforded on eight separate occasions interviews to representatives of the various parties concerned, and in December, 1922, addressed a meeting of the Conference of Local Authorities, at which they indicated the lines on which they considered an equitable settlement could be arrived at. Subsequent to that meeting, three further interviews were granted, but up to the date to which the report is made the protracted negotiations had not achieved full settlement.

The Interests of the District.

The primary consideration of the Commissioners throughout the negotiations was the interests of the district as a whole, it being apparent that the important economies to be effected in the organisation for the supply of electricity could only be realised by the full co-operation of all the parties concerned.

Having regard to the large measure of agreement in principle arrived at between the parties and to the disservice to the public interest that would result from lack of full co-operation due to want of agreement on matters of detail, the Commissioners, at the date to which this report was made, were endeavouring to bring about the settlement of the outstanding points of difference.

Immense Scope for Further Development.

The fifteen electricity districts which have already received consideration by the Commissioners include the most important industrial areas in Great Britain with the exception of the North-East Coast; and the local enquiries held have served to establish the definite advantages to be derived from the reorganisation of electricity supply, and to show difficulties which will have to be overcome before such advantages can be turned to practical account. As a result of the investigations the immense scope for the further development of public supplies of electricity and the great economies to be effected by joint action are amply proved, and further points brought out are the extent to which engineering considerations alone are affected by the numerous interests involved, and the complex questions, both legal and otherwise, which have to be resolved in the settlement of these schemes.

In 1920–1 the maximum demand in twelve of the districts was 1 146 860 kW, while the output was 2 632 million kWh. In 1926–7 it is estimated that these figures will have increased to 2 040 675 kW and 4 990 million kWh, and to 2 937 090 kW and 7 356 million kWh in 1931–2.

The estimated figures for the maximum demand on these two dates show an increase of 78 per cent. and 151 per cent. respectively over the 1920–1 figures, and for output an increase of 89 per cent. and 180 per cent. respectively. The electricity districts concerned are collectively responsible at the present time for the generation of upwards of 50 per cent. of the whole of the public supplies of electricity in Great Britain.

Private Generating Plant.

A feature which has strongly impressed the Commissioners, and which may have an important influence on future development, is the extent to which private generating plant has been

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installed in various parts of the country by manufacturers and trading associations. In the case of one district the private generating plant installed by collieries and other industrial undertakings largely exceeded the total capacity of the plant installed by the whole of the authorised undertakers in the district.

In the past, manufacturers have often found it more advantageous to instal their own generating plant than to take a supply from a public source, but at present the tendency in most cases is to have recourse to public supplies if available at satisfactory rates. There is no doubt that the reduced costs and the increased reliability resulting from centralisation will serve to accentuate this tendency and lead to the gradual discarding of much of the private generating plant at present in operation. The reorganisation of supply may, therefore, be expected to result in a considerable accession to the industrial demand for supplies from public sources with consequent opportunities of effecting still further improvements in efficiency and economy of generation. This will not, however, apply to the large private generating stations which have been installed by colliery undertakings. A number of these stations are giving supplies in bulk to various undertakers, and arrangements might be made with regard to surplus, reciprocal or stand-by supplies from these and for their interconnection to the respective transmission systems.

Economies Dependent on Co-operation.

The evidence given at the enquiries has established beyond doubt that large economies are possible by the reorganisation of electricity supply. These economies will be largely dependent upon the extent to which the various undertakers in a district are prepared to co-operate in the centralisation of generation, in the pooling of resources and of the interconnected stations for the common good, and in discontinuing the use of badly placed stations, and on the fluctuations in the cost of coal, materials and wages, and in raising capital.

Generally speaking, the Commissioners have formed the view that the estimated savings in the case of a number of districts are likely to be exceeded in practice, particularly as regards the conservation of coal consequent upon the centralisation of generation.

The Transfer of Generating Stations.

By the Act of 1919, a Joint Authority may either acquire generating stations and main transmission lines by agreement with the owners, or the whole or any part of an undertaking may be transferred to the Joint Authority upon the terms provided by the scheme. The former provision connotes settlement after the establishment of the Joint Authority, whereas the latter would enable agreed terms to be embodied in the scheme itself. It is apparent that the contemplated centralisation of generation and the economies to be derived therefrom might be seriously affected in the event of individual authorities afterwards deciding not to transfer their stations, and for this reason it is desirable that agreed terms should be included in the approved scheme.

The question whether the problems associated with the transfer of generating stations can be satisfactorily resolved by this procedure remains to be determined. There are indications that it may be ultimately found necessary to defer the settlement of the details of such matters until after the establishment of the Joint Electricity Authority for a District.

Large Extensions Sanctioned.

During 1922–23 the Commissioners sanctioned approximately 422 000 kW of plant for new stations or for extensions, as compared with approximately 169 000 kW during the preceding year. Since January, 1920, when the Commissioners were formed, 1 279 088 kW of new generating plant had been sanctioned. The net addition is somewhat less than this figure owing to the replacement of inefficient or obsolete plant, and the transfer of the administration of the electricity service in Ireland to the Governments of Northern and Southern Ireland.

Of the total generating plant sanctioned, about 29 per cent. was for new generating stations, and 71 per cent. for extensions of existing stations. Of this latter amount, 582 750 kW or 65 per cent. of the total was for extensions to the principal electricity stations in nine electricity districts. These figures afford an indication of the extent to which it has been possible for the Commissioners to control the development along lines which will accord with the engineering schemes for the different districts.

New Generating Stations.

Applications relating to the establishment of new generating stations at Barking, Greenock, Preston, Salford, Stourport, Angerstein's Wharf and Belvedere, were considered by the Commissioners during the year. Formal consent was given to the establishment of stations at Greenock, Preston, Salford and Stourport, and withheld in the case of stations at Angerstein's Wharf and Belvedere owing to the South-Eastern and Chatham Railway Company having made arrangements to obtain the necessary supply for the electrification for their railways from existing undertakers. Consent was also given for the establishment of undertakings at Crowborough, Norton, Sidmouth, Warminster and York (Linton Lock) and to stations for eighteen non-statutory companies including the erection of a 10 000 kW station at Lydney, by the Norchard Syndicate.

The consents given during the year to twelve authorised undertakings and to eighteen non-statutory undertakings in respect of new generating stations represented the initial installation of generation plant with a total rated capacity of 186 590 kW, thus exceeding the combined total for new construction and extensions sanctioned in the previous year.

Transmission Line Extensions.

The number of applications made for consent to the establishment of main transmission lines bears evidence of the important preparations in hand for the further development of electricity supply. Formal consent was given in twenty-two cases, and consideration of other applications was in an advanced state on March 31st, 1923.

At the commencement of the period covered by the Report, thirty-one applications for Special Orders were under consideration. During the year under review 67 further applications for Orders were received, and a complete list is given in the appendix to the Report. A noteworthy feature of the applications made during the year was the extent to which there was competition between two or more applications in respect of the whole or a portion of the proposed area of supply. Twenty per cent. of all the applications sought powers to extend authorised areas of supply. In 63 per cent. powers were sought to establish distribution undertakings, and in six cases the applications related to areas where distribution powers were already in force and undertakings had been established, the applicants seeking authority to carry on the existing undertaking, the repeal of the previous powers being contemplated.

Special Orders and Borrowing.

During the year the Commissioners made Special Orders in respect of 38 of the applications, leaving 59 applications still under consideration, one having been withdrawn. In seven cases, owing to the complicated character of the proposals, local enquiries were necessary, and this course will probably have to be followed in other cases.

Forty-two Special Orders were submitted to and approved by Parliament during the year under review.

During the year 474 applications for sanction to borrow were considered, and sanction given in 336 cases, three applications being refused, and twelve either withdrawn or transferred to other departments. The total amount of the loans sanctioned was £7 923 656, as compared with £13 650 033 during the previous year. Sanction to borrow £4 284 000 was sought by 123 applicants, which were still under consideration on the 31st March.

Large schemes of extension formed the subject of fewer applications for loan sanction than in the previous two years. It has been the practice of the Commissioners to encourage and promote the linking-up of undertakings and the giving and taking of bulk supplies, and there were at March 31st 174 undertakers taking or arranging to take bulk supplies, including cases of reciprocal supplies. In about 95 cases the supply is derived from electric power companies. Since 1920, 51 arrangements for bulk supplies have been entered into, or about 30 per cent. of the undertakings concerned in taking such supplies, and 30 generating stations have either been shut down entirely or relegated to the position of stand-by sources of supply. Five arrangements for mutual assistance were approved during the year, and two other applications involved the breaking up of roads and districts intervening between the areas of supply concerned, and therefore required a special order.

Two Orders were made under Section 4 of the Electric Lighting Act, 1909. During the year the Commissioners approved of the adoption by 22 authorised undertakers of systems of supply other than those approved by the Board of Trade in 1906, and observed that there is a growing tendency towards the adoption of a pressure of 33 000 V for the transmission of energy in giving and taking bulk supplies.

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The Commissioners gave consent to an alteration in the declared system and/or pressure of the supply hitherto adopted in the case of ten undertakers.

Revising Electricity Regulations.

The Commissioners have had under consideration the question of the revision of the existing code of regulations under the Electricity (Supply) Acts with regard to the transmission of electrical energy by means of overhead lines. In August, 1920, the Institution of Electrical Engineers appointed a special committee to investigate the whole problem, and duly submitted the results of their conclusions to the Commissioners, who have decided to adopt the new code in its entirety.

Fifty-nine fringe Orders were granted during the year, and 19 were revoked as the result of certain electric lighting Orders which were suspended during the war coming into operation.

A summary of the returns of fuel consumption made by the various undertakings, which have already been issued separately and dealt with in THE ELECTRICIAN, is given.

Reports are given of the progress made with consents to subscriptions to associations, approval of meters, land for electricity undertakings, transfer of undertakings, extensions of time and the breaking up of streets, while under the heading of Advisory Duties of the Commissioners a number of matters which have already been mentioned in the Report of the Ministry of Transport are dealt with in THE ELECTRICIAN of August 3rd, 1923.

Organisation and Staff.

In dealing with the organisation and staff of the Electricity Commission the Report states that there was a substantial increase during the year under review in the volume of work, and the position was further affected by the termination, on March 31st, 1922, of the period during which the expenses of the Commissioners were temporarily met by monies provided by Parliament. The Commissioners came to the conclusion that it would be expedient for the accounting work in connection with the Electricity Fund, which had hitherto been done by certain officers of the staff of the Ministry of Transport, to be carried out by their own staff, and as a consequence of this rearrangement and of the general increase in work, a solicitor and three other officers were appointed to the established staff, and a further officer to the temporary staff, so that after March 31st, 1923, the staff numbered 46 in all, and consisted of 24 established officers and 22 temporary officers. The estimated cost of administration for the year exceeded the estimated receipts by £44 000, and the liability to the Exchequer in respect of the first annual instalment in repayment of the advances made amounted to £35 000. The total amount to be apportioned among the electricity undertakers was, therefore, £79 000. The actual net expenditure on administration during 1922-3 was £35 566, a saving of £8 434 on the estimate. A further saving of £646 was effected owing to the acceleration in making repayment of the instalment ue to the Exchequer. Of these savings a sum of £4 566 was applied to the further reduction of the outstanding balance of advances. On March 31st, 1923, the outstanding liability of the Commissioners in respect of advances and the accrued interest amounted to £56 000.

During the year 1922–3, 3 888 234 000 kWh were generated in Great Britain, and the apportionments in respect of the £79 000 approved by the Ministry of Transport were made on authorised undertakers in June, 1922, towards the expenses of the Commissioners for 1922–3, thus involving a payment by each authorised undertaker of 4·9d. per 1 000 kWh generated. The basis of apportionment was altered by Section 7 of the Electricity (Supply) Act, 1922, from units generated to units sold, the latter being defined as meaning "all units generated or purchased by a Joint Electricity Authority or authorised undertaker less those used in the generating station, those lost in transmission or distribution, and those sold in bulk to authorised undertakers."

The certified returns submitted to the Commissioners showed that the electricity sold during the year ending December 31st, 1922, was 3 645 190 732 kWh.

Electricity Supply at Bolton.

New Turbo-Alternator and Condensing Plant Installed.

From its modest inauguration in October, 1894, the history of the Bolton Corporation electricity undertaking shows a series of steady progressions, but the most remarkable developments have occurred during the last ten years.

The first generating station was built at Spa Road, and originally contained two engines of 160 H.P. each and one of 80 H.P. On the inauguration of the tramway system in 1899 important extensions and alterations were made, but the demand for power for textile and other factories had by 1912 become so great that it was necessary to erect a new and larger power station. On a site picturesquely termed Back o' th' Bank the Electricity Committee, in February, 1913, commenced the erection of the new station; built at a cost of £130 000, it was officially started up on September 3rd, 1914.

The initial plant installed at Back o' th' Bank consisted of two 5 000 H.P. turbo-alternators generating electricity at 6 600 V, 50 cycles, three-phase. The boiler-house contained four water-tube boilers generating steam at 200 lb. pressure, and each capable of supplying 34 000 lb. of steam per hour. The original equipment included storage water reservoirs, coal-handling plant and the usual auxiliary machinery.

It was very soon found that the increasing demand again made it necessary for the Electricity Committee to extend the generating plant, and, further, the low generating costs as compared with Spa Road justified the committee in shutting down the original Spa Road works entirely, and generating the whole supply at Back o' th' Bank. This necessitated installing converting plant at Spa Road Works, which then became a sub-station. It also involved developing Duncan Street sub-station and erecting a new sub-station at Bradshawgate.

In 1917–18 a 10 000 H.P. turbine, together with two boilers and auxiliaries, were added to the station at a cost of about £80 000. This addition did not suffice for very long, and in 1919 the Electricity Committee launched another scheme still further to extend the Back o' th' Bank buildings, reservoirs and machinery, involving an expenditure of about £820 000.

Statistics compiled by the borough engineer (Mr. W. J. H. Wood) show that during the last ten years the number of consumers has been increased by nearly 127 per cent., and that during that time the plant capacity has been raised from 7 600 kW to 34 000 kW, an increase of over 347 per cent.

The New Turbo-Alternator Set.

On Thursday of last week further plant, comprising a 15 500 kW turbo-alternator set by the English Electric Co. and surface-condensing plant to work in conjunction with that by Hick, Hargreaves and Co., was inaugurated.

The turbine of this unit is of the pure impulse single-flow type, controlled by an oil-relay governor of customary design. The steam conditions under which the plant is required to operate are as follows:—

Pressure at turbine stop valve ..	200 lb. per sq. in.
Superheat	150 deg. F.
Vacuum at turbine exhaust ..	28 in.
Barometer	30 in.

The machine, which is illustrated in Fig. 3, is designed for an economical load of 12 500 kW, runs at a speed of 3 000 revs. per min., and is specified to supply an overload of 15 500 kW for two hours under the specified steam conditions. At this overload it is capable of supplying three-phase current at 50 cycles, 6 600 V, at a power factor of 0·8.

The design is such that the alternator will carry this overload continuously, although it was only specified to do the load for a period of two hours. Owing to the size and weight of the machine it was found necessary to assemble the stator core and windings on the site.

Fans are supplied on the rotor to supply the necessary ventilating air to the end portions of the stator. Cooling air is supplied to the central portion of the machine by means of a separate motor-driven blower set placed in the foundations. The whole of the ventilating air is drawn through a spray-type wet-air filter, and after passing through the machine, is discharged into the engine-room through the exhaust opening at the top of the stator. The rotor is of the usual cylindrical type, the body being forged solid with the shaft. In order to keep the bearing centres as short as possible the sliprings

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have been placed outside the bearing between the bearing and the overhung exciter.

Surface Condensing Plant.

The duty of the condensing plant (Fig. 1) is to condense 160 000 lb. of exhaust steam per hour and to maintain a vacuum of 28 in. (barometer 30 in.) when supplied with cooling water at a temperature of 75 deg. F. The cooling surface is 23 500 sq. ft., and the amount of cooling water passing through the condenser is 1 120 000 gallons per hour.

Care has been taken in the design of the condenser to ensure that the steam makes intimate contact with the whole of the tube surface, so as to secure the maximum efficiency. The tubes are disposed so that the resistance to the passage of steam through the condenser is reduced to a minimum.

To ensure that the air is withdrawn from the condenser at maximum density, a devapourising chamber is provided in the lower pass, the chamber being formed by means of steel

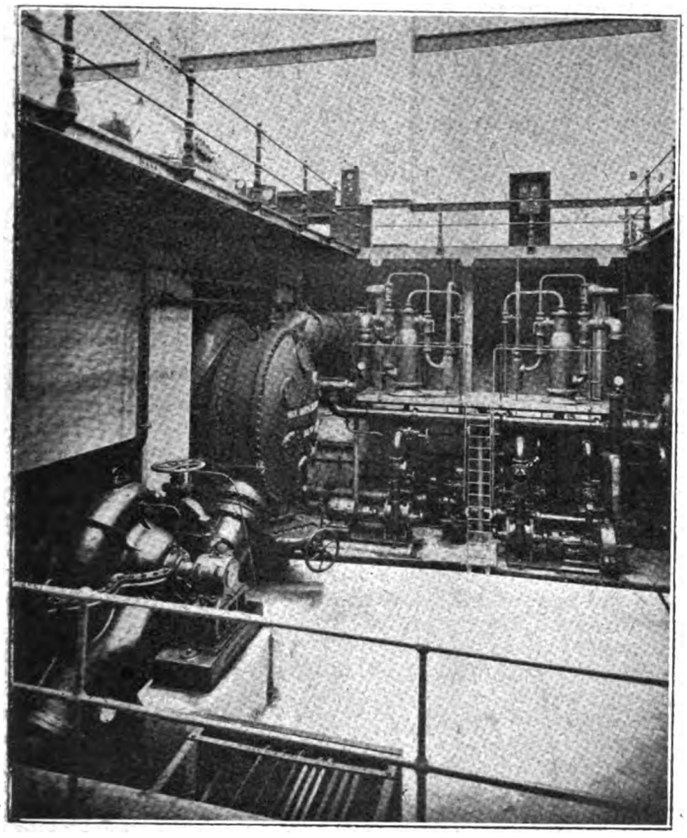

FIG. 1.—VIEW OF THE NEW CONDENSING PLANT AT BOLTON.

plates running from one end of the condenser to the other. At each end of this chamber openings are provided, through which the air is drawn. The air passes among the tubes in the devapourising chamber, and, owing to the reduction in volume, the air-extraction apparatus is able to work with maximum efficiency.

Air-Extracting Apparatus.

The air-extracting apparatus is of the Hick-Breguet type, consisting of single steam jet two-stage ejectors with an intermediate condenser. This apparatus is duplicated, one of the sets acting as a stand-by to work in conjunction with either the new 12 500 kW plant or the 12 000 kW set already in commission. The Hick-Breguet Ejectair is designed for dealing with 160 lb. of dry air per hour, and the system of operation by two steam jets in series with an intermediate condenser makes it possible to obtain a high degree of air extraction combined with a low steam consumption.

The condensate extraction pump is motor-driven, has a capacity of 16 000 gallons per hour when running at a speed of 1 440 revs. per min., and is capable of discharging the condensate against a head of 50 ft. A duplicate extraction pump is provided to work in conjunction with either the new 12 500 kW set or the adjacent 12 000 kW set. This latter pump is operated by a steam turbine running at 3 600 revs. per min., suitable reducing gear being fitted to reduce the turbine speed of 3 600 to the pump speed of 1 440 revs. per min.

Of the split casing type the circulating water-pump has a capacity of 18 666 gallons per minute when running at a speed of 325 revs. per min., and is capable of delivering this amount against a head of 28 ft. It is operated by an electric motor through a flexible coupling. In addition to this circulating

FIG. 2.—GENERAL VIEW IN THE ENGINE ROOM AT BACK O' TH' BANK STATION.

pump, a stand-by pump has been installed. This, in its turn, is operated by a steam turbine running at 3 000 revs. per min., reducing gear being provided to reduce to the pump speed of 325 revs. per min. The stand-by pump is arranged to supply

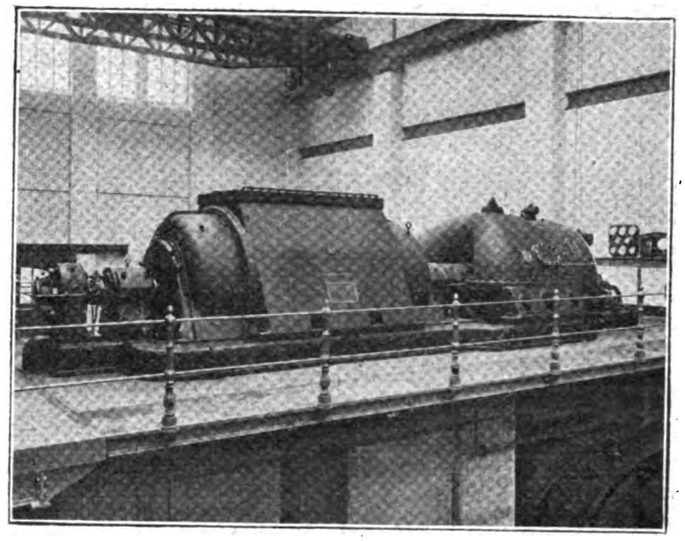

FIG. 3.—THE ENGLISH ELECTRIC TURBO-ALTERNATOR SET. VIEW FROM ALTERNATOR END.

water to the surface condensers of either the new 12 500 kW set or the 12 000 kW set already in commission, and furthermore, is so arranged that it can, when required, supply water to the condenser of a 6 000 kW set.

Magnetic Tests on Iron.

Estimation of Mechanical Properties.

A system of testing winding ropes by magnetic exploration is described by Mr. R. L. Sandford in "Mining and Metallurgy," and in the course of the article he points out that the possibility of utilising magnetic tests on iron and steel for the estimation of their mechanical properties is based upon the fact that the same factors which determine their mechanical properties also determine their magnetic properties. Any influence which operates to alter the mechanical properties produces a corresponding change in the magnetic properties. The change, however, is not directly proportional, and herein lies the difficulty in the way of immediate application of the method. A considerable amount of work has already been done, and a number of investigations are now in progress for the accumulation of the data necessary for determining the relationships that undoubtedly exist.

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Radio Extension of the Telephone System to Ships at Sea.*

By H. W. NICHOLS and LLOYD ESPENSCHIED.

In 1919 the American Telephone and Telegraph Co. and the Western Electric Co. initiated a development programme which had for its object the development of a radio telephone system by which any telephone subscriber of the Bell System could carry on a conversation with a telephone station located on a ship, and that from the point of view of the speakers the operation should be similar to the carrying on of an ordinary toll call between land wire stations.

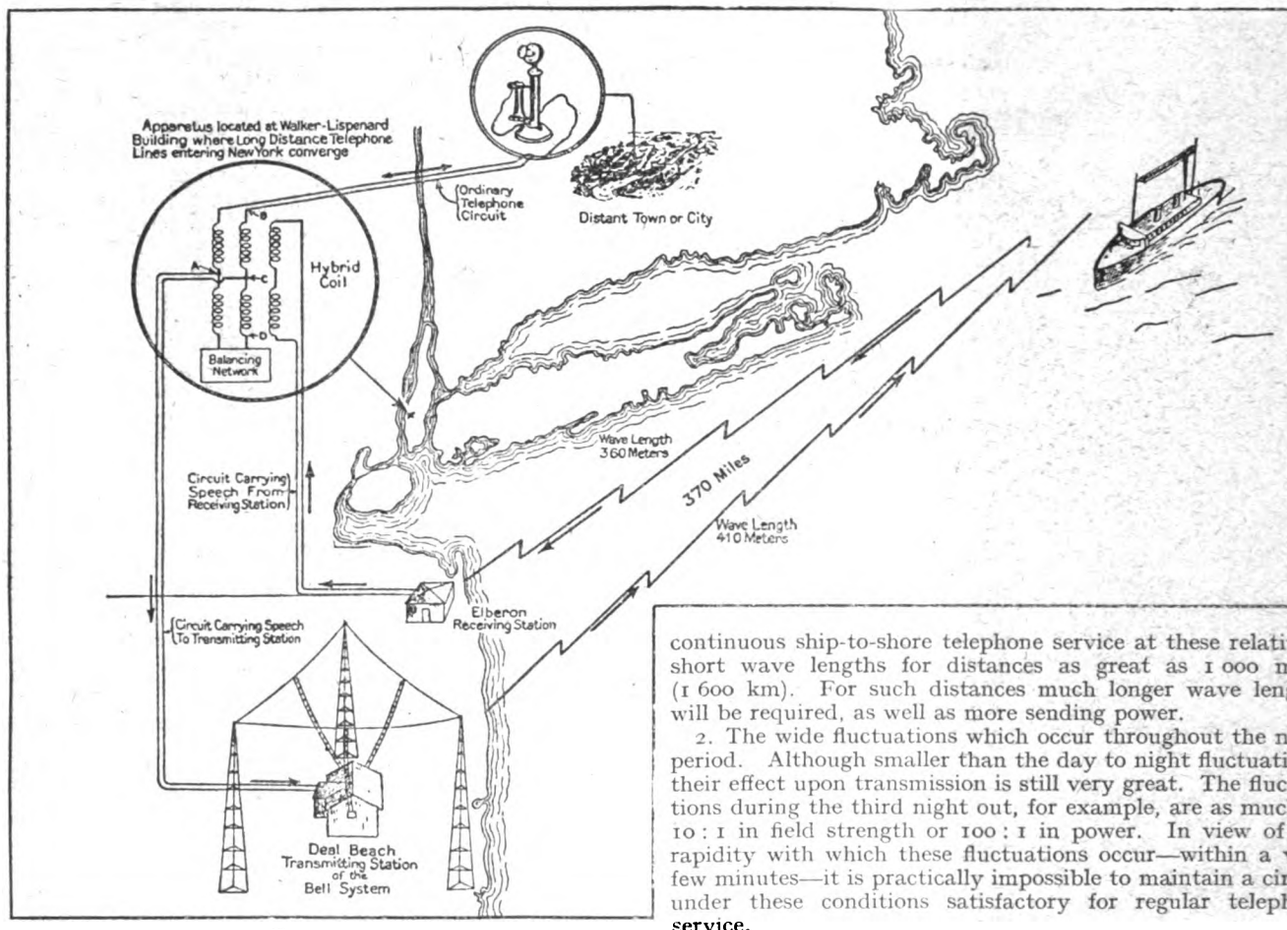

FIG. 1.

Fig. 1 shows the system which, after preliminary trials on a smaller scale, was put into operation. An important feature of the inter-connection is the hybrid coil and balancing network there shown. The windings of such a coil are so designed as to establish a sort of Wheatstone bridge circuit. This bridge circuit accomplishes the joining of the regular two-wire telephone circuit with the sending radio channel on the one hand and the receiving radio channel on the other, while till maintaining an electrical separation between the two radio channels. It is really therefore the connecting link between the two-wire type of circuit of the telephone plant and the four-wire circuit of the radio link. The radio receiving circuit corresponds to the generator branch of the Wheatstone bridge, and radio transmitting circuit to the detector branch. The two-wire telephone line corresponds to the " X " arm of the bridge and the balancing artificial line to the " Y " arm. The radio arms are, in effect, formed by the windings of the hybrid coil.

Variations.

Careful measurements were made of the variation in received field strength and some very interesting results are given in Fig. 2.

The curve shows up the following important factors :—

1. The enormous variation between day and night in the received field strength which occurs at distances of the order of 1 000 miles (1 600 km) using wave lengths of 350 to 400 metres as now employed in broadcast transmission. The curve shows night to day variations of the order of 100 : 1 or a power ratio of 10 000 : 1. This means, for example, that it would require 10 000 times more power to " get through " as well during the day as during the best times at night. These enormous day to night fluctuations are now familiar to broadcast listeners. This curve shows the impossibility of giving continuous ship-to-shore telephone service at these relatively short wave lengths for distances as great as 1 000 miles (1 600 km). For such distances much longer wave lengths will be required, as well as more sending power.

2. The wide fluctuations which occur throughout the night period. Although smaller than the day to night fluctuations, their effect upon transmission is still very great. The fluctuations during the third night out, for example, are as much as 10 : 1 in field strength or 100 : 1 in power. In view of the rapidity with which these fluctuations occur—within a very few minutes—it is practically impossible to maintain a circuit under these conditions satisfactory for regular telephone service.

3. The most interesting thing to observe is that the fluctuations tend to fall within the two curves A and B. The day transmission is a pretty definite proposition, following closely the Austin-Cohen formula. The night transmission appears in the nature of a " bob-up " from the day condition, but seems to be limited in the extent of its " come-back " by the loss imposed by the simple inverse-with-distance law. The fact that the difference between curves A and B is entirely

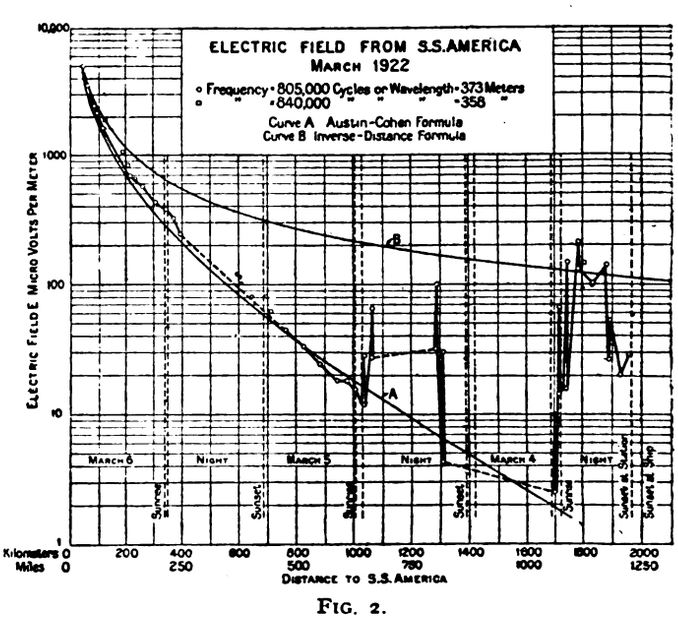

FIG. 2.

* Abstract of a Paper before the Institute of Radio Engineers.

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one of absorption suggests that the very large and rapid night fluctuations, which are now so well known to broadcast listeners, may be explained in large part, if not in whole, by variations in atmospheric absorption.

Occasional Long Distance Transmission.

Many of the long distance records which have been made on short waves and low power can be accounted for simply on this basis—that the absorption which ordinarily obtains during daylight has been temporarily wiped out.

Operating Tests.

A series of operating tests were carried out for a period of about three months, starting in January, 1921, and operating between Deal Beach station and the s.s. "Gloucester." It was found, as was to be expected, that the time required to put through the radio connections to the vessels is large in comparison with the connecting time on the wire lines.

Taking a typical record sheet the following results are shown :—

		Summary.		Per cent.
Total calls ..	31	Calls completed and satisfactory ..	28	90.3
Completed ..	28	Calls completed and unsatisfactory ..	0	
Cancelled ..	3	Calls cancelled due to system failure ..	0	
Long Distance	0	Calls cancelled not due to system failure	3	9.7
Toll.. ..	1			
Local ..	30			100

Average time—

Radio	A ..	13.6	mins.
,,	B ..	16	,,
Wire	A ..	8.0	,,
,,	B ..	0	,,

$$\frac{\text{Total minutes operation}}{\text{Total calls}} = \frac{551}{31} = 17.7$$

Transcontinental Ship Link.

A most interesting case is that in which the ship was linked up with the transcontinental telephone line and connected through to Catalina Island in the Pacific, thus bringing together the two oceans. The circuit arrangements for one of these demonstrations are given diagramatically in Fig. 3. Both the Deal Beach and the Green Harbour shore stations were used, since it was desired to reach the ship anywhere on her course from Boston to the Delaware capes. The demonstration was, therefore, also an example of connecting the ship into the land telephone system through either of two shore stations. As a matter of fact, at one time the vessel could be reached through both stations. During both the rehearsal and the demonstration the operator on the vessel talked successfully, although with some difficulty, with the Catalina Island operator, while New York listened in.

Electricity for Agriculture.

What is Being Done in America.

Although some progress is being made in the electrification of agriculture in this country, development is bound to be slow if continued on the present haphazard lines. It is therefore interesting to note how the problem is being tackled in the United States, where a meeting in Chicago of the National Electric Light Association and representatives of the American Farm Bureau Federation has decided to form a committee to investigate the relation of electricity to agriculture.

The formation of this committee, states the "Electrical World," brings together various groups which are vitally interested in the problem of rural electrification, and for the first time in American history enables the farmer through his own representatives to participate actively in solving the problems met in adopting a new form of power. The committee will endeavour to direct development work along sound economic and engineering lines—eliminating the hit-or-miss methods—and to ensure maximum results at minimum cost. It recognises that electric service on the farm offers great possibilities for improving living conditions and reducing the cost of production, but before these can be realised there are many economic and engineering problems to be solved.

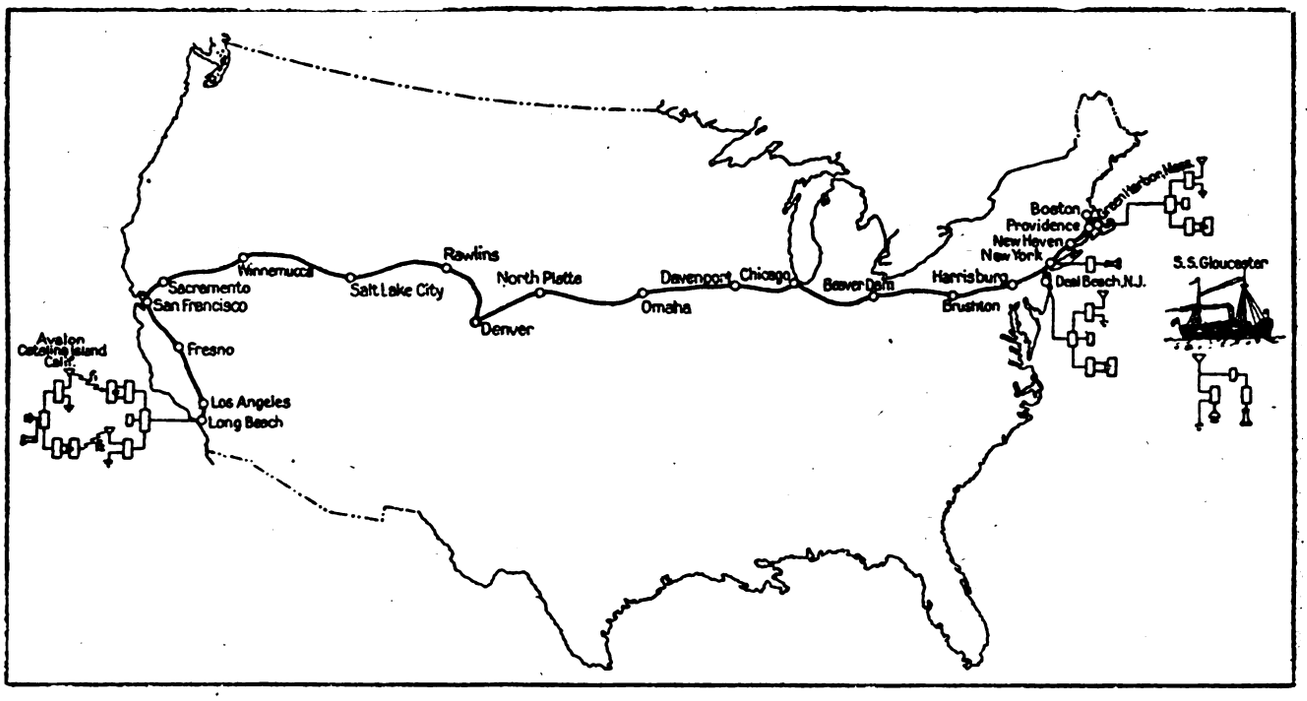

FIG. 3.

Farm Power Survey.

The first step in this direction taken at the request of the committee has been the undertaking by the United States Department of Agriculture of a national farm power survey to determine the amount of power used in agriculture, the power requirements for various farm operations, the types and sizes of prime movers used, the power requirements of various machines and what operations are still done by hand. Out of this survey should emerge sufficient facts to form a basis for the economic studies and engineering developments necessary. Surveys will be conducted to determine for what operations electricity is used to-day and also to find out what obstacles stand in the way of its general application to farm operations.

It has been estimated that less than 7 per cent. of the American farms are served by electricity, but an official of the Farm Bureau Federation estimates that no fewer than 500 000 additional farms will be using electricity within the next eight years.

Aluminium Paint and Heat Radiation.

Reducing Heat Transmission Through Thin Materials.

The aluminium or bronze paint generally applied to radiators greatly reduces their effectiveness and makes it necessary to have a larger surface for the same heating effect, according to experiments performed by Dr. W. W. Coblentz, of the U.S. Bureau of Standards. Dr. Coblentz finds that the heat radiated from an aluminium painted radiator surface is less than a third of that emitted by a radiator of the same size painted with a non-metallic paint, enamelled, or simply allowed to rust.

On the other hand, he finds that aluminium paint is a very effective means of reducing the amount of heat transmitted through a thin material.

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Advertising in the Engineering Press.

The Layout.

By HUGH M. GOODY.

Previous notes in this series have dealt with the component parts of an advertisement—headline, copy, illustrations, nameplates, etc. The purpose of the present article is to indicate how the complete advertisement should be prepared for the press. To commence it is necessary to warn the engineering advertiser against a possible misapprehension. Although, for convenience, the press advertisement has been dealt with sectionally and the present notes are in the nature of information as to how to build up the complete announcement, it is not advisable to create the parts of an advertisement and then fit them together. All really successful advertisements are conceived as a whole and the process of advertisement construction should be downward from the complete conception rather than the reverse.

Objects of Layout.

The layout or "dummy" of an advertisement consists of a rough plan which serves a dual purpose, to show the advertiser what his advertisement will look like in its completed state and to enable the artist and printer to translate the advertiser's conception into actual type. A successful layout involves a knowledge of two subjects, namely, balance and typography.

As to balance, space does not allow of any detailed advice, but, in the case of the engineering advertiser, a good deal can be left to his innate sense of design. In any case, the art of correctly balancing the components of an advertisement is beyond the scope of these notes. As to the proportion of black and white space, this should be approximately equal. Of the black, about a quarter should be devoted to solid black (i.e., "display" lines and the solid blocks of the illustration) and the remainder to the grey masses (type and the grey portions of the illustration). These figures are, however, approximate only and cannot be laid down arbitrarily.

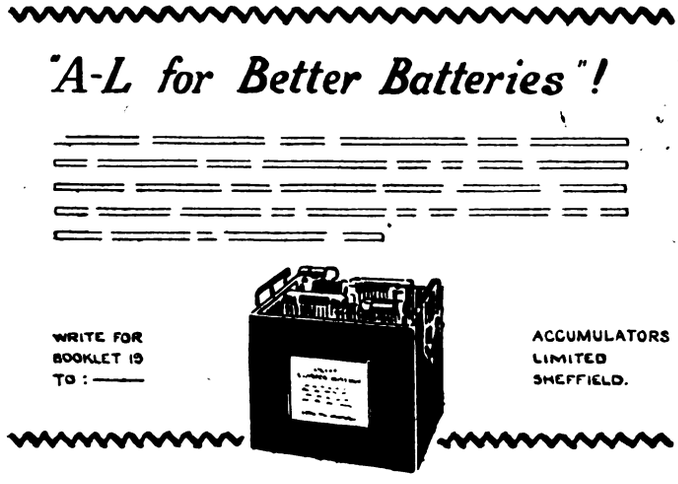

FIG. 1.

Notes on Typography.

Typography is, of course, a study in itself, and a knowledge of the numerous families of very beautiful type which are now available is essential if a good standard of advertising is to be maintained. The advertiser should obtain, either through his printer or otherwise, a type book showing styles and sizes: one of the best of these is that issued by the Caslon Foundry. The following brief notes will, however, secure the avoidance of the worst pitfalls.

Do not use several different varieties of type in the same advertisement. Wherever possible, the necessary contrast between the several portions of the copy should be obtained by using the various styles (*i.e.*, bold face, light face, italic, outline, etc.) in a single family. One of the best type families for display purposes (*i.e.*, headlines and other heavy lines) is "Cheltenham." For the body of the advertisement either Cheltenham Old Style or Caslon may be employed. The latter is, of course, the more beautiful and the departure from the Cheltenham family is hardly noticeable.

Type sizes are at present regulated on the "point system," there being 72 points to the inch. Thus 10 pt. type (an ordinary reading type, known previously as "long primer") measures just under one-seventh of an inch. (This article is set in 9 pt.) This measurement includes not merely the

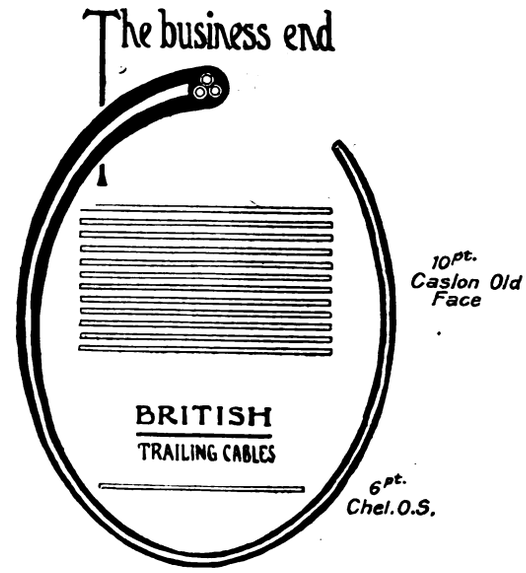

FIG. 2.

height of the actual letter, but also the shoulder at the top and bottom, equivalent to the minimum space between one line and the next. Thus in the case of 10 pt. type there will be seven lines to the inch and so on for other sizes. The sizes in most general use are 6, 8, 10, 12, 18, 24, 30, 36, 48 and 60 pt. To calculate the amount of space required for a headline, reference must be made to the type book to determine the number of letters to the inch. The amount of space required for any given copy can be quickly determined when it is known that 8, 10 and 12 pt. types give 32, 21 and 14 words to the square inch respectively. Similar calculations can, of course, be made for other sizes.

36pt. Chel. Bold Face

10pt. Chel. Old Style

10pt. Chel. Bold

Having considered briefly the questions of balance and typography, we will now proceed to the actual layout. This should be full size and should commence with four pencil lines indicating the size of the space available. We will assume that what is required is a half-page horizontal advertisement describing an accumulator. Owing to the small number of journals in which the advertisement is to appear (or other similar considerations) it is not desired to spend a large sum upon artist's and engraver's fees and consequently the object is to produce a distinctive effect in the simplest possible manner.

The Border.

Knowing that the use of a special border is one of the best ways of achieving this object, the advertiser conceives the advertisement shown in Fig. 1. A sketch of the desired illustration is roughed in on the layout and the border is either shown complete or sufficiently so to indicate the style. The headline is then added, and the amount of space required for the copy indicated. This space is filled in with lines so as to give approximately the correct weight to this portion of the advertisement. The display lines at the foot should now be added and the sizes and styles of the various lines indicated in the margin. The layout is then complete and can be passed to the engraver for the preparation of the necessary block and border and then to the journal in which it is to appear. The copy should be sent in on a separate sheet: no attempt should be made to indicate it on the layout. Having advocated a distinctive border it is perhaps necessary to add that "fancy" borders should be used with the greatest

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discretion. This applies, however, not only to specially designed borders, but to many stock borders, since the average printer's stock will contain many examples more hideous than would occur unaided to the engineer.

We will suppose now that it is required to advertise an electro lifting magnet. Your conception of the advertisement is that it should illustrate the greatly increased efficiency of the modern lifting magnet and the greater weight which can be lifted by a given size of magnet, and that the illustration should show a magnet in actual operation, preferably in a well-known works. Obviously this is the field for the half-tone, but it is not necessary to make a block of the entire announcement, in this case a vertical half-page. The advertisement must, however, meet the reader's eye as a single entity—there must be nothing patchwork about it. In such a case the border round the half-tone block must be such as can be matched accurately with ordinary printer's

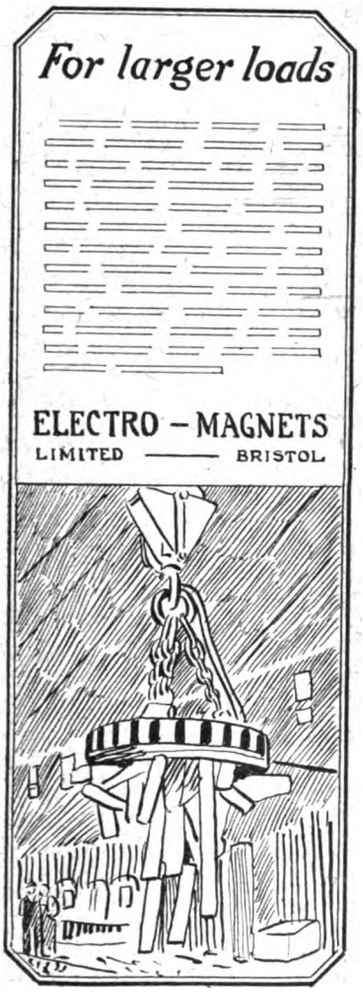

FIG. 3.

rule. Fig. 3 shows how this may be done. A very simple border has been chosen, but the idea can be carried out very effectively in a variety of ways. The half-tone block should have no "shoulder" on the top edge, so that the rule may butt directly up against the block without leaving a gap.

The Advertisement Block.

In cases where an advertisement can be used a number of times in different papers, a more satisfactory method than that suggested in the previous paragraph will be to employ a block for the complete advertisement. A layout for such an advertisement is shown in Fig. 2. Such a rough plan, with possibly a sectional drawing or photograph of the trailing cable in question, will be sufficient to enable the engraver to make the required block.

An endeavour has been made in the previous paragraphs to indicate the manner in which an advertisement is prepared for the press. It must, however, be emphasised that both the conception of an advertisement and its preparation are highly technical matters which the engineering advertiser can hardly hope to handle successfully, unaided. It has, however, been advocated throughout these articles that, in technical publicity, the advertiser should retain a large measure of control over his announcements, and the notes in this and the preceding articles are designed to enable him to exercise this control effectively and intelligently.

Broadly, the object of these articles has been twofold:

1. To enable the smaller firms to carry out a certain measure of publicity in simple fashion with the minimum of outside help (i.e., merely the guidance of the agent through whom the contracts are placed).
2. To indicate to the larger firms the way in which they should set about obtaining expert assistance on what is, after all, a technical subject.

If these objects have been in any measure achieved, these notes will have served their purpose, though obviously it has been impossible to treat the subject other than in an extremely superficial fashion.

The Official Opening of Barton Station.

The official opening yesterday by the Earl of Derby of the Barton Power Station of the Manchester Corporation was celebrated in a number of ways, including an inspection of the station itself and a luncheon at which numerous official guests were present. But we think that those guests will treasure most among their recollections of the occasion a something tangible in the shape of a handsome souvenir booklet dealing first with the history of the undertaking, secondly with Barton itself, and thirdly, but not least, with the human beings who have played their part in bringing this great scheme to fruition. The letterpress tells of the work that has been done since 1890 in raising the Manchester Electricity Department to the position of the largest municipal electrical department, with connections amounting to 212 744 kW, excluding bulk supply, a plant capacity of 209 150 kW, and a generating station (Stuart Street) containing the largest amount of equipment (106 750 kW) under one roof, in the kingdom. It is fitly illustrated not only with pictures of plant itself, but with photographs of the Earl of Derby, the Lord Mayor of Manchester, the chairman of the Electricity Committee (Ald. W. T. Dagnall), the deputy chairman (Ald. W. Walker), Mr. S. L. Pearce (consulting and chief engineer and manager) and other officials connected with the erection of the station. It is a production to be studied and treasured.

As regards the station itself, full details of its construction and equipment were given in our issue of June 8th, 1923, while photographs illustrating it appeared in THE ELECTRICIAN for June 15th, 1923. We need therefore only remind our readers that it is built on a site of 14¼ acres in Trafford Park on the south side of the Bridgewater Canal and close to the Manchester Ship Canal. The site is capable of accommodating 150 000 kW, 82 500 kW being at present installed. The station consists of a boiler house 314 ft. long by 87 ft. wide by 86 ft. high. Parallel to this is the turbine room, which is 243 ft. long and 65 ft. wide. The main transformer and switch house is a three-story building parallel but separate from the turbine room, while office and workshop accommodation is also provided.

Fuel is delivered both by rail or canal and a storage ground is provided for 26 000 tons. The boiler house bunkers have a capacity of 3 500 tons—65 hours' supply. The coal is handled by a very complete system of cranes and conveyors.

The steam raising plant consists of nine boilers, each capable of evaporating 100 000 lb. of water per hour. Each unit is complete in itself with economiser, integral superheater, air heater, chain grate stoker, mechanical and forced draught and chimney. The working pressure is 375 lb. per sq. in. at a final steam temperature of 738 deg. F.

The turbine room contains three 27 500 kW turbo-alternators running at 1 500 revs. per min. and generating current at 6 600 V. The steam pressure at the stop valve is 350 lb. per sq. in., the total temperature 700 deg. F. and the vacuum at the exhaust 29·1 in. The switchgear is of the cellular type and the station supplies the Manchester area through four 0·3 sq. in. feeders, the transmitting pressure being 33 000 V. Two 0·2 sq. in. feeders are used to supply energy to the Lancashire Electric Power Co.'s system, while two feeders of the same section supply energy to Stretford. Five distributing stations in various parts of Manchester transform the energy to 6 600 V for distribution, the one in High Street, Chorlton-on-Medlock being the first complete outdoor sub-station in this country operating at 33 000 V.

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Co-Operation in Wireless.

A Plea for a Live Policy.

By E. Alexander.

Speculation is rife at the moment as to the result the report on broadcasting will have on the wireless trade. There is, however, a much more serious consideration which seems to require forceful and diplomatic handling—namely, whether the future of the industry is going to develop along normal lines like any other industry, or whether components and their production is to be all there is in it. It is most extraordinary that an industry such as wireless should undoubtedly be has developed into a " make it yourself hobby," and the whole subject stigmatised as a boy's experimental pastime rather than a necessity in every home.

Is Amateur Manufacture a Necessary Part of Wireless ?

Who would think of making their own sewing machine or bicycle, and does anybody regard the making of a bicycle as a necessary result of desiring to own one ; or, in other words, is it more the rule that one should make their own home furniture rather than buy it ready made ? How has this state of affairs been brought about, and why is the major portion of the possible wireless market beyond the reach of the trade owing to the public erroneous supposition that in order to enjoy wireless concerts one has to mess about with soldering irons and purchase a mass of wireless junk that is neither understood nor desired to be understood. Can one imagine, for example, vacuum cleaners sold in bits for the unfortunate purchasers to put together themselves.

Realising that the situation is such as described—and it is—one looks round for the reason and finds it unfortunately in the policy of most periodicals and newspapers, which all describe wireless receivers as something that one has to make up oneself. There is scarce a mention of purchasing a set in the normal manner like a piano, lawn mower, or any other household article. No ; wireless receivers must be made at home from bits, or otherwise it is not a wireless receiver ; and if some deluded buyer purchases a ready-made set like a normal individual, then it is an object of no interest and cannot possibly give results comparable with one made from the latest triple amplification, half a valve circuit described in the latest issue of " Radio Gadgets," with a sale of ten million per week, perhaps.

Who is the Experimenter ?

Before the impression is gained that we are out to stop, prevent, or abuse the experimenter, let us at once clearly understand who the experimenter is and what is his place in the scheme of things. The genuine experimenter was in existence long before broadcasting came ; in fact, it was largely owing to his energies that we have broadcasting at all. All honour to him ; but why, now that broadcasting has come, are all listeners supposed to be experimenters, and the whole of wireless considered an experiment. The genuine experimenter is with us always, at least, we hope he will be, and it is up to the whole trade to foster him, supply his wants, and see to it that his status is maintained, and that he is not indiscriminately herded in with the whole listening public, who for some reason known to editors alone are now supposed to be experimenters.

A Severe Check on the Wireless Trade.

These are, then, the facts. Wireless broadcast came, and it was supposed on precedent that an industry would be built up on normal lines like motor cars, gramophones, and the like. The Press stepped in and educated the public into the belief that it was best to make your own set in order to listen in, that one could be made for an infinitesimal sum in comparison with a bought article, and that all listeners were experimenters—or should be. The result of this editorial policy has been to impose a severe check on the whole of the wireless trade, to get the genuine experimenter discredited, and to completely stop the sale of sets which manufacturers spent large sums in perfecting and laying down plant for manufacture. Few people regard wireless in the home as anything but a toy, having a lot of messy wires, accumulators, and such non-drawing-room implements.

Can we have a little co-operation ? The manufacturer has done his share ; he has financed the broadcasting company, developed his research departments, employed thousands of the unemployed, created stocks, subscribed capital, and dealt generously with the Press in his advertising quota. Will they not help him a little : why cannot the Press, and particularly the wireless section, popularise wireless as wireless for broadcast reception and not as an experiment ? Why cannot they popularise good makes of wireless sets ? Why must their every column be filled with " How to avoid buying a set by making one yourself " ; in fact, why are they trying to kill the trade altogether and make it into a marine store dealer's side line ?

The Manufacturers' Complaint.

There is no desire that those people who desire to make their own sets should not do so, and do so intelligently, but the manufacturers' complaint is that the public are being educated against buying complete sets ready made, and are thereby being made to become indifferent to this wonderful opportunity. Last Saturday evening the writer remarked on this subject at the dinner table. A loud-speaker was gently droning a waltz, a vocal selection followed : the guests proclaimed it to be delightful and they all wished they could have likewise in their own homes. On expressing surprise and suggesting that there was nothing to stop them, the reply came : " Oh, but you know all about wireless and we know nothing ; we could never make a set work." These people all read the papers and I have personally seen a wireless paper in their homes, yet they think that in order to receive wireless broadcast, one has to know all about wireless. How would the average owner of a watch feel if he were supposed to know all the inward workings of a watch before he could tell the time.

Manufacturers will have to watch their advertising quota, and if the policy of occupiers of the editorial chair is to ruin them, then in sheer self defence they will have to withhold their contributions to those journals which insist on converting every potential listener into a pseudo-experimenter. They can all help—even those journals whose avowed object is the genuine experimenter—by including something of interest to the potential buyer who is not and does not want to be an experimenter, either genuine or otherwise.

The Empire Wireless Deadlock.

Position of the Marconi Co.

The deadlock that has arisen between the Post Office and the Marconi Co. as to the conditions on which a licence shall be granted to the company for wireless communication with the Dominions and foreign countries is dealt with at considerable length in Wednesday's " Times." It appears that the Post Office has made proposals for a pooling arrangement between it and the company, which the latter regard as unfair and a handicap to their enterprise. It is understood that the whole matter is to be discussed by the Imperial Economic Conference probably this week.

In the course of a statement reviewing the whole matter, Mr. Godfrey Isaacs is reported to have said that the negotiations had been proceeding upon the basis of possible co-operation in the working of the Post Office stations and the stations which private enterprise was to erect. The conditions suggested would, however, have been destructive of co-operation, would have destroyed the elasticity of private enterprise, impaired the possibilities of improvement in the service and limited the scope of the conduct of the business. In these circumstances the Marconi Co. did not feel justified in accepting licences, though they were willing and anxious to carry through the scheme under the pooling arrangement, if the operations were to be conducted by private enterprise. It is hoped that licences to communicate with foreign countries will be granted on terms consistent with policy enunciated by Mr. Bonar Law entailing competition both with the Post Office and private enterprise.

The Empire Press Union is said to be very much dissatisfied with the position, and has applied for an opportunity to make a statement to the Imperial Economic Conference.

Books Received.

" Les Transformateurs." By P. Bunet. (Paris : J. B. Ballière et Fils.) Pp. 632. 55 fr.

" Radio Telegraphy and Telephony." By E. W. Marchant. (London : Hodder and Stoughton.) Pp. 137. 6s. net.

" Annual Report of the Board of Regents of the Smithsonian Institution, year ending June 30th, 1921." (Washington : Government Printing Office.) Pp. 638.

" Proceedings of the Institution of Railway Signal Engineers (Inc.), 1923, Part 1, February–July." (Reading : Joseph Hawkes.) Pp. 185. Price to non-members, 7s. 6d.

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Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

THE ELECTRON THEORY.

To the Editor of THE ELECTRICIAN.

SIR,—In THE ELECTRICIAN of September 21st Mr. Sayers details some of his difficulties in reconciling electron theory with electromagnetic theory. Now, unless I have failed to understand his difficulties altogether, they are due to a confusion between ether and matter and are quite easily resolved. Thus, he is troubled about the possibility and explanation of the existence of an electrostatic field in the ether. He remarks, quite rightly, that an electrostatic field is determined by an excess of electrons on the one hand and a defect on the other, and inquires " what is an electrostatic field in the ether of space if there are no electrons ? " The answer is that we do not know any more (nor less) on the electron theory than we did on the old theory. We *do* know what would happen if there were electrons introduced, but when there are none there is simply the field. The electrons whose excess or defect determines the field are those on the boundary of it, so that if the field is applied to a dielectric or conductor, it is not the electrons in the field which determine the latter (although they modify it, because it moves them and they superimpose their own field on it, which remark contains the germ of the explanation of specific inductive capacity or dielectric constant) but those at its boundary.

Similarly, the magnetic field, whether that in a beam of light or produced on a molar scale, is due to the motion of the electrons in the source of light, or in the conductor whose field is under consideration, and if there are no electrons in the field (as in the ether) they are not affected ! If there are any present they are set in motion in the usual way.

To put the matter another way, Mr. Sayers seems not to have realised that the electron theory is not concerned with electromagnetic fields, but only with the electricity which causes them.

His other difficulty, as to the phases of the electrostatic and magnetic fields in a beam of light, since it refers to the field, is not in any way due to the electron theory. In fact, I think that on Maxwell's own theory, the electric and magnetic fields are in the same phase.—I am, etc.,

JAMES H. AWBERY.

Teddington, Middlesex.
October 4th.

ELECTRICITY SUPPLY AT AYLESBURY.

To the Editor of THE ELECTRICIAN.

SIR,—I have read with great interest the account of the steam consumption tests carried out by Mr. Selvey on the British Thomson-Houston turbo-alternator at Aylesbury (*see* THE ELECTRICIAN, September 21st, p. 303), and there is one point which attracted my attention in particular, namely, the values found for the efficiency of the alternator.

On working back from these efficiencies I find the losses in the alternator are approximately :—

	Load.			
	½	¾	1/1	5/4
Actual output in kW ..	805	1 159	1 512	1 877
Loss in kW	99·5	100	104·3	111

On putting these losses against the output in kW, the no-load loss appears to be 94 kW approximately.

This gives an increase in loss from no-load to over-load of 18 per cent., which I should term remarkably low, even for a power factor of unity.

It would have been of interest if the power factors of the various loads had been given. The fact that it was necessary to supplement the station load with a water resistance load would tend to make the power factor of the higher loads approach unity, and thus lead to slight over-estimation of the no-load loss by the above method and corresponding under-estimation of the above percentage.—I am, etc.,

J. L. JEFFERSON.

Newcastle-on-Tyne.
October 5th.

PROPOSED ELECTRIC HEATING ASSOCIATION.

To the Editor of THE ELECTRICIAN.

SIR,—With reference to Mr. J. H. Bowden's suggestion for the formation of an Electric Heating Association (*see* THE ELECTRICIAN, September 28th, p. 337), I would like to point out that, as a result of a suggestion made at the 1922 Convention, the Incorporated Municipal Electrical Association has a committee—on which the companies are represented—dealing with the problems of electric cooking. Area sub-committees have also been formed throughout the country.

Twelve months' hard work have been put in by the committee under the chairmanship of Mr. R. B. Mitchell, of Glasgow ; and it is largely due to this committee and the efforts of the B.E.D.A. that the demand for cookers has gone up enormously during this period. The question of producing a standard cooker is under consideration by this committee and also by the B.E.S.A.

May we be spared the formation of yet another Association ; the ground seems to be well covered already—I am, etc.,

ALEX C. CRAMB,
Hon. Secretary,
Incorporated Municipal Electrical Association.

London,
October 4th.

IMPROVING THE SHAPE OF ALTERNATOR VOLTAGE WAVES.

To the Editor of THE ELECTRICIAN.

SIR,—I notice in the abstract you have published this week of the paper by Mr. Turney and myself, on " A Method of Improving the Wave Shape of Alternators," that diagrams 3a and 3c have been displaced ; 3c is the wave shape of the machine before correction, and 3a is the wave shape of the machine after correction.

Since the meeting of Section G on September 19th, I have looked through the journal mentioned in the discussion, the " Archiv für Electrotechnik," to see whether I could find an account of an arrangement similar to that which I described, but have not succeeded in my search.

Mr. Jack also referred to the fact that a device similar to the one I described had been used by the B.T.H. Co., but of this, also, I have found no account anywhere. The use of " resonant shunts " on telephone circuits to prevent interference by induction is mentioned in a paper in the Proceedings of the American Institute of Electrical Engineers, but this, of course, is a different device from the one which I described, in which ripples are got rid of *at the source* by using circuits of zero reactance across the supply and a limiting reactance in the main circuit (or, in the case of three-phase generators, in the neutral circuit) to reduce the ripple frequency currents to smaller dimensions. The same arrangement as that described in my paper can be applied to direct current circuits to get rid of ripples. Although the old saying that " there is nothing new under the sun " *may* be true in this case, up to the present I have not found any reference to a device of this nature in previous literature.—I am, etc.,

E. W. MARCHANT.

Liverpool.
October 6th.

ELECTRICITY AND THE PRESERVATION OF FOOD.

To the Editor of THE ELECTRICIAN.

SIR,—Public interest has been aroused by articles in the Press on the use of food preservatives. A recent writer pointed out that much of the food preservation work carried out now with chemicals could perhaps be effected with " cold," and suggests that " cold " might be laid on like water, gas and electricity.

It would be a convenience to lay on " cold " and " vacuum " as we do electricity and water ; the time for it is perhaps not yet, but there is a problem for the inventor which has never been solved, even if it is capable of solution—that is the easy abstraction of heat from bodies but little hotter than the surrounding air.

It is so simple with electricity to deliver heat or raise the temperature of a body and so much more complicated to deliver " cold " or extract heat from a body. There are refrigerating appliances, but they mostly contain reciprocating machinery, and the smallest are apt to represent considerable expenditure. The inventor who can give us the inverse of the electric fire, and for a few pounds provide a cupboard or receptacle in which a body can be chilled or kept cold by a small expenditure of electrical energy should secure a big reward.—I am, etc.,

J. W. BEAUCHAMP,
Director and Secretary,
British Electrical Development Association.

London, September 28th.

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"THE ELECTRICITY AGE."

To the Editor of THE ELECTRICIAN.

SIR,—Mr. Rutherford Blackie in your last issue refers to confusion and misunderstanding regarding stand-by coal, but I can assure him there is no confusion in my mind on the matter.

The confusion appears to arise from mixing up the running plant load factor with the station load factor. In the examples given in my article, I allowed for the whole of the turbo generating plant being run at full load continuously, therefore no account need be taken of no-load steam consumption.

The item " stand-by coal " is that required to keep the steam range alive, etc., which at this station works out approximately at 1 000 lb. of coal per hour. It is a negligible, or perhaps unnecessary, item in stating the cost of running a station with 100 per cent. load factor, but a matter of considerable importance in a station with 30 per cent. load factor,

I should be interested to know why Mr. Blakie should refer to my article as an " interesting speculation." Does he infer that the proposition is not a practical one ?—I am, etc.,

J. HORACE BOWDEN.

Poplar.
October 6th.

33 000 V Transformers for Manchester.

Details of Ferranti's Latest Design.

In the annual report of the Electricity Commissioners, with which we deal elsewhere in this issue, reference is made to the increasing use of pressures of 33 000 V on main transmission lines. The employment of these pressures carries with it certain modifications in the design of the transformers and other apparatus on the circuits as is evident from the details of three 3 000 kVA 32 000/11 000 V transformers which have been recently supplied by FERRANTI to the Manchester Corporation for use in the Middleton sub-station.

These transformers are of the oil-immersed self-cooled core type connected in delta-star with the neutral point available. As the illustration (Fig. 1) shows, they are arranged to take

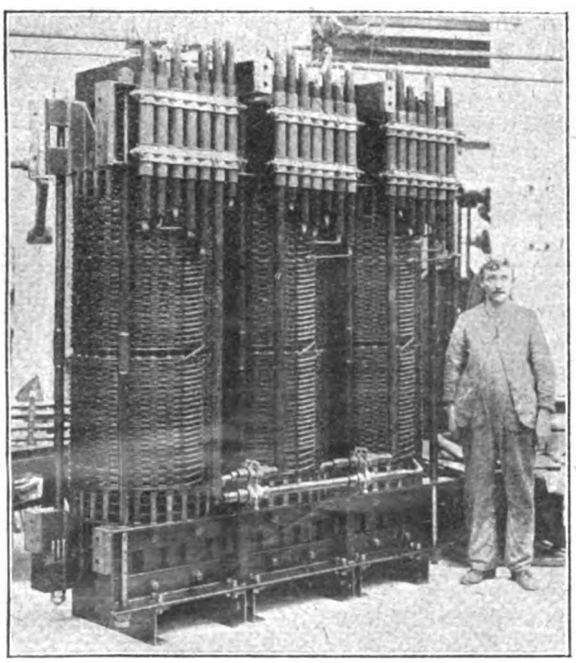

FIG. 1.—3 000 kVA 3-PHASE FERRANTI TRANSFORMER, 32 000-11 000 V, 50 PERIOD, SHOWING REINFORCED INSULATION ON H.T. TAPPING FOR MIDDLETON.

circular coil concentric windings. The cores are built up of high grade transformer iron punchings and are proportioned with due regard to rigidity. Interleaved joints are made between the bottom yoke and the legs, but the top yoke is removable, the top of the legs and the underface of the top yoke being machined flat so that a satisfactory butt joint can be made between the two.

Details of the Design.

The punchings are held together by braced steel clamps, a substantial channel section being used in the yoke. Well insulated bolts are used through the channel clamps and leg plates, and care is taken to ensure that no shearing strain is applied to the insulation due to the tension on the main vertical tie bolts. Heavy bolts passing vertically through the flanges of the yoke clamp, and also through the short rigid steel clamps placed across the yokes at the top and bottom, hold the complete core solidly together, and additional vertical bolts passing through the yoke clamps are provided to eliminate possibility of mechanical failure.

Axial movement of the coils is prevented by substantial insulating end supports which butt against the flat surfaces formed by the inside faces of the yokes and channel clamps. These supports are designed so as not to interfere with the free passage of oil through the ducts, and to allow of even distribution of mechanical pressure, thus preventing coil distortion.

The Windings

The windings are of the concentric circular coil type (L.T. spiral, H.T. disc), with the primary and secondary so placed in relation to each other that any mechanical stresses

FIG. 2.—3 000 kVA TRANSFORMER LEAVING THE WORKS FOR MIDDLETON.

acting on the windings in a radial direction, as a result of external short circuits, are uniformly applied and do not tend to distort the coil shape.

Care has been taken to guard against the effects of insulation shrinkage by assembling each leg of H.T. coils complete with separators on a special framework on which they were stoved and then compressed to final dimensions whilst hot, before placing them in position on the cores. In addition, the Ferranti patent spring clamps are fitted at the centre of each set of coils, thereby automatically and effectively making provision for taking up any slight shrinkage which may develop during operation on circuit.

Ample oil ducts for efficient and even cooling and elimination of " hot spots " are provided to allow of free circulation of the cooling oil, and it is noteworthy that every turn of the windings is in direct contact with the oil. In addition, care has been taken in the choice of oil in order to prevent the possibility of the formation of sludge.

The transformers are provided with a central point lift, thereby ensuring that the strain upon the slings and lifting tackle, whilst removing the transformer or replacing it in its tank, cannot exceed the weight of the transformer. Each transformer is contained in a boiler iron tubular tank of robust construction, thoroughly strengthened and stiffened ; all the joints, being welded, are hot oil tight. The tanks are supplied with an oil level gauge, thermometer pocket, oil drain valve and a set of swivel rollers which allow of the transformer being moved in any direction. Further small oil valves are fitted to the top and bottom of the tank for use in connecting up an oil filter set.

The transformers are supplied with conservator vessels complete with calcium chloride breathers. These not only ensure that only dry air will come in contact with the reduced surface of the oil in the conservator vessel and maintain the di-electric strength of the oil, but also prevent the formation of sludge by securing the absence of air in contact with hot oil in the main tank.

Similar transformers have been supplied to the West Gloucestershire Power Co. in connection with the Lydney Scheme. These will be used in an outdoor sub-station about 300 yards from the generating station. These transformers are of the outdoor type with a capacity of 3 000 kVA transforming energy at 50 periods from 6 600 V to 33 000, the connections being star-delta on the high tension and low tension sides respectively. They are of the oil-immersed self-cooled outdoor type with a conservator vessel.

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Merchandise to Sell and Profit By.

***In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of* THE ELECTRICIAN.**

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

"The Homecharger."

We illustrate a battery-charger which is of U.S.A. manufacture and is marketed in this country by THE CARFAX CO., LTD. It is sold under the popular trade name of "The Homecharger." A full and complete description of the charger is quoted in leaflet No. 701, but a few details in these columns will be of service.

The device is a popular size rectifier for charging three or six cell bateries in the home or private garage on a.c. circuits. It

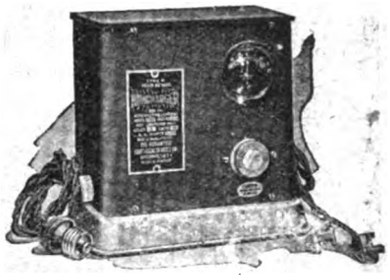

FIG. 1.—A NEW BATTERY CHARGE.

fills a need for a simple and economical means for charging batteries such as used for starting and lighting on motor cars, for operating radio receiving sets, etc. It can be connected to any alternating current circuit, consumes less than 100 W per hour, and has a charging rate sufficiently high to charge a battery of one 100 Ah

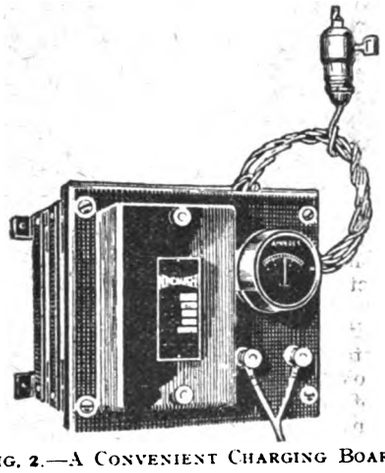

FIG. 2.—A CONVENIENT CHARGING BOARD.

capacity or less fully overnight. The rectifier is on the vibrating armature principle. The complete apparatus is listed at £7 10s.

The company are exhibiting their products at the "Bristol First" Exhibition, which is being held under the auspices of the local Rotary Club.

A Useful Domestic Lamp for 16s. 6d.

An adjustable electric lamp which is being manufactured by INGRAM & KEMP is known as the "Spersom" lamp, and, as will be appreciated, is a device which will prove very popular with the public. Leaving aside the many useful features which the lamp can boast, the popular price of 16s. 6d. will make it appeal to the public. A most compelling booklet is published by the same firm describing the device in a domestic and chatty manner, and this should prove a useful aid to secure business. Among the several features which will make the lamp a ready seller is that it can be readily dissembled and packed up within itself, so to speak, making it suitable for packing in a small travelling bag.

"Staines Art Ware."

BURLECTAS LTD. are now marketing a range of electric table lamps which will interest all showroom buyers who are seeking novel and, at the same time, artistic lines for the display counters. We are not able to illustrate a standard which would convey the note which Burlectas have succeeded in attaining in the whole range because we cannot do justice to the colours and decorations. Certainly there are prospects for considerable success, because they represent an entirely new line of thought in table lamp designs and are certainly worth the attention of every showroom buyer. A very artistic folder is offered by Burlectas Ltd. to the trade.

Autoveyors' Capacity Bridge.

We commend to the notice of the trade, and particularly to the wireless retailer and manufacturer, the small booklet recently published by AUTOVEYORS LTD. describing their three-electrode variable condenser capacity bridge. It has many technical features which cannot be described in detail in this column but they are features which will appeal to what can be called the advanced wireless experimenter or amateur. From this standpoint it will appeal to the wireless retailer. The device will also be of particular interest o wireless appafatus manufacturers.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

From the RECORD ELECTRICAL CO. we have received a mailing card briefly describing the "Cirscale" moving coil ammeters and voltmeters.

The IMPERIAL ENGINEERING CO. are among the first to announce publication of their list of fires and other appliances for the 1923–4 season.

Henley's joint box compounds are fully described in the second edition of list U.M.1, recently published by W. T. HENLEY'S TELEGRAPH WORKS CO.

"Prescot Aluminium Matting and Sections" is the title of a list, No. P 180, recently issued by the BRITISH INSULATED AND HELSBY CABLES, LTD.

Retailers who seek something very novel in the way of telephone accessories will be interested in the device just placed upon the English market by the BRITISH HUSH-A-PHONE CO.

We have to make an announcement that is becoming a regular feature of this column. We refer to the monthly trade price list regularly issued by SIEMENS AND ENGLISH ELECTRIC LAMP CO.

Among the "notices" of new publications must be included an announcement of a descriptive list No. 4153B entitled "Oil Immersed Circuit Breakers" by the BRITISH THOMSON-HOUSTON CO.; also descriptive list No. 2190 from the same company.

It has been our pleasure to enlarge on Fuller's accumulators in our "Merchandise to sell and profit by" columns. It will be noted with interest that FULLER'S UNITED ELECTRIC WORKS have recently published a new list No. 250A, quoting up-to-date data and prices on the whole range.

The PARSONS MOTOR CO. ask us to announce that they have recently published two new catalogues, one bearing the No. 62 and entitled "Parsons Gears and Fittings," and the other bearing the No. 63 entitled "Parsons Marine and Stationary Oil and Petrol Engines." Engineers and others who specialise in marine work are invited to ask for copies of these lists.

"A catalogue of instruments manufactured by Johnson and Phillips, Ltd.," is an event to merit the attention of all engineers and others who have need to know the best markets in which to buy instruments. The complete range is described in catalogue M just published by JOHNSON AND PHILLIPS, and a copy will be sent on request.

"Bigger Business" is the intriguing title which the makers of the now-famous Rawlplug have adopted for their chatty little magazine. It will be issued periodically, and the August issue has just come to hand. The RAWLPLUG CO. will welcome new names to their mailing list, and the magazine will be posted regularly as and when published.

The METROPOLITAN-VICKERS ELECTRICAL CO. will be pleased to send to all interested readers of THE ELECTRICIAN copies of their most recent publications—(*a*) leaflet 255/1-1 describing their type "K" oil circuit breakers; (*b*) circular 1250/2 on the "Breaking capacity of oil circuit breakers"; and (*c*) a circular on "High voltage bushing insulators."

An event of importance in publicity is the batch of folders, broadsheets, etc., published by the British Thomson-Houston Co., Ltd., and referred to in THE ELECTRICIAN recently. With these folders, etc., the retailer is fully equipped to secure the large business which will undoubtedly "roll in" as a result of the advertisement which appeared on the front page of the "Daily Mail" on the 14th. The same company also announce the issue of booklet L.272 describing "The Eye-Restolite" lighting unit which we have dealt with in THE ELECTRICIAN.

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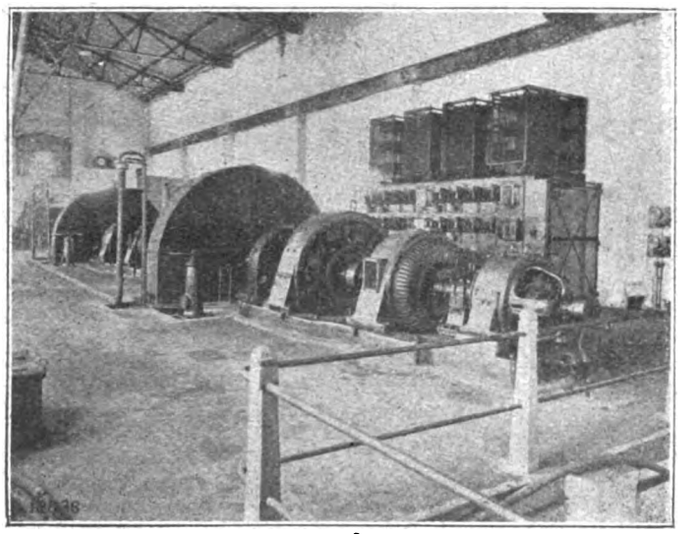
Electric Winders for Collieries.

Obtaining Uniform Demand on Supply Mains.

An order for two electric winders of exceptional interest has been placed with the British Thomson-Houston Co., Rugby, by the Bolsover Colliery Co., for the new "all-electric," Thoresby Colliery.

The winders, the mechanical parts of which will be constructed by Robey and Co., will be used for sinking shafts to a depth of 350 fathoms, and are each designed for a normal coal load of 3 tons 18 cwt. per wind or a total output of 193 tons per hour for each winder. Parallel drums, 18 ft. in diameter and 10 ft. 6 in. wide, will be used, in conjunction with a balance rope, and the motors, which will be coupled direct to the drums, will each have a continuous rating of 1 500 H.P. Two motor generator sets, each equipped with a 20-ton flywheel, will be used to convert the energy of the supply from alternating current at 2 200 V 3-phase to direct current at 650 V, and, by means of an automatic contactor type slip regulator, the peak loads during acceleration will be drawn from the kinetic energy of the flywheels. The adoption of this method will, it is claimed, result in a practically uniform demand on the supply mains.



A Typical B.T.-H. Colliery Winding Equipment.

The control gear, which is to be of the most up-to-date design, will incorporate a very complete system of safety and emergency devices, and, in addition to the usual h.t. and l.t. switchgear, change-over gear will be supplied to enable each motor to be supplied from either motor generator set.

The accompanying illustration shows a similar Ward Leonard Ilgner equipment recently completed by the British Thomson-Houston Co. at one of the Staveley Coal and Iron Co.'s pits.

The British Empire Exhibition.

Electrical Space Nearly all Let

Electrical and allied manufacturers who contemplate showing at the forthcoming British Empire Exhibition, and have not yet booked their space, have but little time left in which to make up their minds, as nearly all—94 per cent., to be exact—of the space allotted to the British Electrical and Allied Manufacturers' Association has now been let. The remaining sites are most of them relatively small, but the size of an exhibitor's stand does not necessarily bear any relation to the amount of business that can be done from it if the goods and their presentation are right.

For the benefit of those who would like to be represented at this great Exhibition but find the prospect of keeping a portion of their staff in constant attendance at Wembley beyond their resources, the Association has made special arrangements whereby any manufacturer can hand over a showcase containing his exhibit with the knowledge that the B.E.A.M.A. will take care of it and relieve him of all responsibility concerning it during the whole of the Exhibition period. Adjacent to the showcases will be placed letter boxes into which visitors will be invited to place communications for the exhibitor; the Association will collect and forward the letters daily, thus keeping the manufacturer in close touch with his customer.

A suitable rendezvous for engineers visiting the Exhibition will be ensured by the provision of an Engineers' Club, the cost of which is to be shared by the B.E.A. and the B.E.A.M.A. The restaurant attached to the club will be an all-electric one equipped by B.E.A.M.A. members. Large glass windows along one side of the kitchens will enable the public to see continuous demonstrations of electric cookery.

Vines and shrubs in conjunction with a building of some architectural merit conceal the real purpose of A NEW SUB-STATION erected in a residential district of San Diego.

Bulk Supply for Hornsey?

A London Electricity Supply Problem.

The question whether the Hornsey (London) Corporation should be allowed to continue to generate electricity for its own requirements or whether it should be compelled to take a bulk supply from the North Metropolitan Power Co. was discussed at Hornsey Town Hall on Monday, when Col. T. C. Ekin presided at an inquiry by the Electricity Commissioners in regard to an application by the Hornsey Corporation for consent to an extension of the municipal power station at an estimated cost of £38 500.

For the Corporation, Mr. R. M. Montgomery urged that whatever advantage might accrue from taking a bulk supply would, by reason of the price, fall to the North Metropolitan Power Co. When application was made to the Commissioners in 1921 for sanction to certain extensions, he continued, the Commissioners concluded that it would be cheaper for Hornsey to extend its plant and increase its output than to take a bulk supply from the North Metropolitan Co. He claimed that the people of Hornsey would have to pay £20 000 less in the next six years under the proposed extensions than would be the case if the bulk supply were adopted.

Mr. Arthur Collins produced figures to show that from 1925 to 1930 local generation would result in a saving of £21 354. In 1931 a large expenditure of new capital would be necessary, but this would not destroy the advantage that Hornsey held, and would hold up to 1940.

Evidence was given by Mr. Arthur U. Seabrook and Mr. Norman Staniland, the borough electrical engineer, and the inquiry was adjourned until Tuesday, when Mr. W. C. P. Tapper, the Stepney borough electrical engineer, gave evidence in support of the Hornsey Corporation's case.

Captain John M. Donaldson, chief engineer to the North Metropolitan Co., said the company contemplated reducing their price to the level of Hornsey's figure. Stoke Newington took practically all its supply from his company, and was able to supply its consumers at 5½d. per kWh.

Mr. W. Craig Henderson, on behalf of the North Metropolitan Co., said it was wasteful to use little stations which frittered away coal when large central generating stations, by means of their internal economy, used less coal in ratio to the amount of energy generated.

The inquiry then terminated, and it was announced that the Commissioners would give their decision in due course.

Electricity and the Public.

What the Home Journals Tell their Readers.

A month ago we drew attention to articles in monthly periodicals read in the home and showed how these publications could lead domestic policy towards the "all electric" age.

In the current number of "Good Housekeeping" Mr. A. Arnold gives some useful hints regarding fuses and meter reading in an article entitled "Lighting the House with Electricity." "Let the Electric Motor Work for You" is the title of another article in the same issue. The writer describes how after procuring a small electric polisher for silver, many additional uses were discovered for it. After testing it under home conditions the writer characterised its achievements, coupled with a low consumption of electricity, as surprising.

Electric Laundering.

An article in "The Ideal Home" describes how a large family wash can be undertaken single-handed with the aid of an up-to-date washing machine, and singles out the electrically-operated type for special commendation. There is, however, little else of electrical interest, with the possible exception, in an article on "Light and Heat in the Home," of a statement that the most wasteful gas appliance is the ordinary gas oven!

"Homes and Gardens" has a special heating and lighting section in which the advantages of electricity for heating are emphasised. Mr. J. S. Dow deals with the question of choosing lighting fittings for period furnishing schemes and points out the difficulty of avoiding glare where cut glass chandeliers are used with electric light; this glare can, of course, be avoided. Dealing with essentially modern fittings the writer says that high candle-power electric lamps, used in conjunction with semi-indirect fittings of the bowl type, are most efficient as distributors of light, and can produce charming effects. He also enters a plea for fuller co-operation between architects and lighting specialists with a view to utilising more fully the architectural features of a room in the lighting scheme, in such a way that the architectural features themselves become "lighting fittings."

Faraday House Old Students.

Fifteenth Annual Dinner and Concert.

The fifteenth annual dinner of the Faraday House Old Students' Association, will be held at the Hotel Cecil, on Friday, October 19th. Mr. H. W. Miller will be in the chair, and a large attendance is expected. Members of the Association may introduce guests, who need not necessarily be Faradians. A musical entertainment will, as usual, follow the dinner, and old students who are desirous of attending should make early application for tickets to the Secretary, Faraday House, Southampton Row, London, W.C.1.

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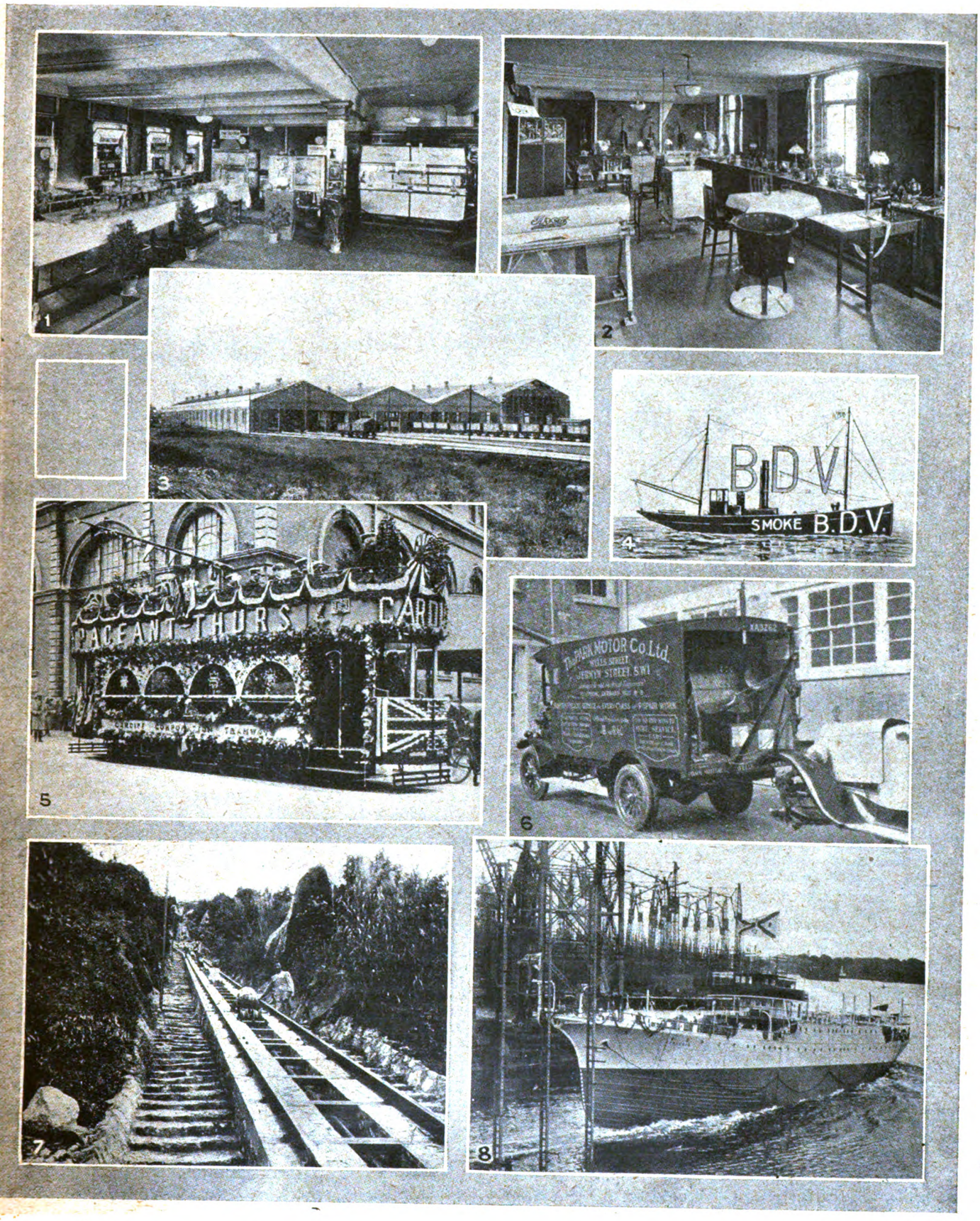

Electrical News in Pictures.

1 and 2. *Domestic electrical appliances shown in pleasant surroundings at Liverpool.*
3. *The L. & N.E. Rly.'s new electric train sheds at Gosforth.*
4. *The first marine electric advertising sign* (p. 414).
5. *The Tramway Dept.'s contribution to Cardiff Shopping Week.*
6. *Equipped with "wireless," this repair lorry is controlled from headquarters.*
7. *Section of the Penang Hill Rly., to be opened this month.*
8. *Launching the Western Telegraph Co.'s c.s. "Norseman"* (p. 401).

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Electric Battery Locomotives.

Technical Requirements in £1 000 Competition.

As previously announced in THE ELECTRICIAN, the competition for the £1 000 prize offered by Mr. C. Markham, of Chesterfield, for an electric storage battery locomotive for use underground in coal mines, will be open to competitors of any nationality until about next April.

Technical Requirements.

According to the technical requirements, which have now been made public, the locomotive must be capable of exerting a draw-bar pull in either direction of not less than 600 lb. at a speed of 3½ miles per hour on straight track for a period of 1¾ hours for each complete charge of the battery. The battery shall have an output of not less than 12 kWh at the one-hour rate, and not less than 18 kWh at the five-hours' rate of discharge. The working voltage shall not exceed 80 V. The actual output of the battery will be carefully measured while the locomotive is hauling a load of five tons. Each competitor is to state the percentage of the full output of the battery when discharging at the two-hour rate which will be required to perform the actual test duty necessary for 36 double journeys on the test track to be provided, and the suitability of the battery for general service will be considered in connection with this ratio.

The acceleration of the locomotive from rest with a full load on straight clean track on a rising gradient of 1 in 24 shall be such that the speed of 3½ miles per hour shall be reached in not less than 15 seconds and not more than 20 seconds. The electrical control must be such that the speed, fully loaded, on straight and level track may be regulated to a speed not exceeding five miles per hour.

Battery Changing.

Designs must include provision for the quick and easy replacement of a discharged battery. The constructive features considered necessary to obviate as far as possible the dangers of electric shock, etc., include :—

Open sparking in ordinary use.—The design of the locomotive as a whole shall be such that in ordinary use there shall be no risk of open sparking.

Open sparking arising from defects.—It will be necessary also to provide for possible danger arising from electrical or other defects which may result in sparking, or an electric arc, or in fusing of conductors, or in setting fire to such inflammable material as may be used unavoidably in the construction, or insulation, of the electrical equipment.

Between all parts of electrical equipment which do not move relatively electrical cables outside enclosures should be contained in substantial rigid hard metal pipes or casings, so as to enclose the cables completely. Where there is relative movement cable connections should be made fire-proof.

Flame-proof enclosure.—Parts of the equipment subject to sparking in ordinary use must be dealt with by flame-proof enclosure, and those parts which may entail danger if defective should be similarly enclosed if possible.

Mechanical damage.—The risk of mechanical defects and of external injury should be minimised by construction designed to withstand severe vibration and rough usage, and by the avoidance of unshielded projecting parts of the electrical equipment.

Interference with, or careless replacement of, covers.—Flame-proof enclosures which may require to be opened during a working shift, such as for the replacement of fuses, if any, should be few in number, readily visible to casual inspection, and should bear a warning,

Design of Flame-Proof Enclosures.

Partitioning.—To avoid "pressure heaping," there should be no passage or opening between separate flame-proof enclosures through which gas or flame can pass, and there should be no avoidable constriction of the area within any such enclosure such as to constitute separate enclosure with communicating passages.

Walls of flame-proof enclosures.—Insulated conductors should not be taken through openings or bushed holes in the wall of a flame-proof enclosure, but should terminate at fixed insulated studs, making a permanent flame-proof junction with the pierced wall. The portion of the stud external to the flame-proof enclosure should be adequately enclosed.

Joints in structure.—All joints in flame-proof enclosures should be metal to metal, with machined faces. No attempt should be made to secure a gas-tight joint. The absence of any stud or set screw from the walls of a flame-proof enclosure should not cause communication between the enclosure and the outside. Bolts must not be used. The number of securing bolts or screws and the rigidity of the parts should be sufficient to prevent buckling or springing, such as to vitiate the flame-proof enclosure.

Types of enclosure.—The enclosure of electrical parts other than the battery should be total without ventilating openings, but provision may be made for the relief, or prevention, of excessive internal gaseous pressure provided such vents are flame-proof. The enclosures containing the battery may be ventilated provided the openings are so protected as to constitute a flame-proof enclosure.

Assumption for testing in gas.—It is to be assumed that gas may obtain access to any flame-proof enclosure that is not hermetically sealed, and the enclosure should be flame-proof for any mixture of methane and air within the limits of inflammability of such mixtures.

Control of Electrical Circuits : Switchgear.

Main switch.—A double-pole excess current circuit breaker, with free handle, should be provided and connected between the battery terminals and the motor circuits and as near as may be to the battery terminals. *Motor Controller.*—The motor controller should be provided with a "dead-man's handle," to insure interruption of the circuit when the locomotive driver is not in control. *Charging Terminals.*—A plug box, or other suitable terminals, should be provided for connection to the charging circuit. These terminals should be housed in a locked enclosure or otherwise effectively protected while the locomotive is in use.

All parts of the electrical circuit should be insulated from the structure, special attention being paid to the insulation of the battery.

Trade Within the Empire.

A Valuable New Guide for Business Men.

Every manufacturer and merchant is turning over in his mind the best means of increasing his trade during the present slack period. Europe, to his cost and distress, is a comparatively closed market. His natural desire is to trade with his nearest neighbours, yet his patriotism prompts him to seek trade within the Empire. The Imperial Conference and the forthcoming Empire Exhibition next year naturally turn his immediate thoughts to the latter. Trade within the Empire has long been a possibility, but hitherto has been carried out under no organised scheme.

The principal reason is that it has not been organised on an Empire basis. This defect is now to be remedied. Simultaneously with the opening of the British Empire Exhibition at Wembley in the spring of 1924, under the patronage of the Prince of Wales, there will be brought into existence, through the agency of the Federation of British Industries with Ernest Benn, Ltd. (Benn Brothers) as publishers, a great publication containing a comprehensive survey of the resources and possibilities of the Empire for the use of business men in this country and overseas. The Federation of British Industries is itself organising the preparation of the matter, and Sir Eric Geddes is taking a personal interest.

Message from the Prince of Wales.

This great Empire trade survey will contain a "foreword" by the Prince of Wales, in which he recommends the survey to the attention of "all those who have at heart the proper organisation of the Empire's natural wealth."

Briefly stated, this business men's guide to Empire trade will put commercial men and traders throughout the world in possession of a summarised index of Imperial products with the information which is necessary to enable them to buy within the Empire. It will have the further value that it will enable other nations to buy from the Empire by showing them where, within its confines, the raw materials and manufactures they need are available.

The various Governments of the Empire are co-operating in supplying much of the information on which the work will be based. The completed work will comprise twelve volumes covering the resources of the Empire in food and raw materials, also the requirements, present and prospective, in relation to production.

Producer, Manufacturer and Merchant.

To meet the needs of producers, each volume will give the fullest possible particulars of the demands of the different parts of the Empire for raw materials, of the sources from which these demands are at present met, and of the principal importers of the different commodities. To meet the needs of manufacturers each volume will show at a glance not only the precise amount of the exportable surplus of the different commodities, but will also give particulars as to their quality and the industrial uses to which they are best adapted, the usual channel of supply, such information as can usefully be given regarding average prices, and the names and addresses of principal producers, merchants or exporters from whom they can be obtained. After analysing and detailing the present production and consumption of raw materials in the different countries, the survey deals with the potential future supplies, and thus will provide merchants, banks, financial houses and development companies of all kinds with invaluable information never previously collected in a single work.

This brief synopsis speaks for itself. Nothing of the kind has ever been attempted before. This Empire trade guide will circulate through the entire world, and it is no exaggeration to say that the twelve volumes will form an indispensable adjunct to trade. Incidentally they will form one of the most valuable advertising media ever published.

Electrical Trades' Benevolence.

Sir Philip Nash Appeals for Funds for E.T.B.I.

SIR PHILIP NASH, who will preside at the annual festival on November 14th of the Electrical Trades' Benevolent Institution, has issued an appeal for contributions to assist in making the invested funds, from which the present income is under £800, sufficiently large to meet the increasing demands on the Institution for pensions and for temporary relief. The objects and work of the Institution are too well known to require elaboration here. Donations may be sent to Sir Philip, or to the hon. secretary, Mr. F. B. O. Hawes, 18 and 21, Park Mansions, Vauxhall Park, South Lambeth Road, London.

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Electricity Supply.

Extensions and Developments.

DARTFORD Urban Council has received sanction to a loan of £11 000 for extensions to the electricity works plant.

CARLISLE Electricity Committee is applying to the Electricity Commissioners for a loan of £233 882 for a new generating station.

MAIDENHEAD Town Council has received from the Electricity Commissioners sanction to a loan of £8 700 for mains and services.

BLACKPOOL Electricity Committee intends to apply for sanction to borrow £5 000 for the purchase of electricity meters required during the next two years.

Plant extensions estimated to cost £140 000 are being considered by SUNDERLAND Electricity Committee. The proposed scheme involves the provision of a 10 000 kW turbo-generator.

PENYBONT (Bridgend) Council has been notified of the sanction of the Electricity Commissioners to its Kenfig Hill electricity scheme, which involves an expenditure of £25 180.

Work has been commenced by the SHROPSHIRE, WORCESTER, and STAFFORDSHIRE Electric Power Co. on its new power station on the River Severn at Stourport.

PLYMOUTH Corporation has submitted for approval to the Unemployment Grants Committee details of schemes of proposed relief works, including the provision of additional electricity plant and mains, to the value of £169 160.

A deputation from BURNLEY Corporation has interviewed Accrington Corporation regarding a proposal to proceed during the coming winter with the laying of an electricity main between the two towns, in accordance with the technical scheme arranged by the Electricity Commissioners for the Mid-Lancashire Electricity District. Burnley Corporation is now waiting for a reply to its inquiry as to the price at which Accrington will be prepared to supply electricity at the Hapton–Huncoat boundary.

Reference was made at a meeting of CHELTENHAM Town Council to a difficulty the Electricity Committee had had in obtaining the sanction of the Electricity Commissioners to a loan for additional plant required for undertaking extensions. The Commissioners, it was explained, advised that instead of putting more money into the Corporation plant, they should take a bulk supply from the West Gloucestershire Power Co.'s station at Lydney. This would have necessitated a complete change in the system of distribution at Cheltenham, which could not be effected at a less cost than £40 000. The Council's application was agreed to.

Alterations in Charges.

BISHOP'S CASTLE Town Council has granted the Electric Light Co. permission to charge 1s. per kWh for electricity up to March 31st next.

Electricity for private lighting in WIMBLEDON is to be reduced from 6d. to 5½d. per kWh in the winter, while the rate for cooking and heating is reduced from 1½d. to 1d.

Tapping New Areas.

CHILWELL Parish Council is approaching the Notts and Derby Electrical Power Co., with a view to obtaining a supply of electricity for Chilwell and district.

At a meeting of the THORPE Rural Council it was announced that a verbal agreement had been made between the two local collieries—Hatfield Main and Thorne—and the Electrical Distribution of Yorkshire, Ltd., for the latter to take the surplus supply of electricity from the collieries for local consumption, and that the maximum charges would be 7½d. per kWh for lighting and 10½d. per kWh for heating and domestic purposes; also that there would be a revision of prices every three years.

Inquiries and Orders.

The Minister of Transport proposes to confirm the CRANBROOK RURAL DISTRICT and the NORTH SOMERSET ELECTRICITY SPECIAL ORDERS. Objections to the Secretary, Ministry of Transport, Whitehall, London, S.W.1.

EAST RETFORD Corporation has applied to the Electricity Commissioners for a Special Order to generate and supply electricity in the borough and rural district of EAST RETFORD. Objections to the Secretary, Electricity Commission, Whitehall, London, by November 5th.

WOLVERHAMPTON Corporation is applying for an Electricity Special Order extending the Corporation's area for electricity supply to certain parishes in the Cannock and Seisdon Rural districts. Objections to Secretary, Electricity Commission, Whitehall, London, by October 30th.

The Western Electric Distributing Corporation has applied to the Electricity Commissioners for a Special Order to supply electricity in so much of the borough of ANDOVER and the rural district of Andover as lies within a circle at a radius of two miles from a point on Millway Road, equidistant between Weyhill Road and Salisbury Road. Objections to the Secretary, Electricity Commission, Whitehall, London, S.W., by November 5th.

North Wales Joint Authority.

The Electricity Commissioners have convened the first meeting of the NORTH WALES AND SOUTH CHESHIRE JOINT ELECTRICITY AUTHORITY for to-day (Friday), at 2.30 p.m., in the Council Chamber, Town Hall, Llandudno. Sir Harry Haward will preside during the initial proceedings until a chairman has been appointed by the Joint Authority.

Forty Years Ago.

"The Electrician," October 13th, 1883.

THE TELEPHONE AT WINDSOR.—H.R.H. Princess Christian has had a telephone line put up to connect her residence, Cumberland Lodge, with the fire station at Windsor. The line is a little more than four miles long, and is intended only for fire alarm purposes, we believe.

* * *

OVERHEAD WIRES IN LONDON.—It is stated on good authority that about 1 400 wires cross Leadenhall Street, which is situate in the busiest part of the city. What this number will have increased to by this time next year we cannot foretell, but there will not be much of the azure sky left to gladden the vision of Leadenhall Street soon.

* * *

THE FORTH BRIDGE.—This bridge is to be lighted by electricity. The work has been placed in the hands of Messrs. Crompton and Co., who will furnish the requisite machinery to supply 11 Crompton arc lamps and 120 Swan incandescent lamps. The peculiarity of this installation is that the leads will be rather long and have to be extremely well insulated to guard against the action of water.

* * *

TESTING ELECTRIC LAMPS.—Efforts are being made to obtain independent and accurate tests of the electric lamps exhibited at the Chicago Railway Exhibition. A committee has been appointed, with Dr. Henry Morton at its head, and premises taken in Chicago in which to carry out the tests. It only remains for the electric light companies concerned to subscribe their respective shares of the costs of carrying out the tests for the committee to get to work.

Personal Items.

Mr. F. J. GORDON, of Fuller's United Electric Works, is making an extensive tour throughout Canada.

Morecambe Town Council has increased the salary of Mr. J. BOYCE, the electrical engineer, by £50 per annum.

Mr. JOHNSTONE WRIGHT, the city electrical engineer of Belfast, has had his salary increased from £1 400 to £1 750 per annum.

Mr. ROBERT EDWARD SHOTT has been appointed secretary of the Victoria Falls and Transvaal Power Co., in succession to the late Mr. Alfred Wilson Bird.

Ilford Urban Council has decided that in future Mr. G. T. GREGORY, chief technical assistant at the electricity works, shall be known as the deputy electrical engineer.

Southampton Town Council has appointed Mr. P. J. BAKER, who has been acting as manager, as manager and engineer of the tramway undertaking at a salary of £700 per annum.

Manchester Electricity Committee has regretfully accepted the resignation of Mr. F. E. HUGHES from his position as secretary of the Electricity Department as from December 31st next.

Capt. R. C. PETTER and Mr. R. J. NORTON, who have for many years been associated with Petters, Ltd., Yeovil, as London manager and commercial manager respectively, have been appointed to seats on the board of directors.

Relinquishing his position with the London, Midland and Scottish Railway as assistant electric trains engineer, Mr. R. E. DICKINSON has sailed for Australia to take up an appointment with the New South Wales Government Railways.

Mr. J. S. D. MOFFET, the late manager of the Belfast Corporation tramway undertaking, flew with his wife from Belfast to Manchester last week. As previously stated in this column, Mr. Moffet will shortly take up his duties as manager of the Salford tramways.

At last week's meeting of the Belfast Tramways Committee, the new manager, Mr. SAMUEL CARLILE, was cordially welcomed by the chairman, the Lord Mayor, and other members of the committee, who assured him of their cordial support and co-operation. The appointment of Mr. Carlile, who has been connected with the Belfast tramway undertaking for 23 years, carries an initial salary of £800 per annum, rising to £1 000.

Obituary.

Mr. W. G. F. Webster.

Mr. WALTER GEORGE FREDERICK WEBSTER, head of the firm of Webster and Son, electrical engineers, Dover Road, Folkestone, has died in the 69th year of his age. He was one of the pioneers of electricity for lighting in the town, and carried out several important private installations in East Kent.

Mr. James Batty.

The death took place on October 4th, at his residence, 40, Hibson Road, Nelson, of Mr. JAMES BATTY, aged 46, who had been in business in Burnley as an electrical engineer for 25 years. Mr. Batty, who was working until a fortnight ago, started in partnership with a Mr. Calverley, but the partnership was dissolved 14 years ago.

Mr. A. McIntosh.

The death is announced at the age of 49 years of Mr. ALEXANDER MCINTOSH, of 64, Church Street, Woking, who had for the past 23 years been on the staff of the Woking Electric Supply Co. Mr. McIntosh, who became an associate member of the Institution of Electrical Engineers in 1910, was at the time of his death superintendent of the mains and meters department.

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Legal Intelligence.

An Arc Welding Fatality.

Failure of Prosecution for Negligence.

At Chesterfield last Saturday W. Hollins and Co. were summoned for not taking proper precautions in connection with the repair of a steam boiler by the electric arc welding process, it being alleged that in consequence of such neglect a man named Keeling was killed by electric shock. The South Yorkshire Electric Welding Co., Mansfield, were summoned as the agents of Hollins and Co., who were the complainants in a case brought against the Welding Co. for failing to use properly constructed apparatus and to take proper precautions. The case for the Home Office, as prosecutors, was that Charles Keeling was inside a steam boiler at Pleasley Mills, repairing plates with an electric arc welding apparatus. It was contended that the pliers used were not properly insulated, and that the man was not wearing gloves, as required. After a lengthy hearing the Bench dismissed all the summonses.

Thefts of Electricity.

Tampering with Meters at Blackpool.

How electricity was wrongfully taken from a power meter and used for lighting purposes was described at Blackpool last Friday, when George Wm. Hodge, North Albert Street, was fined £5 for the offence. It appeared that last June defendant, who had a workshop with two meters, instructed the Corporation to remove the lighting meter, leaving one for power. About June he went to reside over the workshop, and the suspicions of the authorities were aroused owing to the high power consumption. Investigation revealed that five lamps for lighting purposes had been connected to the power circuit, thereby consuming a considerable amount of electricity at power rate.

The Blackpool magistrates also fined Samuel Hart 20s. for connecting an electric meter without notice. He pleaded not guilty. For the Corporation, it was stated that when the former tenant left the house the fuse from the electricity box was removed and the box sealed up. When defendant became the tenant he signed a form asking for supply on August 11th. When an employee of the electricity department called on August 10th he found the seal broken and the fuse replaced, thereby providing a supply for the house.

The defendant emphatically denied all knowledge of it, and suggested that someone else had done it.

Rent of a Telephone Installation.

Alleged Inefficiency of System.

In the Mayor's and City of London Court recently, Mr. Registrar Dell had before him a case in which the I.T.C., Ltd., claimed £6 8s. from C. Melin and Co., for the rent of a private telephone installation. For the plaintiffs it was stated that in November last the defendants forwarded a cheque for rent, and made no reference to the installation being inefficient. In May last it was alleged, however, that the instruments were defective; the defendants added that they had been unable to use the installation for over a year. The defendants' contention was that the whole system was defective; it frequently broke down. They had given six months' notice to terminate the contract, but had found that it was for 21 years. The Registrar pointed out that the defendants, in order to succeed, would have to give concrete cases of inefficiency in the service. Although the service was now complained of, he had no letters before him in which they made complaints. In all the circumstances, he must give judgment for the plaintiffs.

An Electric Fittings Contract.

Hairdresser's Disputed Account.

At Marylebone County Court on October 4th, before the Registrar (Mr. Vaughan-Roderick), Stanley Herbert King, electrician, 119, Portobello Road, Notting Hill, sued Mrs. Gill, hairdresser, of 51, Pembridge Road, Notting Hill Gate, for £2 14s., the cost of putting in plug and socket connections. For the plaintiff it was stated that plugs only were ordered, and four of these were put in each room. The defendant refused to pay the account because no switches were put in and oilcloth was damaged. The plaintiff's witness said switches were not required. The Registrar gave judgment for the plaintiff for the amount claimed with costs.

Electrical Installation at a School.

Consulting Engineers' Claim.

Mr Justice Coleridge recently gave judgment in the action brought by Handcock and Dykes, consulting engineers, of 11, Victoria Street, London, S.W., against Tate and another, in which the plaintiffs claimed to recover £141 odd against the defendants (the proprietors of a girls' school at Bushey, Hertfordshire) for professional services rendered in regard to an electrical installation. The facts of the case have been previously reported in THE ELECTRICIAN. Assuming the amount of the contract at £900, Mr. Justice Coleridge gave judgment for the plaintiffs for £67 10s., but as the defendants had paid £75 into Court he awarded them the costs up to the date of the payment into Court, but decided that the defendants should have the costs of the action after the date of the payment in. His Lordship also awarded the plaintiffs the costs of the defendants' counterclaim.

Tenders Invited.

GREAT BRITAIN.

WATFORD CORPORATION, October 15th.—Wiring 40 houses for electric light. Tender forms from the Borough Engineer.

NORTH WITCHFORD GUARDIANS.—Installation of electric bells in the Institution at Doddington. Particulars from the Master.

GRAVESEND CORPORATION, October 15th.—Two electrically driven air compressors. Specification from Mr. F. T. Grant, 4, Woodville Terrace, Gravesend.

KEIGHLEY CORPORATION, October 16th.—Supply and erection of poles for overhead h.t. line 1 200 yards in length. Specification from the Borough Electrical Engineer.

COMMISSIONERS OF H.M. WORKS, ETC., October 19th.—3 000 V three-phase motor and air compressor for the National Physical Laboratory, Teddington. Specification (deposit £1 1s.) from the Contracts Branch, Office of Works, King Charles Street, London, S.W.1.

DUNDEE CORPORATION, October 19th.—Twin and three core, l.t., lead covered, paper insulated and double steel tape armoured cable. Particulars from the General Manager and Engineer, Mr. D. H. Bishop, Dudhope Crescent Road, Dundee.

COUNTY OF LONDON ELECTRIC SUPPLY CO., October 30th.—Condenser tubes for Barking power station. Specifications from Mr. F. C. McQuown, Manager and Secretary, Moorgate Court, Moorgate Place, London, E.C.2.

STOKE-ON-TRENT CORPORATION, November 14th.—Three-phase e.h.t. and l.t. switchgear for Marsh Street transformer station. Specification (deposit £2) from the Borough Electrical Engineer, St. Peter's Chambers, Stoke-on-Trent.

ARGENTINA.

ARGENTINE STATE RAILWAYS, November 2nd.—Electrical material. Specification (15 pesos) from the offices of the Department in Buenos Aires.

AUSTRALIA.

POSTMASTER-GENERAL'S DEPT., SYDNEY, October 18th.*—Protective apparatus (Schedule 61). November 1st.*—Telephone apparatus and parts.

VICTORIAN ELECTRICITY COMMISSION. December 15th.—Four 1 000 kVA single phase transformers and spares. Specification (No. 23/145) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2. January 3rd.—Aluminium steel cored cable and accessories. Specification (No. 24/1) from the Agent-General. Charge for specifications, 10s. each, returnable.

CANADA.

TORONTO MUNICIPALITY, October 23rd.*—Horizontal centrifugal sewage pump directly connected to 220 V three-phase motor on truck, with piping, valves, etc. (Contract 55).

ITALY.

PORTO MANRIZIO AND ONEGLIA, October 31st.—Construction of electric tramway, four miles in length, between Porto Manrizio and Oneglia. Tenders to the municipality of either of those cities. The concession hitherto in existence for this work has been annulled.

NEW ZEALAND.

PUBLIC WORKS DEPT., WELLINGTON, December 4th.*—Metering equipment for Mangalas power scheme. December 11th*.—Indoor and outdoor type apparatus for Penrose (Auckland) sub-station in connection with Waikato power scheme; and transformers, also for the Waikato power scheme.

SOUTH AFRICA.

JOHANNESBURG CORPORATION, November 1st.*—H.T. switchgear cubicles.

Telegraph and Telephone Notes.

A NEW TELEPHONE EXCHANGE is to be erected at Sloane Terrace, Chelsea, London.

At a meeting of Hull Corporation Telephones Committee last week the telephone manager submitted an estimate of the cost—£33 700—of a FURTHER EXTENSION TO THE AUTOMATIC SYSTEM. It was decided to apply to the Ministry of Health for sanction to borrow this amount.

The new twin screw cable steamer "Norseman," which has been launched by John Brown and Co. for the Western Telegraph Co., is a sister ship to the "Mirror," delivered by the same builders to the Eastern Telegraph Co. in July last. The principal dimensions of the new vessel are 270 ft. 8 in. in length overall, 37 ft. 2 in. in extreme breadth, 25 ft. in moulded depth, and of 1 850 tons gross. She will have a speed of twelve knots on service. There are three cable tanks of a total capacity of 16 000 cu. ft., equivalent to about 530 miles of cable.

In the recent return by the Treasury showing the total revenue of the United Kingdom for the half-year ended September 30th, it was stated that the EARNINGS OF THE TELEGRAPH SERVICE amounted to £2 500 000, the same amount as in the corresponding half-year of 1922, and those of the telephone service to £7 100 000, an increase of £200 000. In 1912, when the Post Office took over the telephone service, there were 730 703 telephones. To-day there are 1 050 672, through which 730 000 000 local calls, it is estimated, have been made this year, and 59 500 000 trunk calls.

* Particulars from Department of Overseas Trade.

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The First World Power Conference.

A Synopsis of the Subjects for Discussion.

Almost as stupendous a work of organisation in its own way as the British Empire Exhibition, where it is to be held from June 3rd to July 12th next, the World Power Conference which meets under the presidency of the Earl of Derby will be the first of its kind, and will deal with questions of vital importance, not only to electrical, but to all kinds of engineers. A very large attendance is expected and Mr. D. N. Dunlop, of the B.E.A.M.A., who is organising director of the Conference, expects that between 150 and 200 papers will be presented and discussed. An important feature of the Conference will be the presentation by each of the countries represented of a comprehensive review of its own power resources, which should form an admirable background for the remainder of the programme.

The Classified Programme.

According to the classified programme which is now available, the Conference will have five divisions dealing with (1) power resources, (2) power production, (3) power distribution, (4) power utilisation, and (5) general matters relating to power. These divisions will be sectionalised in the following manner:—

Division I: (Section A) National Review of Power Resources.—1. General survey; 2. Investigation of national resources; 3. power resources available and utilised; 4. administration; 5. electrical power market. *Division II*: (Section B) Water Power Production; (Section C) Preparation of Fuels; (Section D) Steam Power Production; (Section E) Internal Combustion Engines; (Section F) Power from other Sources. *Division III*: (Section G) Power Transmission and Distribution. *Division IV*: (Section H) Power in Industry and Domestic Use; (Section J) Power in Electro-Chemistry and Electro-Metallurgy; (Section K) Power for Transport; (Section L) Power for Illumination. *Division V*: (Section M) Economic, Financial, and Legal; (Section N) 1, research; 2, standardisation; 3, education; 4, health; 5, publicity; 6, general.

Review of Power Resources.

The national review of power resources will comprise for each country a general survey of national power resources, developed and undeveloped, including (*a*) Water power, fuel power, transportation, etc.; present practice and future developments; (*b*) Short historical review of development; (*c*) Attitude of governments towards development, short summary of legislation; (*d*) Financial policy regarding state and private ownership; (*e*) State encouragement in the development of cheap power.

The functions and scope of national and local organisations for collecting data regarding national power resources will be discussed and the power resources available and utilised will receive detailed treatment.

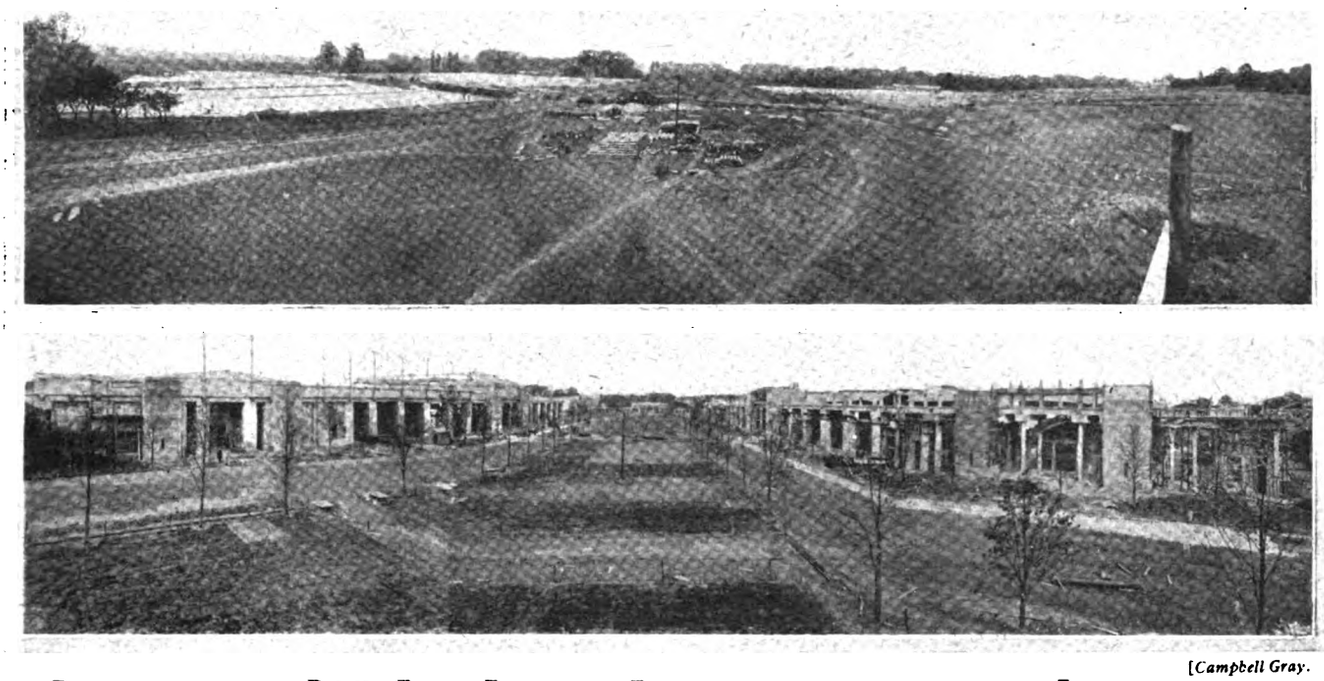
An interesting feature in Division I will be the discussions on the electrical power market in central station activities, industry generally, electro-chemistry and electro-metallurgy, pulp and paper industry, and railway electrification.

Division II will deal with power production on similarly thorough lines, the main subjects comprising water power production preparation of fuels, steam power production, internal combustion engines, and power from other sources.

Transmission and Distribution.

Power transmission and distribution in Division III will be subdivided as follows:—1. A.C. transmission and distribution: (*a*) A.C. generators and motors; (*b*) A.C. transformers; (*c*) A.C. switchgear; (*d*) super power stations—present and future; (*e*) transmission lines and systems, with special reference to line design, transforming, and regulating equipment; (*f*) local distribution systems, design, and operation; (*g*) standardisation of voltages and frequencies; (*h*) underground cables for high voltage; (*i*) submarine cables for power transmission. 2. High voltage direct current, generation, transmission, and distribution. 3. Low voltage distribution and electrical storage. 4. Power transmission and distribution by means of gas. 5. Mechanical transmission of power.

With the utilisation of power as its main theme, Division IV will discuss power in industry and domestic use. Section K will tackle the question of power for transport by land, water and air, and Section L power for illumination, with special reference to electric power, and recent developments in electric lamps.



[*Campbell Gray.*

PREPARATIONS FOR THE BRITISH EMPIRE EXHIBITION. THE TOP PICTURE SHOWS THE SITE EARLY THIS YEAR, AND THE ILLUSTRATION BELOW GIVES AN IDEA OF THE RAPID PROGRESS THAT HAS SINCE BEEN MADE.

Great Britain's Contribution.

Among the papers arranged to date by the British National Committee, of which Mr. B. Longbottom is the chairman, are:—"The Coal Resources of the World," Sir Richard Redmayne; "National Review of Water Power in Great Britain and Ireland," Prof. A. H. Gibson; "Problems relating to Run-off, Storage, and the Allocation of Catchment Areas in Great Britain and Ireland," W. J. E. Binnie; "Points affecting economy in general layout and design," C. M. Norrie and W. H. Munro; "The Scope of Development to meet progressive demands," E. C. Bergstrom; "Steam Generation," Sir James Kemnal; "Steam Turbines," Sir Charles Parsons; "Internal Combustion Engines," James Richardson; "The Transmission and Distribution of Electrical Energy," C. H. Merz; "Large Generators," A. B. Field; "High Voltage D.C. Generation and Distribution of Electrical Energy," J. S. Highfield; "Mechanical and Hydraulic Variable Transmission of Power," Dr. H. S. Hele-Shaw; "The Application of Electrical Energy," Sir Alexander Kennedy; "Application of Power to Rail Transport," Roger T. Smith and C. B. Collett; "Application of Power to Road Transport," Col. R. E. Crompton; "Illumination," C. W. Sully; "The Financial Aspect of Hydro-electric development," George Balfour, M.P.; "International Standardisation," C. le Maistre; "The Education of the Apprentice," Prof. A. P. Lawrie, and Prof. F. G. Baily; "The Education and Training of the Engineer of the Future," A. P. M. Fleming; "The importance of greater public interest in mechanical progress," T. C. Elder; "Co-operative Publicity in the Public Supply of Electricity," J. W. Beauchamp; and "The Study of the Human Element in Production," D. R. Wilson.

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Electric Traction.

Tramway Extensions and Developments.

LIVERPOOL Tramways Committee is said to be considering the introduction of lighter and faster tramcars, and of railless trolley 'buses.

MANCHESTER Tramways Committee is seeking Parliamentary powers for the operation of trackless trolley vehicles along routes where tramways have already been authorised but not constructed.

PAISLEY tramway tracks are being altered to meet the requirements of the Glasgow Tramways Committee. Portions of the route passing under bridges are being lowered to permit the passage of covered-top trams.

BIRMINGHAM Tramways Committee intends to apply for sanction to continue the Alum Rock section along Alum Rock Road and Burney Lane into Stechford, a distance of nearly three miles. The immediate extension proposed is one of about a mile.

Fares, Receipts and Passengers.

GLASGOW Tramways Committee recommends that the existing tramcar fares and stages should be made applicable to the Subway Railway.

Traffic receipts on the MERSEY RAILWAY during the week ended September 29th totalled £4 101, bringing the year's total to date up to £175 408.

Said to be the cheapest in the country, the maximum fare on LIVERPOOL tramways will shortly be 2d. This will enable a passenger to ride 6½ miles for that amount.

During the fortnight ended September 30th the traffic receipts on the MADRAS electric tramways totalled Rs.49 661, an increase of 12·4 per cent. on the corresponding period last year.

Consideration of a proposal for the issue of season tickets on certain routes as an experiment for six months has been delayed for a further two months by EDINBURGH Tramways Committee.

Traffic receipts on LONDON tramways controlled by the Underground Group during the week ended September 29th totalled £39 618, a decrease of £5 942 on the corresponding week last year.

The revised scheme of tramway stages which has been prepared by the MANCHESTER Tramways Committee following the adoption of the idea of a "central area" stage has been referred back for further consideration.

Official returns of 34 of the PRINCIPAL TRAMWAY UNDERTAKINGS in the United Kingdom, as published by "The Tramway and Railway World" for the week ended September 22nd, give total receipts of £340 419, or £19 691 less than in the corresponding week of last year.

Proposed Electric Railway for Manchester.

In view of the Prime Minister's statement that he will be prepared to consider schemes for providing employment, it has been decided to submit a scheme for the proposed MANCHESTER AND DISTRICT ELECTRIC RAILWAY for the consideration of the Government. The complete scheme provides for 32 miles of railway, of which about eight miles will be underground. The plans have been in preparation for a considerable time. For the present it is proposed to limit the application for assistance to the cost of the central underground sections, eight miles in length, plus about four miles of surface railway. It is estimated that the cost of this twelve miles of double line, inclusive of the electric equipment, stations, lifts and rolling stock, will be £2 500 000.

Miscellaneous Traction News.

Free tramway transit for the blind is proposed at CROYDON.

EDINBURGH Tramways Committee is sending a deputation, consisting of Councillors Mancor and Lamb, and Mr. R. Stuart Pilcher, tramways manager, to inspect the cement tramway track in use in Sheffield, Birmingham and Leeds.

Although it was urged by a deputation that the contract be kept in EDINBURGH, the Tramways Committee has accepted the tender of the Bristol Wagon and Carriage Works Co. for eight tramcar bodies, after having ascertained that the company is paying the standard rate of wages.

Miscellaneous.

In connection with the Redding pit disaster it is stated that the EXISTENCE OF ELECTRICAL APPLIANCES rendered possible rescue work which could not otherwise have been undertaken.

Speaking at the Conference of the British Commercial Gas Association at Birmingham last week, Mr. A. W. Smith, general manager of the Birmingham Gas Department, said ELECTRICITY FOR POWER had, of course, come to stay, and in fact it was adopted in most up-to-date gasworks.

The re-wiring for electric lighting purposes of the Admiralty, Home Office, and Privy Council offices on Monday produced a STRIKE OF ABOUT 180 ELECTRICIANS, who objected to the employment of boy labour under conditions which, they alleged, were opposed to trade union rules. A meeting between trade union officials and the contractor was held, when terms of a settlement were discussed.

The General Electric Co. was awarded 1st prize in the CARDIFF TRADE PAGEANT for a tableau on a vehicle, and also received a 3rd prize for a display of goods and advertisements on a heavy motor vehicle. Among the competitors in the Window Display Competitions were Cross Brothers, electric light contractors, Cardiff Electric and Wireless Supply, Ltd., Radio Accessories Co., and Lawrence Brothers, electric light contractors.

Wireless News.

B.B.C. Membership Open to Dealers.

At an extraordinary general meeting of the British Broadcasting Co. on Tuesday, the terms of the agreement arrived at between the Postmaster-General and the company were unanimously approved.

Lord Gainford, who presided, said the Postmaster-General desired that membership in the Company should be extended to dealers and this was recommended, provided dealers signed an agreement that so far as the broadcasting scheme was concerned they would handle only British-made goods. At a later stage a resolution was passed admitting dealers to membership of the company.

Dealing with the growth of broadcasting, Lord Gainford pointed out that in nine months, starting from nothing at all, a regular service had been conducted in six broadcasting stations every night of the week. The company had been and still was being boycotted by various organisations who imagined that its activities would be prejudicial to theirs, though it had shown every desire to work in amicable co-operation with them. The B.B.C. trade mark has been pirated abroad, and, it was feared, also at home. More definite steps were now being taken to protect it. He was informed that up to last Saturday 32,000 constructors' licences had been applied for. The returns were not then complete so the total number would be much greater. A proposal for issuing a 5s. licence for school children would be considered, but they were limited for the moment by the agreement made.

Retailers' Associations on the Report.

The Wireless Retailers' Association and the Wireless Committee of the Electrical Importers' and Traders' Association have both issued statements strongly approving the Report of the Broadcasting Committee, but disapproving the failure of the Postmaster-General "to give effect to the essential recommendations of the Committee." Both bodies deplore the continuance of the royalty system and protest against the use of the powers of a single Government Department to place a veto on imports without the consent of Parliament.

Traders and the New Regulations.

A representative of THE ELECTRICIAN, who invited the opinions of retailers of imported wireless apparatus regarding the new regulations, gathered that few of them were at all alarmed at the implied ban on foreign component parts. In fact, one retailer who deals mainly in imported goods, declared that the new regulations would tend to help his business, for with the knowledge that a constructor's licence could be obtained the public would not now hesitate to buy parts, which need not have the B.B.C. stamp. Another importer pointed out that the Customs were still allowing the importation of foreign-made parts, and he failed to see how any promise made by the Postmaster-General could prevent him or any other dealer from selling them. In this connection an official of the Post Office is understood to have agreed that dealers in imported apparatus were beyond their scope, but he pointed out that the Postmaster-General could take action under the Wireless Telegraph Act against users of apparatus who had evaded their obligations.

Other Views on the New Scheme.

There seems to be a general agreement among wireless users that the compromise announced by the Postmaster-General last week meets the case very fairly until the expiry of the agreement between the Government and the B.B.C. Many manufacturers, however, regret that it is not possible to give legislative effect to the prohibition of the use of foreign component parts. Some declare, in fact, that the market can still be flooded with cheap foreign parts. Others take the more optimistic view that people are beginning to realise that it is to their advantage to buy well-made parts.

Hull Electricity Workers.

Trade Union Complaint of Victimisation Not Supported.

Having received from time to time complaints of tyrannical conduct to which, it was alleged, the workers had been subjected at the hands of officials of the Hull Corporation Electricity Department, the Electricity Committee last week invited Mr. Ward, of the Electrical Trades' Union, to state the case of the men.

The chairman said the men at the Sculcoates Lane works complained that they were being continually harassed by Major Herbert Bell, the city electrical engineer, and allegations of victimisation and tyranny were made. As far back as June 26th he asked Mr. Ward, as representing the men, to bring forward specific charges, and promised that if charges were proved the officials concerned would be dealt with. The chairman added that during the last two years there had been a reduction in the number of men employed at the works, and consequently those kept on had been called upon to do a full day's work. This might have had something to do with the complaints.

Mr. Ward, who said he had been asked by his branch to bring the matter to the attention of the Electricity Committee, said he could not make any specific charges. He had only general statements to offer, and would not give the names of complainants. On being requested to tell members of his union that they must make specific charges, Mr. Ward intimated that he had nothing further to say on the matter.

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Companies' Reports, Dividends, etc.

. Traction and Power Securities Co.—Ordinary shareholders have received an interim dividend of 3s. 6d. per share, free of tax.

Ferranti, Ltd.—The net profit for the year to June 30th last was £36 362, plus £24 482 brought in, making £60 844, less transferred to general reserve (making that fund £90 000) £20 101, leaving £49 682. The directors recommend a dividend of 10 per cent., free of tax, on the ordinary shares, carrying forward £25 162.

Siemen's Brothers and Co.—The directors have issued a circular in which they state that the company has received communications from several shareholders referring to a circular issued by the New Trust, Limited. The company has no knowledge of the New Trust, nor does the name appear on its share register. The business, it is added, is steadily recovering from the general industrial depression, and the improvement mentioned by the chairman at the general meeting in May last has since been well maintained.

Hurst, Nelson and Co.—A net profit of £62 229, against £82 680 for the preceding year, is reported for the year ended July 14th last. With £18 187 brought forward, there is a total of £80 416, which the directors propose to apportion as follows:—Dividend on the preference shares, £12 000, payable in two equal instalments on November 10th and May 15th next; to general reserve, £10 000 (against £20 000), raising this reserve to £100 000; dividend on the ordinary shares at the rate of 2s. per share, free of tax (the same); bonus on the ordinary shares at the rate of 1s. per share, free of tax (the same); and reserve for payment of an interim dividend, free of tax, on May 15th next, on the ordinary shares, £10 000 (the same); leaving a balance of £18 416 to be carried forward.

Supply and Lighting.

Western Electric Distributing Corporation.—A final dividend at the rate of 10 per cent. per annum has been declared on the ordinary shares.

Isle of Wight Electric Light and Power Co.—The year's working resulted in a profit of £29 422, making available, after providing for interest, preference dividend, depreciation, etc., and including £583 brought forward, £11 005. After payment of the dividend of 3 per cent., tax free, on the ordinary shares, announced in our previous issue, and the placing of £3 500 to reserve, there remains to carry forward £339.

Victoria Falls and Transport Power Co.—An increase of £34 670 on the previous year is shown in the net profit, which totals £207 596 for the past year. The profit is arrived at after providing for interest on debentures, and £380 046 for depreciation, income tax, etc. Including £90 408 brought forward, there is a disposable surplus of £298 004. The directors have declared a dividend of 8 per cent., less tax, on the ordinary shares for the year, as against 5 per cent. for 1921, and a further and final dividend of 4 per cent., less tax, on the preference shares, making 10 per cent., leaving a balance of £91 546 to be carried forward. The annual meeting will be held at Winchester House, London, E.C., on October 18th, at noon.

Cable, Telegraph and Telephone Companies.

Bell Telephone of Canada.—Announcement is made of the declaration of a quarterly dividend of 2 per cent., payable on October 15th.

Eastern Telegraph Co.—The directors announce the payment by warrant on November 1st next of interest for the half-year ending October 31st on the company's 4 per cent. mortgage debenture stock.

New Issue Success.

Lancashire Electric Light and Power Co.—Subscription lists for the issue, last week, of preference and ordinary shares, were closed on the opening morning, but applications received by first post the following day from debenture and share holders and from the country were considered. It is understood that the allotment to the public of either class of share will be very small, owing to the large response by existing shareholders.

New Issue.

East African Power and Lighting Co.—An offer was made during the week of 200 000 ordinary shares of 20 Kenya shillings each at £1. The company, it will be recollected, was formed in January, 1922, to acquire the Nairobi Electric Co. and the Mombasa Electric Co., the total purchase price being £160 000. For last year a dividend of 8 per cent. was paid, and for the first half of this year shareholders received an interim dividend at the rate of 5 per cent. per annum. The proceeds of the issue will be applied to redeeming the whole of the outstanding debentures, which amount to £100 000, and in payment for the buildings and additional plant contracted to be purchased. The local board in London consists of Mr. J. G. B. Stone (chairman), Mr. K. A. Scott Moncrieff, and Sir T. O. Callender.

New Companies.

Peranne and Co., Ltd.—Private. Cap., £2 500 in £1 shares. Electrical engineers. Solicitor: A. T. Lewthwaite, 3, Duncan Street, Islington, London, N.1.

H. B. (Engineers), Ltd.—Private. Cap. £250 in £1 shares. Radio and electrical engineers. Reg. office: 6, The Parade, Aldersbrook Road, London, E.12.

Colello, Ltd.—Private. Cap., £500 in £1 shares. Manufacturers of and dealers in electric fittings, etc. Reg. office: 167, Clarendon Road, Notting Hill, London, W.11.

Wilson, Feather and Co., Ltd.—Private. Cap., £12 500 in 2 500 7 per cent. cumulative preference and 10 000 ordinary shares of £1 each. Electrical engineers, etc. Reg. office: 50, Wellington Street, Glasgow.

Bagenalstown Electric Lighting and Power Co., Ltd.—Private (registered in Dublin). Cap., £4 000 in £1 shares. To instal electric lighting and power in Bagenalstown. Reg. office: Church Street, Bagenalstown, Co. Carlow, Ireland.

Business Items.

Mr. Alexander Brewster, for 18 years with Lockheart and Macnab, has commenced business as an electrical engineer at 6, Baker Street, Stirling.

Hill, Upton and Co., electrical engineers, George Street, Oxford, were highly commended for a window in the "Things to Use" section during Oxford shopping week.

Switchgear and Cowans, Ltd., Old Trafford, Manchester, announce the alteration of their telephone number from Trafford Park 597 to Trafford Park 1107 and 1108.

C. A. Vandervell and Co. announce a further reduction in the prices of their batteries for Ford cars, the standard model being reduced from £4 10s. to £3 10s., and the model *de luxe* from £4 18s. 6d. to £4 5s.

Carron Company, Falkirk, point out, in connection with a reference in a recent issue to their electric fires, that they make these fires not only in cast iron, but also in sheet iron, brass, copper, and other materials.

Baughan and Co., electrical engineers, Duke Street, Reading, have adopted the weekly contributory scheme to the Royal Berkshire Hospital. The principals of the firm have guaranteed to subscribe to the hospital general fund an annual sum of not less than the total subscriptions of the employees.

Mr. J. Gledson, of J. Gledson and Co., manufacturers' agents and wholesale factors of electrical material, 48, Blackett Street, Newcastle-upon-Tyne, announces that he is to-day (Friday) taking into partnership his son, Mr. W. R. Gledson, and Mr. George Summerson Killey, who has been with the firm for the past 14 years. No alteration in the style of the firm will be made, but additional premises have been taken at No. 26, Eldon Square, adjoining the present building.

After Business Hours.

Rawcester Athletic Association's Tennis Tournament.

The members of the Rawcester Athletic Association (Rawlings Brothers, Ltd., London) met the president, Mr. W. R. Rawlings, on their private tennis ground adjoining Southfields Station recently, when the winners of a "sealed handicap" which had been played throughout the season were declared. Miss Grace Kathleen Kirkham and Mr. Harry Kirkham, both of Wimbledon Park, were the winners of the Ladies and Gentlemen's Competition respectively, and the president bestowed on the winners a badge surmounted in gold with the monogram of the club, and in addition he gave them a racquet and blazer which had been given by the president and chairman of the club. The eight runners-up of the sealed handicap then played a knock-out tournament, the winners of which were Miss Dorothy Campbell and Mr. W. R. Rawlings.

Siemens' Concert and Prize Distribution.

Members of Siemens' Sports Club attended a concert and prize distribution at Woolwich Town Hall on Wednesday last week. The prizes were distributed by Gen. Sir Hubert Gough, the winners of the inter-departmental challenge trophies being:—Cricket: Apparatus Department (Ground Floor)—E. S. Llewellin (Capt.), A. P. Berg, H. J. Burt, F. G. Dean, H. Everson, J. B. McDonald, C. W. Nearn, J. Price, A. H. Rudkin, S. C. Smith, F. Tull, J. H. Underhill. Tennis: Commercial and General Offices—F. J. Foster, T. H. Austin, H. Brown, C. F. Edwin, F. J. Peschek, R. Skinner, L. S. Stapley. Bowls: Apparatus Department (Ground Floor)—G. Wood (Skip), F. W. Andrews, J. F. Edwards, A. Padgen, C. Watson. Swimming: Apparatus Department (3rd and 4th Floors)—F. O. Heard, A. Robins, A. E. Williams. Sports: Apparatus Department (Ground Floor)

Prizes for individual championships were awarded as follows:—Bowls: 1st, G. Wood (Apparatus Department); 2nd, R. H. Eady (Apparatus Department). Swimming (Ladies): 1st, C. Robins (Commercial and General Offices); 2nd, D. Cranham (Commercial and General Offices); 3rd, D. Hayes (Lead Cable Department). Swimming (Men): 1st, A. Robins (Apparatus Department); 2nd, W. Burr (Commercial and General Offices); 3rd, W. Waring (Joint Box and Fitters' Department). Athletics: W. Lindop (Apparatus Department).. Tennis (Mixed Doubles): Miss W. G. Dyer and Mr. C. F. Edwin (Commercial and General Offices). Swimming Gala Prizes: *Event* 1—1st, G. Auger; 2nd, V. Philpot; 3rd, J. Perry. *Event* 2—1st, R. Budgen; 2nd, K. Waterfield; 3rd, K. Budgen. *Event* 3—1st, W. Saunders; 2nd, E. Llewellin; 3rd, W. Chenery. *Event* 12—1st, A. Rivett; 2nd, L. Bird; 3rd, L. Bateman. *Event* 17—1st, A. Rivett; 2nd, L. Bird. *Event* 19—1st, F. Waite; 2nd, E. Llewellin. Swimming Splash Night Prizes: W. Saunders, W. Waring, H. Budd, R. Searle, J. Wood, D. Cranham, D. Hayes, N. Warrener.

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Electrical Exhibition at Lincoln.

Increasing the Domestic Demand.

It would be hard to find a better advocate of the extension of the use of electricity in the home than Mrs. Susie E. Hammer, of Hackney, whose article on this subject in our Autumn Trade Promotion Number is fresh in the mind. It is interesting to learn, therefore, that the Lincoln Electricity Committee has been able to secure her services as lecturer at its exhibition of domestic electrical appliances, which opened last week. Among the exhibitors are Carron Company, who show electric cookers in use, together with grillers, electric glue pots and a wide range of stoves, and the Hotpoint Electric Appliance Co., whose display includes cookers, washing machines, kettles, toasters, teapots and vacuum cleaners. A variety of cooking and heating appliances is exhibited by the British Electric Transformer Co., while other notable exhibits are supplied by the East Midland Engineering Co., C. A. Howard, W. Gregory and Son, R. C. Roe, A. Scott, General Electric Stores, Ltd., and the Jackson Electric Stove Co.

Institution Notes.

The recent postcard vote taken among the members having addresses in the London district shows that the majority of those who voted were in favour of 6 p.m. for the ordinary meetings of the INSTITUTION OF ELECTRICAL ENGINEERS, and it has accordingly been decided to continue to meet at 6 p.m. (Light refreshments at 5.30 p.m.)

In the programme of E.D.A. Salesmanship Conferences already issued the London meeting for April 11th next was left blank. It has now been decided that the subject will be "Selling Electric Power," by Mr. W. Y. A. Anderson, of the Birmingham Electricity Supply Department. Mr. B. Longbottom, of Electro-Motors, Ltd., will preside.

The annual dinner of the BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION will be held at the Connaught Rooms, Great Queen Street, on Thursday, November 15th, at 7.30 p.m. The President, the Earl of Derby, will be in the chair and, as already announced in THE ELECTRICIAN, the Prince of Wales is to be present.

Following a meeting of the council at 6 p.m., the annual general meeting of the FINSBURY TECHNICAL COLLEGE OLD STUDENTS' ASSOCIATION will be held at the Finsbury Technical College to-night (Friday) at 7 p.m. The accounts for 1922 show that, after including a balance of £31 from 1921, the income from subscriptions, sales of tickets, etc., was £207, against expenditure totalling £152. The Association holds War Stock valued at £32 and cash at bank and in hand amounts to £66. It has been decided to hold the twelfth annual dinner at the Engineers' Club, Coventry Street, London, on Saturday, November 10th, at 7 p.m., when the chair will be taken by the President, Mr. W. M. Mordey. Tickets, priced 10s. 6d., may be obtained from the hon. secretary, Mr. H. P. Guy, 74, Silver Street, Edmonton.

Glasgow Corporation Electricity Department.

Engineering Society's Inaugural Meeting.

The Glasgow Corporation Electricity Department Engineering Society opened its new session on Monday, October 1st, when Mr. R. B. MITCHELL, President of the Society, and engineer and manager of the Department, delivered his annual address. Mr. H. M. Stronach presided, and there was a good attendance of members.

Mr. Mitchell reviewed the progress of the Department from the outbreak of war until the present year, and gave some interesting figures to show the influence of certain events on the output and load of the Department. He also gave some results of the operation of the Dalmarnock plant, and outlined the scheme for the further extensions which are about to be proceeded with.

Electro-Harmonic Society.

Thirty-Eighth Season's First Smoking Concert.

As announced in a previous issue the Electro-Harmonic Society's first smoking concert of the season will be held in the Caxton Hall, Westminster, to-night (Friday), at 8 p.m., with Maj.-Gen. Sir Philip Nash, chairman of the Metropolitan-Vickers Electrical Co., in the chair. The artistes include Miss Marion Browne (soprano), Miss Marjorie Booth (contralto), Mr. Ivon Walters (tenor), Mr. Edern Jones (baritone), Miss Josephine la Barte (songs and impressions), Mr. William Primrose (violinist), Mr. Rex Harold (entertainer), Mr. Bernard Flanders (solo pianoforte and accompanist).

An Electrically-Illuminated Marine Sign.

Interesting Advertising Development.

The electrically-illuminated advertising sign is a familiar sight on land, but British enterprise has now succeeded in putting it on the sea. A steam drifter has been utilised to carry the first marine sign, to advertise a brand of tobacco at seaside resorts. The letters of the sign are 10 feet high. Special weather-proof screw socket 20 W lamps are used and energy is supplied by a 12 kW generating set. Mr. Newton May, of May's Advertising Agency, is responsible for originating and carrying through the enterprise, and the electrical equipment was supplied by Duncan Watson & Co.

Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

ALPHA MANUFACTURING CO., 26, High Road, Balham, electrical engineers. £17 12s. 2d. September 6th.

ANSTING AND CO., 63, Mysore Road, Lavender Hill, electrical engineers. £14 16s. 11d. August 29th.

BELDON, G., AND CO., 7, Lampton Road, Hounslow, electrical engineers. £44 8s. 5d. August 29th.

DAVIES, Mr. W. H., trading as CENTRAL ELECTRICAL ENGINEERING CO., 52, Great Queen Street, W.C., dealer. £17 8s. 7d. August 29th.

HARRISON, Mr. J. R., 11, King's Walk, Nottingham, electric globe specialist. £19 17s. 2d. September 4th.

MITCHELLS ELECTRICAL AND WIRELESS, LTD., 188, Rye Lane, Peckham, manufacturers. £10 12s. 4d. August 20th.

NOBLE, James, trading as EMPIRE RADIO SUPPLY CO., 324, High Street West, Sunderland. £14 19s. 6d. August 14th.

SELECTRA RADIO PRODUCTS, 26, Ebury Street, Victoria, S.W., electricians. £13 17s. 6d. August 30th.

Receivership.

NEAL (GEORGE H.) AND CO., LTD.—F. Wilcock, of 1, Great Winchester Street, E.C., was appointed receiver on September 28th. 1923, under powers contained in debentures dated February 22nd, 1923.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

MORGAN AND TAYLORS RADIO ELECTRIC, LTD., 122, Wellington Street, Cardiff. Creditors were called together recently when a statement of affairs was presented which showed liabilities of £4 046, made up as follows: unsecured creditors, £2 979; bankers, £967; and cash creditor, £100. The assets were estimated to realise £2 750. It was reported that the meeting had been called in consequence of two trade creditors commencing proceedings. The directors felt that it was only fair to put the company's position before the creditors to see if some arrangement could be entered into. The company was registered in July, 1922, with a nominal capital of £1 000, in £1 shares. The issued capital was £703, of which £403 had been issued for cash. Between July 13th, 1922, and July 31st last, when a balance sheet and profit and loss account was prepared, there was a turnover of approximately £8 000, and after allowing all the expenses there was a net loss of £[illegible]. The loss was due to the fact that the wages, salaries and travelling expenses had been very heavy. It was stated that one of the directors offered to purchase the claims of the creditors against the company for 5s. in the £, payable in cash. It was decided that this offer was inadequate, but that seven days should be given within which to allow of an offer of not less than 10s. in the £ being submitted, payable and secured to the satisfaction of the five principal creditors. The opinion was also expressed that failing such an offer being forthcoming the company should go into voluntary liquidation and appoint Mr. S. E. Clutterbuck (Clarke, Dovey and Co.), as liquidator. The following are creditors:—Auckland, G. Z., and Son, £250; British Thomson-Houston Co., Ltd., £80; Concordia Electric Wire Co., Ltd., £69; Clarke and Co., Ltd., Manchester, £64; Edison and Swan Electric Co., £184; Engineering Equipment Co. (1919), Ltd., £87; General Electric Co., Ltd., £30; India Rubber, Gutta Percha and Telegraph Co., Ltd., £376; Igranic Electric Co., Ltd., £60; Metropolitan-Vickers Electric Co., £58; McMichael, Ltd., £200; Siemens Bros., and Co., Ltd., £165; Sterling Telephone Co., Ltd., £87; Siemens and English Elect Lamp Co., £58; Western Electric Co., £845.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Companies Winding-Up Voluntarily.

SCOTT (JAMES), LTD. W. R. MacGregor, 5, Fenwick Street, Liverpool, chartered accountant, appointed liquidator.

YERA ELECTRICAL, LTD. Captain Montague Evans, M.C., F.S.I., F.A.I., 2, Melbourne Place, W.C.2, appointed liquidator.

Bankruptcy Information.

WHITELOCK, Ernest William James, 4, Leagrave Road, and 7, Cheapside, Luton, electrical engineer. Receiving order, October 2nd. Debtor's petition.

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Reference Index to Recent Wireless Publications.

R.000. RADIO COMMUNICATION (GENERAL)

Long-distance Wireless (*Electrical Times*, 63, p. 350, April 5th, 1923). R.000.
Decimal Classification of Radio Subjects (*Journal of American Institute of Electrical Engineers*, 42, p. 617, June, 1923). R.030.
E. Branly. Wireless Telegraphy (*Annales des Postes Télégraphes et Téléphones*, 12, p. 415, March, 1923). (Book review.) R.050.
C. Toohe. Radiotelephony (*Annales des Postes Télégraphes et Téléphones*, 12, p. 415, March, 1923). (Book review.) R.050.
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Zones of silence in Radiotelephony (*Annales des Postes Télégraphes et Téléphones*, 12, pp. 742–743, June, 1923; *Telegraph and Telephone Age*, February, 1923). R.113.
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R.600. RADIO STATIONS (DESCRIPTIONS AND EQUIPMENT.)

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G. V. Haskell. Summer Time and Radio (*Scientific American*, 129, pp. 90–91, August, 1923). R.900.
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A system of transmitting colours by wireless or wire telegraphy (*L'Electricien*, 54, p. 260, June 1st, 1923). R.900.
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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

202 228 H. E. OSBORN. Manufacture of electric incandescent lamps and thermionic valves. (29/1/23.)
193 473 PHILIPS' GLOEILAMPENFABRIEKEN. Electric lamps. (17/2/22.)
196 285 METROPOLITAN-VICKERS ELECTRICAL CO. Electric welding. (11/4/22.)
202 241 IGRANIC ELECTRIC CO. (CUTLER-HAMMER MANUFACTURING CO.). Regulation of electric circuits. (2/5/22.) (Divided Application on 199 887.)
196 631 E. MOMMSEN, (legal representative of T. L. CARBONE, deceased). Flame arc lamp with an enclosed arc. (24/4/22.)
199 042 AUTOMATIC TELEPHONE MANUFACTURING CO. Telephone systems. (14/5/21.) (Divided Application on 179 030.)
202 122 L. J. LEPINE. Switch boxes connected with electric cables. (10/2/22.)
202 347 A. J. H. ELVERSON. Electric contact-breakers. (17/3/22.)
202 351 V. R. NICHOLSON. Electrically-driven lathes. (27/1/23.)
202 354 O. ZINKE. Apparatus for use in recording telephonic conversation. (8/4/22.)
178 451 M. MORRISON. Rectifiers for electric currents. (12/4/21.)
202 384 R. C. KAY. Portable electric lamps. (15/5/22.) (Cognate Application, 17035/22.)
202 389 J. F. PERRY, A. STUBBS, and METROPOLITAN-VICKERS ELECTRICAL CO. Electrically operated mining plant. (16/5/22.) (Addition to 197 783.)
202 398 EVERSHED AND VIGNOLES and G. B. ROLFE. Electrical testing-instrument. (17/5/22.)
202 403 SIEMENS BROS. AND CO., LTD., E. A. PETITHORY, and J. E. COLLYER. Selecting devices for telephone systems. (18/5/22.)
202 408 E. SCHATTNER. Electric starting switches. (18/5/22.)
202 416 V.L. OIL PROCESSES, LTD., O. D. LUCAS, and F. G. L. JOHNSON. Electric primers and vent sealing tubes. (19/5/22.)
202 418 BRITISH THOMSON-HOUSTON CO., and A. P. YOUNG. Sound emitting apparatus and other electrical apparatus. (20/5/22). (Cognate Application, 1856/23.)
202 425 T. G. ANDERSON and G. H. HUNTSWORTH. Telephone circuits. (23/5/22.)
202 427 CREED AND CO. and F. G. CREED. Electromagnetically controlled switching apparatus. (23/5/22.)
180 682 P. IBACH. Control of electric motors, driving pumps, and compressors. (25/5/21.)
180 685 G. WEISSMANN. Electric batteries. (25/5/21.)
202 438 H. L. THOMAS. Multi-layer electric inductance coils. (27/5/22.)
183 436 WESTERN ELECTRIC CO. Automatic telephone switches. (21/7/21.)
202 469 G. MARR. Construction of electric switch. (29/6/22.)
186 036 AKT.-GES BROWN, BOVERI ET CIE. Apparatus for effecting repeated closings of automatic electric switches. (10/9/21.)
183 845 H. C. E. BOUTARD. Induction motors. (29/7/21.)
202 509 R. H. BARBOUR and J. M. L. SLATER. Electric motor control systems. (4/8/22.)
184 816 MEGUIN AKT.-GES, and J. H. LEOPOLD. Combined magnetic and wet separating process for the treatment of partly combusted fuel. (24/8/21.)
202 516 A. G. ELAM and M. SANDERS. Electric striking and chiming apparatus controlled by an electrically wound spring driven device. (25/8/22.)
202 520 R. M. RADIO, LTD. and H. R. RIVERS-MOORE. Detectors for use in wireless telegraphy and telephony. (28/8/22.)
202 537 E. G. GARD. Means for controlling the distribution of electric power to moving picture projecting machines. (20/9/22.)
202 539 LODGE-COTTRELL, LTD. (METALLBANK UND METALLURGISCHE GES.). High-voltage insulator, especially suitable for electrical gas purifiers. (22/9/22.)
202 573 R. HERD and E. H. PEARSON. Electrical Railway game of skill (8/12/22.)
177 769 SOC. FRANCAISE RADIO-ELECTRIQUE. Printing telegraphs. (29/3/21.)
202 671 F. H. LEFFLER, and A. C. BARTON. Actuation of electric cut-outs. (3/2/23.)
202 685 E. ISHERWOOD. Detachable electric lighting fittings. (27/4/22.)
202 700 J. B. BOLITHO. Receiving apparatus for wireless and other tuned telegraphy and telephony. (16/5/22.) (Cognate Application, 7606/23.)
202 716 A. G. MILL. Gas heating apparatus, also applicable to electric heating apparatus, to enable them to be converted into cooking apparatus. (23/5/22.)
202 733 J. ROBINSON, H. L. CROWTHER, and W. H. DERRIMAN. Directional wireless systems and apparatus. (25/5/22.)
202 744 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.) Electric relays. (27/5/22.)
202 746 A. M. TAYLOR. Electric transmission systems. (29/5/22.) (Addition to 195 429.)
202 755 T. W. BENNETT. Electric switch devices. (31/5/22.)
202 759 E. S. HEURTLEY, and MUIRHEAD AND CO. Automatic telegraphy. (1/6/22.)
202 760 BRITISH BATTERY CO., and J. W. H. REYNOLDS. Connections for electric wires. (2/6/22.)
181 705 WESTERN ELECTRIC CO. Telephone systems. (16/6/21.)
202 768 M. WEBBER, LTD., and R. S. C. BALL. Semi-automatic electric lighting systems and switchboards therefor. (8/6/22.)
202 771 A. B. FIELD, and METROPOLITAN-VICKERS ELECTRICAL CO. Electrical marine propulsion. (9/6/22.) (Cognate Application, 17928/22.)
202 774 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.) Electric incandescent lamps. (10/6/22.) (Addition to 201 629.)
202 784 F. E. PERNOT. Electrical signalling methods. (15/6/22.)
202 786 WAYGOOD-OTIS, LTD. (OTIS ELEVATOR CO.) Electric motor controlling apparatus. (19/6/22.)
202 797 J. STONE AND CO., and A. H. DARKER. Change over switches for electric lighting and other installations for railway carriages and other vehicles. (28/6/22.)

APPLICATIONS FOR PATENTS.

September 24th.

23 761 D. S. B. SHANNON. Receiving apparatus for wireless signalling.
23 762 D. S. B. SHANNON. Wireless signalling apparatus.
23 765 W. J. LINE. Electric switches.
23 767 S. HINCHCLIFFE. Wireless aerials.
23 776 H. HIBBERT and S. RUSHTON. Crystal detectors.
23 787 FULLER'S UNITED ELECTRICAL WORKS and A. P. WELCH. Electromagnetic sound reproducers.
23 788 E. E. WRIGHT. Wireless valve holders.
23 807 L. E. LOVELAND. Combined electric inspection lamp, dash light and map holder.
23 810 H. S. HYDES and F. MEER. Combined wireless receiver and gramophone cabinet.
23 824 F. R. HOYT. Device for supplying filament current for radio reception.
23 826 B. H. N. H. HAMILTON and B. WILLIAMS. Thermionic valves, etc.
23 860 V. I. BASHENOFF and W. VON PLEBANSKI. Aerial conductors for wireless telegraphy, etc.

September 25th.

23 875 W. T. TURNER. Magneto-electric machines.
23 876 MIDLAND ELEC. MFG. CO., and W. L. BARBER. Terminals for electric switches.
23 897 E. TYSZKIEWICZ. Manufacture of cables, etc.
23 904 L. C. BAKER and E. N. QUANCE. Electric heating devices.
23 930 WESTERN ELECTRIC CO. Telephone repeater systems. (28/9/22 U.S.
23 931 ALADDIN INDUSTRIES, LTD., and J. IMBER. Incandescent vapourl amps.
23 937 BURNDEPT, LTD., and C. F. PHILLIPS and S. F. WOODELL. Crystal Detectors.
23 942 E. S. PRIDHAM. Telephone receiver. (25/10/22 U.S.)
23 954 D. E. BARNETT. Electric lamp holders, plugs, etc.
23 956 BRITISH THOMSON-HOUSTON CO. (G. E. Co., N.Y.). Methods of working quartz.

September 26th.

23 988 G. V. DOWDING and K. D. ROGERS. Low and high frequency wiring transfers.
23 993 A. R. BATEMAN. Electric lamp holders.
23 998 and 23 999 J. B. TUCKER. Electric switches, etc.
24 008 C. J. OWEN. Variometer coils for wireless telegraphy.
24 021 H. QUARTERMAINE. Earthing device for wireless sets.
24 032 SOC. FOURNIER ET CIE. Electric testing device. (3/10/22, France.)
24 051 H. HIRSCH. Switch mechanism for electric light advertisements. (27/9/22, Germany.)
24 052 C. BAUER. Wireless transmission.

September 27th.

24 083 A. HARRISON. Crystal detectors.
24 093 H. S. RYLAND. Wireless telegraphy, etc.
24 094 WESTERN ELECTRIC CO. Switches for telephone exchange systems, etc.
24 095 WESTERN ELECTRIC CO. Electron discharge devices. (13/4/22, U.S.)
24 096 WESTERN ELECTRIC CO. Electron discharge devices. (20/11/22, U.S.)
24 119 A. MONARD. Electromechanical apparatus for controlling points of railways, etc.
24 129 E. E. ROSEN and G. SEIBT. Loud speakers for wireless telegraphy, etc.
24 135 and 24 136 G. E. GREEN. Electric heaters.
24 138 UNDERWOOD TYPEWRITER CO., and J. J. COOPER. Control of electrically driven reciprocatory apparatus.
24 139 BRITISH THOMSON-HOUSTON CO., (GENERAL ELECTRIC CO.) Electric motor controllers.
24 146 SULZER FRERES SOC. ANON. Combined internal combustion and electric locomotives. (11/10/22. Switzerland.)

September 28th.

24 159 H. C. CHAMBERS. Electric devices for internal combustion engines, etc.
24 162 A. LLOYD, A. DILGER and E. B. HOMER. Thermionic valve couplings.
24 181 A. A. PROUDFOOT. Wireless telephone amplifier.
24 188 H. P. T. LEFROY. Wireless apparatus.
24 195 C. F. HENDRICK. Voltage reducing apparatus.
24 196 A. C. LOCK and V. J. S. RUSSELL. Electric generators.
24 197 TELEPHONE MFG. CO. and R. L. MURRAY. Telephone receivers.
24 198 C. B. MARKS. Wireless amplification circuit.
24 209 P. A. L. ANSPACH. Automatic telephony. (30/9/22, Belgium.)
24 213 BRITISH THOMSON-HOUSTON CO. Electric switches.
24 214 BRITISH-THOMSON-HOUSTON CO. and L. GRIFFITHS. Electric lighting of vehicles.
24 215 BRITISH THOMSON-HOUSTON CO., D. E. JEWITT and G. O. WATSON. Electric ship propulsion.
24 220 C. BAUER. Wireless transmission.

September 29th.

24 247 COVENTRY AUTOMATIC TELEPHONES, LTD., and J. E. COLLYER. Telephone systems.
24 248 COVENTRY AUTOMATIC TELEPHONES, LTD, and C. W. WILMAN. Telephone systems.
24 251 S. L HOLLAND and W. A. PICKERING. Wireless receiving set.
24 254 A. D. LEE. Wireless masts.
24 262 J. DOHERTY. Connection of cables to levers, etc.
24 284 C. E. HUDSON. Crystal detectors.
24 298 C. M. R. BALBI. Loud speaking telephones.
24 302 H. BOOKER. Means for connecting and bonding cables to junction boxes, etc.
S. G. FROST. Magneto-electric generators for signalling.

Arrangements for the Week.

FRIDAY, OCTOBER 12th.

FINSBURY TECHNICAL COLLEGE.
7 *p.m.* Old Students' Association. Annual Meeting.
INSTITUTE OF METALS (SWANSEA LOCAL SECTION).
7.15 *p.m.* In the Metallurgical Department, University College, Singleton Park. Chairman's Address by Mr. E. E. Dendy.
INSTITUTE OF METALS (SHEFFIELD LOCAL SECTION).
7.30 *p.m.* In the Non-Ferrous Lecture Room of the University, St. George's Square. Lecture by Mr. A. G. Lobley on "Electric Resistance Furnaces."
THE JUNIOR INSTITUTION OF ENGINEERS.
7.30 *p.m.* At the Institution, 39, Victoria Street, Westminster, S.W.1. Paper by Mr. W. Yorath Lewis on the "Never Stop Railway."

SATURDAY, OCTOBER 13th.

THE JUNIOR INSTITUTION OF ENGINEERS.
2 *p.m.* Visit to the Works of the Gas Light and Coke Co. at Beckton.

MONDAY, OCTOBER 15th

INSTITUTION OF RUBBER INDUSTRY (MANCHESTER SECTION).
7.30 *p.m.* In the Banqueting Hall, Midland Hotel, Manchester. Discussion on "Rubber Machinery," by Mr. H. C. Young.

TUESDAY, OCTOBER 16th.

THE INSTITUTE OF METALS (BIRMINGHAM LOCAL SECTION).
7 *p.m.* In the Chamber of Commerce, New Street. Chairman's Address by Dr. F. Johnson.

WEDNESDAY, OCTOBER 17th.

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH MIDLAND CENTRE).
7.30 *p.m.* At the Royal Victoria Hotel, Sheffield. Chairman's Address by Mr Edward Cross, followed by Smoking Concert.

THURSDAY, OCTOBER 18th.

INSTITUTION OF ELECTRICAL ENGINEERS.
6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.2 Inaugural Address by the President, Dr. A. Russell.

FRIDAY, OCTOBER 19th.

INSTITUTE OF METALS (SCOTTISH LOCAL SECTION).
7.30 *p.m.* At the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow. Prof. H. C. H. Carpenter on "Large Metallic Crystals and some of their Properties."
JUNIOR INSTITUTION OF ENGINEERS.
7.30 *p.m.* At the Institution, 39, Victoria Street, Westminster, S.W.1. Lecturette by Mr. F. W. Dye on "The Gas Boiler (or Circulator) and its Applications."
THE INSTITUTION OF MECHANICAL ENGINEERS.
6 *p.m.* At the Institution, Storey's Gate, St. James's Park, London. General meeting. Presidential Address by Sir John Dewrance, K.B.E.

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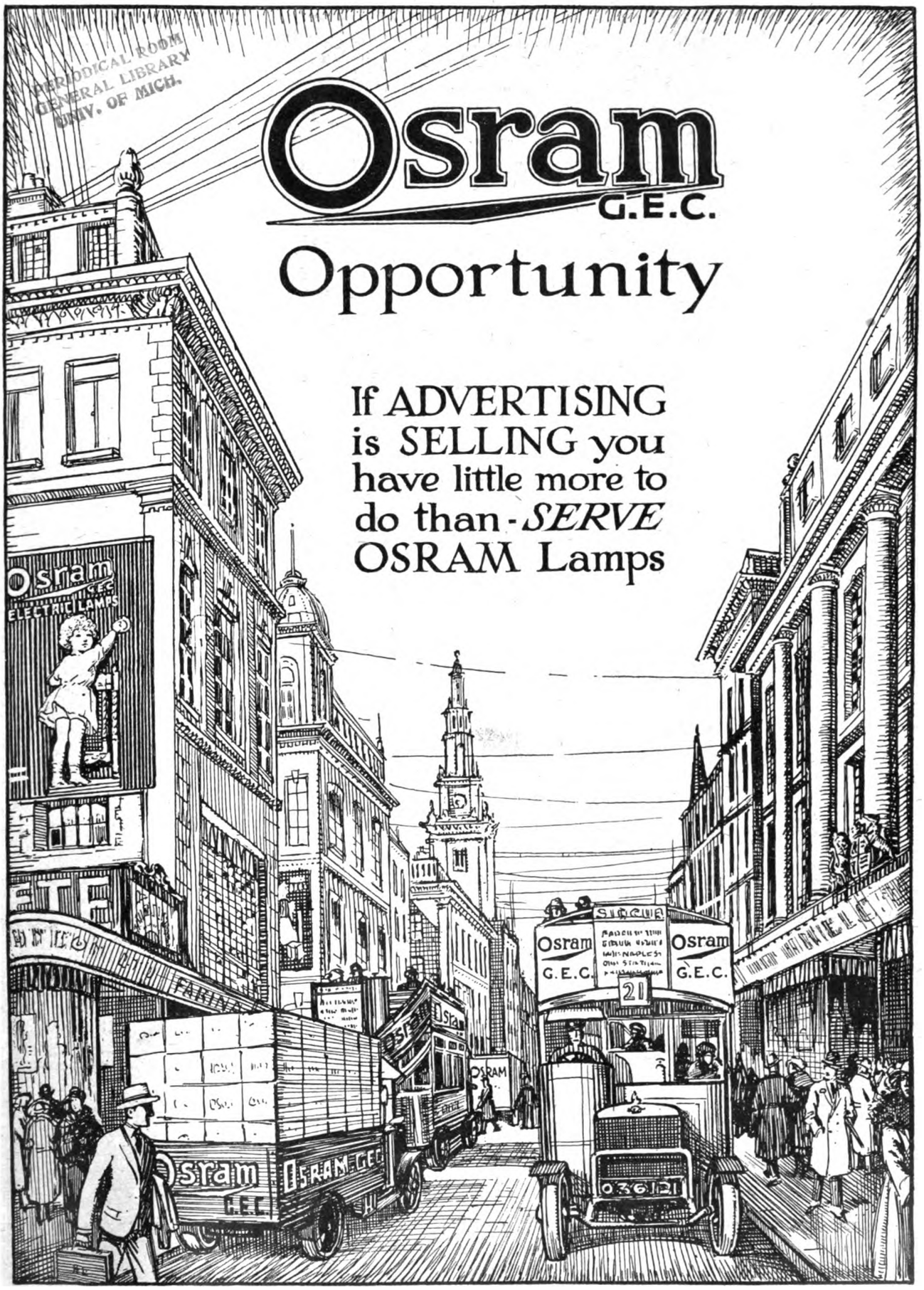

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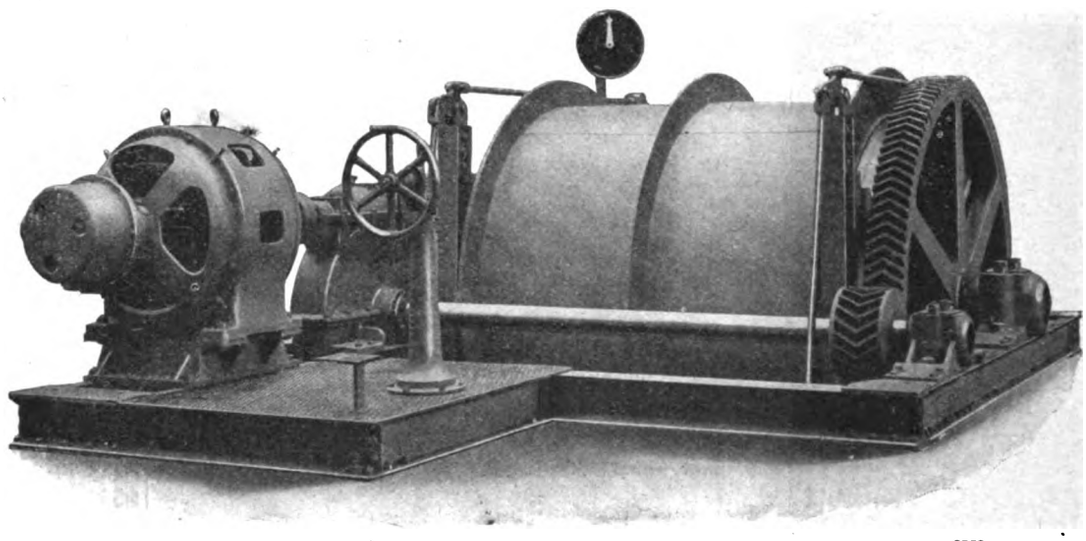

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Notes of the Week.

Selling Wireless.

Though the report of the Broadcasting Committee and the Postmaster-General's compromise have not given universal satisfaction, they have at least cleared the ground to some extent, and made it both easier and necessary for all concerned to set about developing new business by every means in their power. But while one obstacle has been removed, another, as Mr. E. Alexander pointed out in an article which we published last week, remains. The public has been educated by a misguided Press to suppose that it is advisable to make up its own sets, with the result, looked or unlooked for, that it has come to think that only in that way can broadcasting be enjoyed. Now members of the public are not universally expert amateur mechanics, and, as Mr. Alexander rightly remarks, the result of this editorial policy has been a severe check on the whole wireless trade. In a second article, which we publish this week, he deals with the subject from a different point of view: the lack of realisation of the fact that the true selling points for broadcasting sets, as for most other electrical equipment, are ease of control, compactness, and simplicity of operation. He pleads for the production of a "one-handle control" set which can be operated as easily as the gramophone, that all accessories should be swept away, and that repairs and renewals should be done under contract. If big business is to be done, this is undoubtedly the right policy. It has been found successful in the domestic field after other methods have been tried. It will be equally successful in wireless.

Wireless Telephone Problems.

Briefly stated, it may be said that wireless telephony consists in modulating a sustained "carrier" wave to make it correspond with the frequencies of the voice sound waves. To do this necessitates the use of a frequency band not less than 6 000 cycles wide, 3 000 cycles on each side of the carrier frequency. In order to avoid interference, therefore, a band wider than this is required, and in trans-Atlantic communication the frequencies used must be below 60 000 cycles to avoid daylight attenuation, and above 30 000 cycles to prevent telegraphic interference. In the ordinary way, therefore, only four channels of operation would be available for transatlantic working. How this disability has to a certain extent been overcome was briefly described in The Electrician of January 19th, 1923, and a fuller account is given in a Paper read by Messrs. H. D. Arnold and Lloyd Espenschied before a meeting of the American Institute of Electrical Engineers, of which an abstract appears elsewhere in this issue. The method consists in using a bridge or balanced type of modulator at the transmitting end to suppress the carrier frequency in the complex modulated wave and also to suppress one of the side bands in a band filter. At the receiving end the carrier frequency is put in again, allowing telephonic detection to be employed in the usual way. The elimination of one side band virtually doubles the number of transmission channels available, and the suppression of the carrier frequency results in considerable economy of power, while other advantages are simplification of the antenna, ease in receiving adjustment, and reduction in static disturbance. The Paper is of the highest importance as a record of the work which has made a great advance possible.

Future of Electric Welding.

The present autumn season has brought with it the inauguration of two associations whose proceedings will be of more or less electrical interest. The first of these has been formed to deal with matters relating to street lighting, and has already been referred to in The Elec-

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TRICIAN, while the latter is the Institution of Welding Engineers. In the course of his Presidential Address at the inaugural meeting of this latter body last week, Sir PETER RYLANDS called attention to the need for the investigation of welding phenomena, and the close connection which this investigation would have with the problem of the constitution of matter. The final problem to be solved was the achievement of a weld indistinguishable from the adjacent metal, and further research into what happened when the welding metal passed through the electric arc or blowpipe flame was required. The plastic state attained by wrought-iron was an advantage from the point of view of fine welding and its advance gave electric and acetylene welding the preference in the case of steel. We notice that Sir PETER seems to think that electric and acetylene welding are complementary, the former being better for the bigger and the latter for the small work. It would be interesting to know on what evidence this is based. We have seen small welds carried out successfully by electrical methods, and the use of this method is steadily growing in all directions. Its convenience and flexibility are great points in its favour and will undoubtedly affect its future.

The Hornsey Case.

THE evidence given at the inquiry held by the Electricity Commissioners at Hornsey to determine whether the local station shall be extended or whether a supply in bulk shall be obtained from the North Metropolitan Electric Supply Co. is not without interest. It was claimed for the Borough Council that they would be able for many years to come to generate locally more cheaply than they could buy elsewhere. In figures the savings were estimated to be £20 000, spread over six years. The capacity of the plant at present installed at Hornsey is 2 050 kW, and, if the long view is taken, it is obvious that the time must come when for many reasons further extensions will not only be uneconomical but impossible. And even when that point is reached the plant capacity will not be very large. On the other hand, the ramifications of the Power Co. are so wide that the increase in the amount of their generating plant will be much more rapid than that of the local station, and the sites of their stations are much more favourable for extension. Eventually they will be able to generate more cheaply than Hornsey, and it will be interesting to know where exactly the curves will cross. Obviously the points of crossing will be altered to the detriment of the Power Co. by allowing Hornsey to extend. The question therefore is whether it is more advisable to do what is best for the present or what is best for the future. That is a matter of high policy which we are glad the Commissioners and not ourselves have to decide.

Public Contracts and Imperial Preference.

A DISCUSSION has recently taken place in these columns on the propriety of municipal electrical departments and private firms placing contracts for electrical plant abroad. At the present time it is essential that everything should be done to foster not only British but Imperial trade, and for this reason it is well that the Imperial Economic Conference should have discussed the wider question of giving preference to Empire products when public contracts are let. The case for the defence was taken first, and it was shown by Mr. NEVILLE CHAMBERLAIN, Mr. ORMSBY-GORE and Mr. AMERY that it is the practice of the Government Departments in this country to allow equal opportunity for tendering to all British firms, using the term in the widest sense. The CHANCELLOR OF THE EXCHEQUER pointed out that excluding oil fuel the Admiralty purchased only about 1 per cent. of its products abroad, and that the War Office and Post Office had equally clear consciences in the matter. Recently a close investigation had been made into the practice of the various departments, and endeavours were being made to agree upon a uniform policy. This is as it should be, and we hope that the future will see no alteration in the present practice.

Give and Take Necessary.

But preference is a two-edged sword, and if British Government Departments are to tie themselves down to purchase Imperial goods, it is only equitable that the Dominion and Colonial Governments should do the same. That they do not invariably do so at present is shown by the remarks of Mr. NEVILLE CHAMBERLAIN on the action of the New South Wales Government which, in inviting tenders for the Sydney Bridge, suspended the tariff, and thus deprived the Mother Country of the preference she would otherwise have had. In a communication which we received recently from a large electricity supply company in Australia it was stated the Government of that country by its customs laws was encouraging and, in fact, compelling the local manufacture of articles required for home consumption. It has, of course, a perfect right to do this, but the action, if successful, naturally limits the possibilities of British firms obtaining orders, and so reduces their demands for the raw materials which Australia can supply. Whether a world-wide free trade is possible at the present time it is difficult to say, but there is no doubt that there should be free trade within the Empire. In other words, both sides must give and take. For if the Mother Country is to do all the giving and the Dominions all the taking it will only complicate rather than solve the problem.

Telegraphy and Wireless—A Contrast.

THE statement of the Postmaster-General on Tuesday to the Imperial Economic Conference on the subjects of telegraphic and wireless telegraphic communication within the Empire throws into strong relief the difference in the efficiencies of these two services. Before the war it was a just reproach that none of the cables across the Atlantic was British owned. This has been changed by the acquirement and diversion of the German Emden-Azores-New York cable and by the purchase of the Direct United States Co. cable. The service is satisfactory and beats in point of speed all the other transatlantic routes. In other parts of the world the services provided by the Pacific Cable Board and by the Eastern Telegraph Co. and its associated companies are equally good. New work has been undertaken and the leeway caused by the war made up, and, as Sir LAMING WORTHINGTON EVANS rightly said, it is difficult to overestimate the debt which the Empire owes to this great association of companies. To this happy state of affairs the position of wireless telegraphy forms an unpleasant contrast. In Lord BURNHAM'S words, it is deplorable and discreditable. After years of negotiation and search for a solution nothing has really been done, while satisfactory services are being provided by America, France, Germany, Japan, and the Argentine. Lord BURNHAM suggests that the way out of this *impasse* is to allow the service to be undertaken by private enterprise, the Government reserving the right of purchase after a number of years. But we know to our cost what a failure this arrangement has been in the electricity supply industry. It is not likely to be any more successful with wireless. The better arrangement would be private enterprise with a limitation of profits on a sliding scale. But whichever solution is adopted it must be adopted quickly if the Empire is to play any part at all in wireless development.

Taxation and Trade.

THE CHANCELLOR OF THE EXCHEQUER'S recent statement that no reduction in taxation can be expected next year is an example of the lack of enterprise so evident among those who control our national finance. If one thing is certain it is that the reductions of taxation made by Mr. BALDWIN in the spring have been most beneficial. Though unemployment is about the same, the Board of Trade figures show that trade is improving, but improving slowly. And it is worth noting that Great Britain is the only country, America not excepted, where it is not worse than it was a year ago. If taxation had been maintained at the maximum war-time level, it is safe to prophesy that

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we should have gone back too, and our comparatively good position may therefore be ascribed to the very slight relief given in the last Budget. But that is not enough; Government expenditure must be reduced as a preliminary to reduced taxation. This could be done by a further application of the axe. For instance, the Ministry of Agriculture, which before the war was content with a few hundred thousands, is now spending twenty-two millions doing nothing in particular, and not doing it very well. The Ministry of Labour has become a mere distributor of doles. The wiping out of the activities of such departments as these would not only reduce expenditure and relieve taxation, but remove from the trade of the country the incubus of vexatious interference and bureaucratic meddling which is the direct cause of much unemployment.

The Primary Education of Engineers.

In a recent leading article we gave our views on engineering education, and came to the conclusion that the boy who wished to enter this profession should leave school earlier than is now usual, so as to enable his specialised theoretical and practical training to be begun as soon as possible. We suggested that admission to works should take place at the age of fourteen or fifteen as the result of a simple entrance examination, and that thereafter such instruction should be given as would show for what branch of engineering, whether in the drawing office, the shop or the sales department the apprentice was best suited. Finally, we argued that only those whom experience had shown were fitted for higher education should be allowed to undertake it.

A Wider Problem.

But the question of how young engineers are to be trained is only a part of a much wider problem. All boys are not born engineers; neither are they all born politicians or born soldiers. This is a merciful dispensation of Providence, but it is a dispensation that imposes on educationists and others a task of selection which they are sometimes averse to undertake. To insist that a boy should embrace a certain profession because of its social standing, because his family have always done so, because it is easy to find him a position, or because its financial prospects are rosy, has little logically to recommend it; and the best that can be said for it, like the *mariage de convenance*, is that it often works out better in practice than would be expected. Such methods of chance are, however, inapplicable to engineering where the work, among other things, requires that he who undertakes it shall be intelligent, physically fit, and, above all, take an interest in what he is doing. Moreover, the training that the young engineer shall undergo demands more from his powers of application and concentration than does the training for any other profession except, perhaps, medicine, and the very developments which are taking place will make the task harder and harder every year. If interest and the engineering type of mind are lacking his chances of success are slight. It is therefore essential that before any boy, or his parents for him, chooses engineering as his life-work that he should be thoroughly examined as to his suitability. To do otherwise is to waste much time and money, not to speak of bringing another useless recruit into a profession which is already overcrowded.

Vocational Tests.

This necessity is being recognised by engineering employers, if not by parents, and much thought is being given to the devising of what are conveniently called vocational tests. The results of the investigation to date were admirably summarised in the joint discussion which was held at the recent meeting of the British Association by the Engineering and Psychology sections. In opening the discussion Mr. M. H. Tagg, of the National Institute of Industrial Psychology said that though it was possible to devise vocational-tests, which in 15 or 20 minutes would give an indication whether the candidate was fit to carry out some particular operation in the shops, four factors, namely, general intelligence, specific ability, disposition and health, must be considered. Experience had shown that a higher degree of intelligence was required for engineering workers than in any other industry, and that success in selection could only be expected where individual rather than group tests were employed.

Messrs. A. P. M. Fleming and H. J. Brocklehurst, whose views should be particularly interesting to electrical engineers, went a step further. Psychology was not everything, they said, and factors such as home influence must be considered. A boy might not do well in a vocational test, but the facts that he was interested or that his father or friends followed the same trade were points which it would do well to take into account, interest being almost a determining condition for success.

The Best Method of Selection.

But even if such methods of selection which experience has shown to be good are adopted the problem is not wholly solved. For, as Prof. F. C. Lea pointed out, the best method of selection was to watch the boys during the educational period. This supervision, as we have already argued, should be continuous until the boy is out of his apprenticeship, with a view to discovering exactly for what work he is best suited. But the suggestion that the boy should be watched while he is still at school raises a yet more important point—the efficiency or otherwise of primary education in its relation to after-life. According to Bishop Welldon, this efficiency is extremely low. Complaints are made by business men, he pointed out, hat pupils coming from elementary schools are ignorant of spelling, literary expression and geography, and that teachers concentrate too much on intellectual knowledge, and not enough on moral character. He blamed the political activities of the teachers for this, and while calling attention to the justification which the war gave to the engendering the "public school spirit," remarked that the State cannot feel that it has obtained an adequate value for its expenditure unless the citizens of the future are not only better instructed than their fathers, but are actuated by a higher spirit of patriotism.

A Grave Indictment.

This is a grave indictment, and, if it is true, as unfortunately there seems no reason to doubt, it is a sad thing not only for the country, but for the future of engineering. Civilisation and industrial progress are both equally dependent on a high degree of primary education, and no stone should be, therefore, left unturned to increase its usefulness. The State may certainly complain that it has not received a fair return for the money spent on education, but if it does so it has only itself to blame. (We assume that by the State Bishop Welldon meant the whole body politic). For there is, perhaps, no subject in which the man in the street takes less interest than in education, and that lack of interest is, therefore, equally conspicuous among politicians and Government officials.

Cost and Efficiency.

In this connection a great deal has been said about cost. It has been pointed out that education cost sixty times as much in 1921 as in 1870, and that the results are not sixty times as good. Bishop Welldon blames the teachers for this. But the increased cost due to teachers' salaries is but a small proportion of the costs of administration, and, in our opinion, high salaries are well worth while paying if better-equipped teachers are thereby secured. It should be axiomatic that to increase the efficiency of our educational results, which are now admittedly poor, the best brains in the country must be attracted to the teaching profession. That attraction will only be realised by good pay and good conditions of service. But it is an attraction which, from every point of view, it would be worth while doing a great deal to secure.

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Boiler Room Efficiency and the Computation of Operating Results.

By JOHN BRUCE, A.M.I.E.E.

Considerable prominence has of late been given in the technical Press to matters relating to boiler-room operation and boiler-room efficiencies. The majority of the articles have been of a very helpful nature, and have contained a considerable amount of valuable suggestions which it is hoped will be given the consideration they merit by the manufacturers of boiler and stoker plant, boiler-room instrument makers, and last, but not least, the engineering staffs responsible for boiler-room operation in the plants throughout the country.

Fuel economy is a subject that, in the majority of plants, whether generating steam for the production of electrical energy or for manufacturing processes, does not receive the serious attention it deserves. It ought to be more fully impressed on those responsible (whether operatives or directors) for the operation of steam plants in which fuel is prodigally consumed, that their conduct amounts to little short of criminal negligence.

It is not always, however, the commercial or business man whose sanction is necessary for the capital outlay entailed in the installation of instruments for scientific boiler-room control, who can be held responsible where wasteful methods are prevalent. It has been occasionally stated that one of the obstacles to improving the operation of boiler plants in manufacturing concerns has been the "conversion" of the commercial administratives to the fact that instruments properly installed and maintained, and the boiler plant operated from the indications and records from such instruments, would result in a saving that would not only pay for the installation but result in a substantial saving in fuel costs as well.

Engineers Among the Unconverted.

Though a sad admission, there are also many engineers who are equally difficult to convert and who look upon instruments in the boiler-room as so much unnecessary ornamentation. It is not inferred by the foregoing statement that all boiler-rooms in which instruments are not installed are inefficiently operated, though it is difficult to realise how they can be otherwise.

For the economical operation of any boiler-room it is necessary to know what is required to be done, whether it is being done and how it is being done, and without instruments the necessary information cannot be obtained, and the boiler-room crew are continually working in the dark. Boiler-room instruments have been brought to a very high degree of accuracy, reliability and simplicity during the course of the last few years, but there is still room for improvement, especially in connection with the measurement of the air supplied for the process of combustion and the automatic analysis and indication of the constituents of the flue gases.

More Co-operation Required.

Though the present writer is open to correction, he is of the opinion that there is not the co-operation between the instrument makers and the boiler or furnace manufacturers that there could be, and there is room in this direction for the institution of a great amount of valuable research work, the ultimate result of which should be that a boiler unit when installed would be compulsorily equipped with, not only the usual pressure and water gauges, but also reliable instruments from the indications of which the chemical process of burning coal would be accurately and efficiently controlled.

It is realised, of course, that instruments alone will not improve efficiency. How and why they work and the value of their records and indications must be taught to every member of the boiler-room crew engaged in operating the furnaces. Another necessity is the institution of some form of log-sheet so that a continuous record of the indications of the instruments may be tabulated, the operating results analysed, and the various losses separated and methods instituted for their reduction. In connection with the analysis of operating results and the calculation of efficiency figures, there is urgent need for some sort of agreement throughout the country as to methods of computation and the basis upon which efficiency values shall be calculated.

Misleading Statistics.

How often do we hear and see it expressed that the coal consumption of a certain undertaking is so many pounds of coal per kilowatt-hour? Only a week or two ago certain engineering journals published a paragraph containing a statement made in Parliament to the effect that the average coal consumption, over a period of one year, of one large modern power station was 1·99 lb. per kilowatt-hour, and the best figure obtained by any undertaking in the country was 1·72 lb. per kilowatt-hour. Such statements are entirely misleading and are of no value for statistical or comparative purposes unless accompanied by certain other technical data. In the past, power station plant performance has been compared entirely on a basis of weight, and though such a basis is admittedly erroneous, it is surprising and disappointing to note how slowly these old methods are being discarded and correct methods, based on sound scientific principles, devised and adopted. The true figure of merit, apart from generating costs, for any power station is the B.Th.U., either expressed as such or in myriawatts, necessary to produce one kilowatt-hour at the station busbars or to the outgoing feeders. Though this fact is, or should be, obvious to every engineer engaged on the generating side of the industry, one hears and sees the old expressions continually used. Partly to remedy this state of affairs, the younger generation of power station engineers should be educated to think and speak entirely in terms of heat units.

B.Th.U. the Criterion.

Though only a little thought is necessary to realise that the B.Th.U. is the only true basis of comparison from which to judge power station performance, an example for the benefit of junior engineers will make this quite clear:—

1. Station "A" produces a kilowatt-hour for an expenditure of 1·75 lb. of coal, the average gross calorific value of the coal as fired being 11 000 B.Th.U's. per lb.
2. Station "B" produces a kilowatt-hour for an expenditure of 1·90 lb. of coal, the average gross calorific value of the coal as fired being 10 000 B.Th.U's. per lb.

In the case of "A" the heat expenditure per kilowatt-hour was 19 250 B.Th.U's., and in the case of "B" 19 000 B.Th.U's. Obviously, though the coal consumption is greater, the performance of station "B" is better than that of station "A." The example given shows how misleading any statement can be which attempts to compare power station performance on a basis of weight alone.

Nowhere more than in the boiler-room is there the necessity for a reform in methods of tabulating and calculating test or daily operating results. The work done by Mr. David Brownlie in this direction is most praiseworthy, and it is to be hoped that, somewhere in the near future, a scientifically constructed and mutually agreed upon test code will be available between, at least, the larger power station undertakings, that will form a true and fair basis of comparison, and, which it is further hoped, will destroy the conservatism that inhibits the freer publication of power station operating results in the technical Press.

Referring again to the expression, pounds of coal per kilowatt-hour, very seldom is it made clear in such statements whether the statistics are based on the weight of the dry coal or the coal plus moisture as weighed in the boiler-room or arrived at by methods of estimation and guess-work. Whether calculated on a dry or as fired basis the value of the efficiency percentages, expressed in the form of a heat-balance statement are not affected, but nevertheless it should be clearly stated which basis has been selected. As a result of the confusion which exists, many reported evaporation values are very bewildering, especially those which appear in the reports of tests in boiler and stoker manufacturers' catalogues. Unless such reports are accompanied by a detailed heat-balance statement, or it is clearly stated whether the "dry" or "as fired" weight has been used in computing the results, the figures are robbed of any value.

In connection with evaporation values, in the past the figure of comparison has been the equivalent evaporation of a certain amount of water from and at 212 deg. F., the effect of differences in the calorific value of the different coals being neglected. The evaporative performance of a boiler can be computed to a fair basis for comparative purposes by expanding the equivalent evaporation to give the value from and at 212 deg. F. per 10 000 B.Th.U's. in the coal. There

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seems no reason why this value should not be adopted as a standard expression for evaporation values.

Calorific Value.

The point around which most controversy has arisen in reporting boiler test or daily operating results, is the calorific value of the fuel. Systematic boiler-room efficiency control is now in operation in most of our power stations of any considerable size, but the different methods which are in use for calculating the heat value of the fuel rob the operating results of the various plants of any value for comparative purposes, for by comparing results and methods of operation our experience is widened, and ways and means nearer to what we are striving for may ultimately be reached.

At present there are four heating values in common use for the computation of boiler-room and station operating results, viz. :—

1. The gross calorific value of the moisture-free fuel.
2. The gross calorific value of the fuel as fired.
3. The lower calorific value of the moisture-free fuel.
4. The lower calorific value of the fuel as fired.

It is admitted that operating results can only be scientifically tabulated on a basis of heat units, but while the present confusion exists in the matter of calorific values, the results can only be comparative for those stations consistently using the same heat value basis. There are many other points in connection with boiler-room efficiency figures which are in need of reform, but most of them are influenced by the calorific value basis, and until a satisfactory schedule of computations has been drafted and instituted the heart burnings occasioned by reports of boiler efficiencies of 85 to 90 per cent. will still go on.

Graphical Calculation of Overhead Transmission Lines.

In a Paper which is to be published in pamphlet form by the Institution of Civil Engineers, Mr. W. T. TAYLOR deals briefly with the principal electrical characteristics occurring in a bare overhead electric power transmission line, and in a diagram shows the relation between the various elements in a power transmission line when the effect of capacity and leakage is not taken into account. A graphical calculation is given for bare overhead lines. The graphical calculation (plotted to logarithmic scale) has for its basis the formula—

$$e' = R \cos \varphi + X \sin \varphi,$$

where e' denotes the voltage drop per mile per ampere.

In a transmission line the voltage, power, and power factor are theoretically varying along the line, and the variation depends on the fundamental line constants and on the amount and nature of the load. The loss is variable according to the change of load, and the total loss of energy in a kilowatt-year is dependent on the load factor. The voltage regulation is greatly impaired by a low power factor. When the power factor is very high, the line current is almost in phase with the receiver voltage, and the value of IR largely settles the voltage drop; but when the power factor is low —a condition commonly met with in practice—IX becomes the predominating factor. The line current is theoretically varying along the conductor owing to the charging current, but this charging current for those lines under consideration is usually very small compared with the full-load current or the estimated average-load current.

The alternating current overhead power lines under consideration are those designed for operation at a *maximum* of, or preferably below, 50 000 V, a frequency of 50 cycles per sec., a transmission length of 50 miles, and a lagging power factor.

The following practical advantages result from the application of this graphical calculation :—Since the conductor values are based on the diameter of the conductor, the chart should be of international utility. As standards change from time to time, the chart has a permanent value, because it is not affected by a change of standard sizes of conductor. Intermediate or any spacing of line conductors can be visualised at a glance. The bad effect of power factor can be visualised at a glance. A table of sines and cosines is not required. The effect of frequency is shown. A table of ohmic resistance values is not required. There is no necessity to calculate for inductive reactance for any frequency. The chart should be of great value in checking calculations made by the more exact method. By means of the chart, voltage-drop calculations are simplified, the results being sufficiently accurate for all practical purposes.

Electricity Supply in Ontario.

Great Progress during the Past Year.

The fifteenth annual report of the HYDRO-ELECTRIC POWER COMMISSION of the Province of Ontario for the year ended October 31st, 1922, is a volume of nearly 700 pages which in mere size puts our own Commissioners' report to shame. In fairness it must be said, however, that it deals with a large number of matters which are not within the province of the British body, among them a very detailed statement of the accounts of the various systems which come under the control of the Commission.

The volume is not arranged for easy study, and a rather more extended summary of the technical and financial progress would make the task of discovering exactly what is being done a good deal easier.

It appears that the operation of the various systems during the year under review has been marked by a great increase in load. This increase has been general throughout the systems controlled by the Commission, and was particularly rapid during the latter part of the year. But has, in some respects, added materially to the difficulties of operation, as it has demanded constant vigilance on the part of the staff to see that none of the equipment in the numerous stations was becoming overloaded. Voltage regulation has also been a matter which has demanded constant attention, and there was a good deal of difficulty in laying off the equipment for inspection and repair.

Narrow Margin of Generating Plant.

As an illustration of the narrow margin of generating plant which the constant additions to the load caused, the case of the first generator at Queenston may be mentioned. This unit was first placed in operation on January 26th, 1922. On the next day ice trouble at the plants of the Ontario Power Co. and the Canadian Niagara Power Co. reduced the amount of power available from these sources so that it was necessary to load the Queenston generator to full capacity at once.

Load Increases and Improved Business Conditions.

The same state of things was evident throughout the next few months, although other generators were added, and this is taken as an indication of how closely the demand for power follows the increased generating capacity, and how essential it is that no delay should occur in the construction of additional generating plant. This increase in load is partly ascribed to the coal famine, electric heaters doing much to relieve the situation where fuel was not obtainable. Though this influence was not so great during July and August, when artificial heating was not required, the Niagara system showed an increase of over 30 000 H.P. for these two months as compared with the same months of the preceding year, or about 18 per cent. The Central Ontario system showed a growth of 5 000 H.P. or about 24 per cent. increase, the Ottawa system 23 per cent., the combined Northern systems 16 per cent., the Muskoka system 24 per cent., the Rideau system 45 per cent., and the Nipissing system 10 per cent. in the same two months. On the other hand, the St. Lawrence system showed a slight decrease, and the Thunder Bay system only a slight increase. It is evident, therefore, that the growth of load cannot be ascribed, except in a small part, to the abnormal conditions arising out of the coal shortage. In fact the increase in power requirements may be ascribed to improvement in business conditions; and as this improvement increases, a still greater supply of power will be required.

There is some speculation in the report on the position in Ontario if it had been necessary to generate from coal the immense amount of power now produced in the hydro-electric plant. The coal for this purpose could not have been obtained without encroaching on that required for other necessary purposes, while large quantities would have had to be purchased from abroad, which would have entailed sending large sums of money out of the country, and placed a load upon railways which are already taxed beyond their capacity.

The normal operating capacity of the hydro-electric generating plants controlled by the Commission was 572 855 H.P., with a peak load of 601 974 H.P. and an output of 1 855 990 415 kWh. Only one steam plant was in operation during the year, and this has a normal operating capacity of 20 000 H.P., and a peak load of 9 380 H.P. Its output during the year was 150 000 kWh. A peak horse-power of 729 348 H.P., with an output of 2 293 447 600 kWh, was purchased from various other undertakings.

The Queenston Plant.

The most notable feature in the operation of the Niagara system during the year was the putting into operation of the Queenston plant, the first unit of 60 000 H.P. being placed in service on January 26th, 1922. The second unit of a similar capacity was available on March 16th, and a third unit on October 3rd, but even with this additional power the Commission is barely able to meet the demands upon it.

Electrical contractors need no introduction to the "Electrical Contractors' Year Book," the 1923–24 edition of which has just been issued by the Electrical Contractors' Association at 2s. 6d. Containing 362 pages, the latest edition follows mainly on the lines of previous issues. A new feature is the inclusion of the recommendations of the committee, formed in 1922 to formulate a trading policy to be followed by the N.E.C.T.A.

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A Modern Metal-clad Switch.

Some Essentials of Design and Manufacture.

In a recent issue of THE ELECTRICIAN we dealt at some length with the methods employed in the manufacture of modern metal-clad switchgear. These methods sufficiently indicate that simplicity and accuracy are essential factors in the production of this equipment and that if these can be obtained, even at the expense of a good deal of time and thought on preliminaries, there is no reason why the metal-clad idea should not be as successful when applied to switchgear as it is already when applied to cables. This generalisation is as true when we consider switchgear of small current carrying capacity as when circuit breakers for controlling large turbo-alternators, interconnectors and feeders come under review. But the design and manufacture of the latter class of gear introduce some special problems of their own which have been successfully tackled and solved by more than one switchgear manufacturer. How this has been done in one particular case may be illustrated by referring in detail to the "R" type of circuit breaker designed and manufactured by REYROLLE AND CO., under the supervision of Mr. H. W. Clothier. A number have been installed for some time at Birmingham and Manchester, and we had an opportunity of inspecting an example during a recent visit to the Hebburn works. Some of the points which must be taken into consideration in the manufacture of this equipment are given below.

The Conditions Which Have to be Met.

On large networks a first step is to obtain some idea of the value of the short circuit current likely to exist in case of a fault. In many cases attempts have been made to limit the value of this short circuit current by the use of external reactances, but this has a detrimental effect on the operating characteristics of the system. The requisite information regarding switch rating is only obtainable after long experience. An obstacle to progress in this direction is the lack of requisite power for testing out the switches, while the fact that a switch successfully clears a fault is no criterion that it will do so equally successfully on another occasion. Then, again, the correct value of short circuit power that should be taken is difficult to determine, the only certain thing being that calculated values of short circuit which depend on the cable layout, distance of fault, nature of fault, etc., are unreliable, owing to the uncertainty as to the identical point on a short circuit transient at which the switch contacts may separate.

The only thing therefore is to combine exceptionally rigid manufacture with careful testing until more information on the subject can be obtained. This is done in Reyrolle's switchgear and in this particular case the three-phase oil immersed circuit breaker has a breaking capacity of 900 000 to 1 000 000 kVA.

General Description of Gear.

As is usual, too, the "R" type gear is constructed on the draw-out principle—i.e., all parts which are liable to need repairs are rendered dead by withdrawal of the switch from connection with the busbars and outgoing cables. The metal-clad construction places a continuous earthed screen between the operator and all live parts of the gear, while each panel is complete in itself, and allows of the combination of any number to form a multiple board. The gear consists essentially of two main parts:—(1) The fixed portion, and (2) the movable portion.

The fixed portion comprises:—(1) Two duplicate frame standards of massive construction which support the whole structure. The faces of these standards are planed to permit of alignment of plugs, etc., when the switch is racked in or out. A rack is fitted to the top surface which makes the withdrawal of the switch a one-man job. The busbar chambers are supported on a cradle, which rests on the frame standards. The busbars of high conductivity copper are carefully insulated and then supported on moulded insulators inside an iron case. The whole is then filled with a special high melting point compound. In the case of duplicate busbars, selection is made by removable plugs. The possibility of changing over two plugs and omitting the third is eliminated and definite indication given. Further, this method has many advantages. The separate sets of busbars are enclosed in chambers respectively complete and having no conductors projecting into other compartments or tanks except through the detachable circuit breakers. The construction provides that the changeover cannot be effected without the circuit-breaker is first isolated—a simple means thereby being assured of operation without risk of error. The construction of the busbar is of the simplest form and the interlock is not dependent upon cranks, levers or other mechanism, but is obtained automatically by virtue of the draw-out feature.

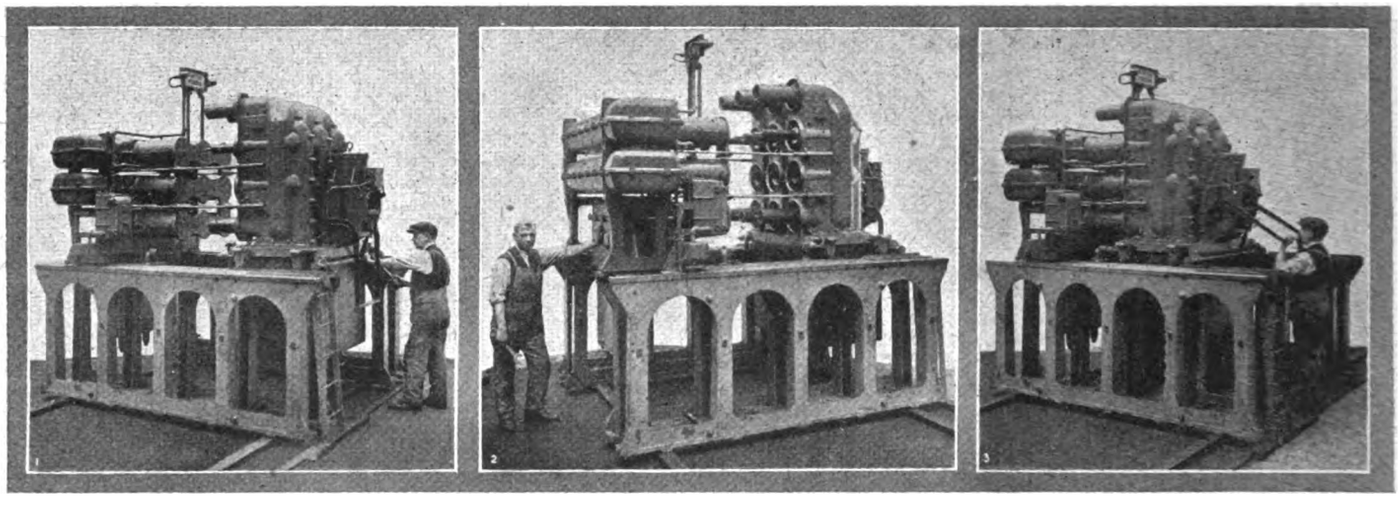

FIG. 1.—VIEWS OF REYROLLE & CO.'S "R" TYPE METAL CLAD SWITCHGEAR.

The Fixed Portion.

The fixed portion also contains the transformer chamber, which is placed in front of the switch and is held in position on the cradle. The transformers are constructed only of high-grade material and special attention has been paid to the insulation to prevent any chance of breakdown occurring, which might put the rest of the gear out of commission. The chamber is filled with compound. Connection is made through the transformers by the lower set of plug contacts on the switch. The current or potential transformers are readily changed if desired.

The potential transformer chamber is supported between the frame standards in front of the switch and is kept quite separate from the current transformers. In order to provide the necessary accessibility with safety, the transformers are oil immersed, and again special attention has been given to the insulation of the transformer primary windings.

Special care has been given to the arrangements of the cable fittings. The dividing box and glands are arranged to suit all classes and sizes of cables. Arrangements are also made for bonding armouring, and in order to damp down circulating currents in lead sheath of single core cables, a special type of insulated gland is provided. The small wiring from relays, and other apparatus is run in tubes throughout the length

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of the board. Inspection boxes are provided at close intervals for the inspection of this wiring. The insulation used is both waterproof and fireproof. The finish of the gear is of highest class, and connecting up is simplified by use of vari-coloured wires.

Operating Details.

Operation can be effected either by hand or electrically, and in each case the mechanism will trip free at any point during the closing period.

With hand operation, by an ingenious disposition of levers the moving parts are easily lifted against the powerful "kick off" springs required to give very rapid acceleration of the parts in opening. The operating lever may be mounted on the circuit-breaker direct, or at a distance with suitable coupling rods in order that remote mechanical control from a slate panel or brick wall may be readily obtained. The actual closing and tripping mechanism is supported from a bracket casting bolted to the switch top plate, and is provided with an iron cover surmounted by a mechanical position indicator.

The movable contacts of the circuit breaker are clamped to a heavily insulated steel tube suspended by two steel rods passing through guide tubes screwed into the top plate. These rods are coupled to steel ropes in the guide tubes which pass over pulleys in oil tight housings, and are finally coupled to the closing mechanism.

The switch is held in the closed position through a toggle which is knocked out by the tripping device when opening, and is so adjusted that very little tripping force is required

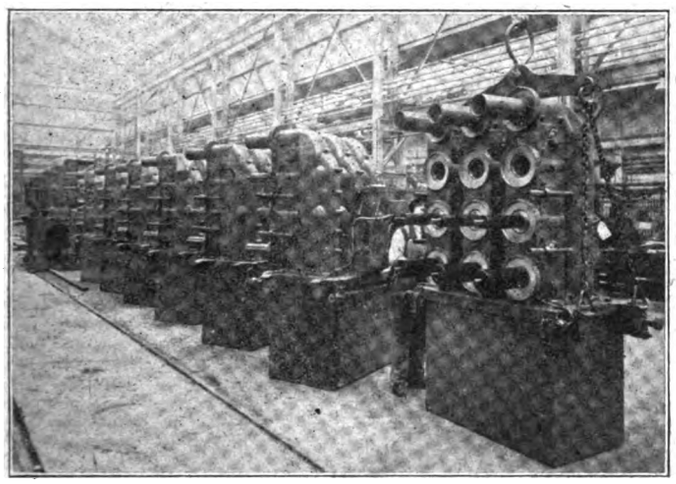

FIG. 2.—THE EQUIPMENT IN COURSE OF ASSEMBLY.

whilst stability against vibration is assured. As the speed of break is high it is necessary to relieve the shock to the mechanism by the interposition of oil dash pots which are conveniently mounted in insulated steel tubes under the oil level; the plungers or pistons being attached to the steel operating rods.

When remote electrical control is used a short stroke solenoid carrying a link motion is employed. This forms a self-contained unit for mounting on to the top plate of the switch proper. The apparatus is coupled up to the cross bar of the switch by means of vertical steel rods suitably guided and fitted with dashpots at their lower ends. Immediately the oil switch has closed the current is cut off from the solenoid independent toggle links holding the switch closed and "pumping" is rendered impossible. These do not interfere with the rapid opening of the switch. The trip mechanism, which also consists of links and toggles, is self re-setting.

Breaking Capacity Factors.

The many features which influence the breaking capacity of a switch may be roughly grouped into two classes:—(1) Those which tend to limit the stresses and (2) those which enable the breaker to withstand the stresses imposed on it.

Exact mathematical reasoning of the phenomena which occur at the opening of the breaker is not yet available due to the many complications which arise. Partially completed reasonings are to hand, but only serve to show the effect of variations in one or two factors.

Speed of Break.

Among the points upon which agreement has been reached may be included the fact that when the switch contacts separate, the resistance between them rapidly increases until it prevents the a.c. energy wave being re-established. By suitably increasing the speed of break—i.e., by increasing the rate of growth of the resistance, the work of rupturing the circuit is facilitated. A heavy head of oil causes greater pressure on the bubble of gas formed at the contacts. One effect of this pressure is to increase the resistance of the arc due to the difficulty in ionising the arc gases under great pressure. This tends to disestablish the arc.

The designer can, of course, limit the stresses under the foregoing headings, but he must cater for their presence by carefully allocating the strength. In this connection, it is essential that the strength of the top plate fastenings, the shortest distance between phases or between phase and earth, number of breaks, total length of break, air vent arrangements, mechanical rigidity of all current carrying parts should withstand the stress to which they are subjected.

Constructional Details.

The circuit breaker is built up on a solid steel top plate, and supports a substantial boiler plate tank of welded steel. The tank is tested to withstand a hydraulic pressure of 300 lb. per sq. in. and for compactness contains all three phases. This arrangement, also results in a greater volume of oil being present than would be possible were the phases in separate tanks. The tank is lined with plywood which acts as a buffer between the turbulent oil and the tank. The stresses actually encountered on the tank must be transmitted through the oil. For raising or lowering the tank a truck with movable platform is provided or a crane may be used to remove the circuit breaker from the panel to a place convenient for inspection, adjustment and repairs. The gases formed during the opening of the circuit are led away in vent pipes so as to be well clear of the gear and the operators. These gases are a source of trouble in open type gear, and repeated serious breakdowns are caused.

Connection is made to the main busbars through plug receptacles which are provided with substantial bakelised paper insulators. These are despatched moisture-proof, and it is claimed to possess marked advantages over the ordinary porcelain type in the way of mechanical strength. The plug itself is of circular self-aligning form, and a good contact is ensured to minimise any local heating that may be set up. The internal connections inside the hoods are treated just as the busbars and the hoods are filled with compound of the same hall mark of quality.

Contact Design.

The copper employed in the breaker is all high conductivity quality. Special attention has been directed to the design of the contacts—they are of the well-known "V" shape, and arranged so that the blow-out effects on heavy transients, etc., increase the contact pressure. The reduction of the time lag on this class of switchgear has been considered, as it is essential that the time lag on fault operation should be reduced to a minimum in order that damage should be limited as much as possible. Eddy current losses due to the armouring have been reduced to a minimum by the use of non-magnetic materials in the armouring.

The potential difference across the contacts is reduced by machining and grinding the contacts to a gauge fit. The fixed contacts are of a heavy construction of large thermal capacity, and are easily renewed. To ensure self-alignment with the contact bar, they are supported on steel springs. In general, this type of contact is eminently suitable for high-breaking capacity. On break, the movement is cushioned by an oil dashpot to take up any jar which may be caused.

Tripping by relays may be quite sensitive due to the balanced action of the forces on the switch. This is the case even when the relay is subjected to heavy vibration.

The control board is of standard type with slate or marble supported on a light steel frame work. Special attention has been devoted to the arrangement of the instruments and relays, so as to give a pleasing effect to the eye, and yet enabling the readings to be taken with the least possible chance of errors. The light wiring is neatly arranged at the back of the board, and by use of vari-coloured insulation, easy rewiring, alterations, etc., are ensured.

The control board may be arranged to operate switches either on same floor level, on different floor level (either above or below), or in different buildings, according to the needs of the situation.

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Transatlantic Radio Telephony.*

By H. D. ARNOLD and LLOYD ESPENSCHIED.

A new method of transmission radiating only a single side-band is being employed for the first time. As compared with the ordinary method of transmission, this system possesses the following important advantages: The effectiveness of transmission is greatly increased because all the energy radiated is effective in conveying the message, whereas in the ordinary method most of the energy is not thus effective. The stability of transmission is improved. The frequency band required for transmission is reduced, thus conserving wave length space in the ether and also simplifying the transmitting antenna problem.

An important element of the high-power transmitter is the water-cooled tubes, by means of which the power of the transmitted currents is amplified to the order of 100 kW or more. The direct-current power for these tubes is supplied from a 60-cycle a.c. source through water-cooled rectifier tubes. A highly selective and stable type of receiving circuit is employed. Methods and apparatus have been developed for measuring the strength of the electro-magnetic field which is delivered to the receiving point and for measuring the interference produced by static.

Transmission Tests.

The transmission tests so far have been conducted on a wave length of 5 260 meters (57 000 cycles per second). The apparatus was located in the buildings of the Western Electric Co., at New Southgate, England.

These tests were carried out as part of an investigation of transatlantic radio-telephony. This investigation is directed to determining—(1) the effectiveness of new methods and apparatus which have been developed for telephonically modulating and transmitting the large amounts of power necessary for transoceanic operation; (2) the efficacy of improved methods for the reception of this transmission and for so selecting it as to give an extremely sharp differentiation between the range of frequencies transmitted and all the frequencies outside of this range; and (3) determining the transmission characteristics for transatlantic distances and the variation of the characteristics with the time of day and the season of the year, including the measurement of the amount of static interference.

The tests are being continued, particularly as regards the study of transmission efficiency.

Single Side-band Eliminated Carrier Method of Transmission.

The method of transmission used in these experiments is what is known as the single side-band eliminated carrier method. With this method the narrowest possible band of wave lengths in the ether is used, and all the energy radiated has maximum effectiveness in transmitting the message.

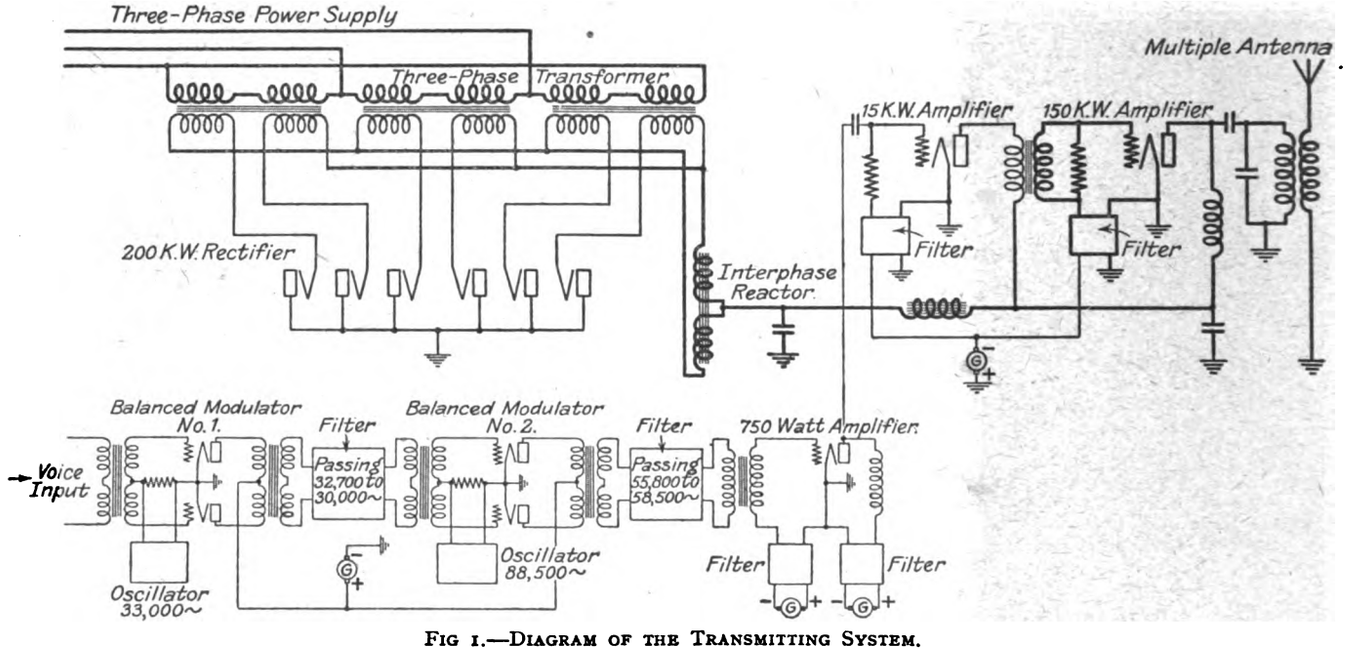

FIG 1.—DIAGRAM OF THE TRANSMITTING SYSTEM.

results of the measurements during the first quarter of the year on the transmission from the United States to England show large diurnal variations in the strength of the received signal and in the radio noise strength, as is to be expected, and correspondingly large diurnal variations in the ratio of the signal to noise strength and in the resulting reception of spoken words. Also, the measurements, although as yet incomplete, show a large seasonal variation. The character of the diurnal and seasonal variations is clearly indicated in the figures. The curves present the most accurate and complete data of this kind yet obtained.

The London Demonstration.

On January 15th of this year a group of about 60 people gathered in London at a pre-arranged time and listened to messages spoken by officials of the American Telephone and Telegraph Co. from their offices at 195, Broadway, New York City.† The transmission was conducted through a period of about two hours, and during this time the words were received in London with as much clearness and uniformity as they would be received over an ordinary wire telephone circuit. The sending apparatus was installed in the station of the Radio Corporation of America, at Rocky Point, L.I., and the receiving

When a carrier is modulated by telephone waves the power given out is distributed over a frequency range, and may be conveniently considered in three parts: (1) Energy at the carrier frequency itself, (2) energy distributed in a frequency band extending from the carrier upward and having a width equal to the frequencies in the telephone waves, and (3) energy in a band extending from the carrier downward and having a similar width. The power at the carrier frequency itself makes up somewhat more than two-thirds of the total power, even when modulation is as complete as possible. Furthermore, this energy can in itself convey no message, as is self-evident. In the present method, therefore, the carrier-frequency component is eliminated, by methods explained in detail below, with the result that a large saving in power is effected. Each of the remaining frequency ranges, generally known as the upper and the lower side-band respectively, transmits power representing the complete message. It is therefore unnecessary to transmit both these side-bands, so that in the present method one of them is eliminated. In this way the transmission of the message uses only half the frequency band required in the usual method of operation. Similarly the frequency band accepted by the receiving set is narrowed to conform to a single band as compared with the usual double side-band reception, and as a result the ratio of signal to interference is improved. Certain other advantages of this method will be brought out in the further discussion.

* Abstract of a Paper read before the American Institute of Electrical Engineers.

† See THE ELECTRICIAN, vol. xc., p. 58, Jan. 19th, 1923.

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While these advantages of the single side-band eliminated carrier method hold good for radio-telephone transmission generally, they become of the utmost importance in trans-oceanic work, because of the necessity of conserving power in a system where the transmitting powers are large, and also because the very limited frequency range available for long distance transmission makes it imperative that each part of the range shall be utilised with the greatest care. Before discussing the method further, the circuits and apparatus which are actually used in the tests will be described.

The Transmitting System.

The transmitting system is shown in simplified circuit form in Fig. 1. It is illustrated as grouped into three parts—the low-power modulating and amplifying stages, shown below in light lines; the high-power amplifiers, shown in heavy lines above and to the right; and the rectifier, which supplies the power amplifier with high-tension direct current, shown in the upper left-hand portion of the diagram.

Referring first to the low-power portion of the system, it will be seen that the voice currents (from either a telephone line or a local microphone) are fed into a balanced type of modulator circuit and are modulated with a carrier current of a frequency of about 33 000 cycles. The result of this modulating action is to produce, in the output circuit of modulator No. 1, modulated current representing the two side-bands, for example, the upper one extending from 33 300 to 36 000 cycles and the lower one from 32 700 down to 30 000 cycles. These components are impressed upon a band filter circuit which selects the lower side-band to the exclusion of the upper one and of any remaining part of the carrier, with the result that only one side-band is impressed upon the input of the second modulator. This second modulator is provided with an oscillator which supplies a carrier current of 88 500 cycles. The result of modulation between the single side-band and this carrier current is to produce a pair of side-bands which are widely separated in frequency, the upper one, representing the sum of the two frequencies, extending from 118 500 to 121 200 cycles, and the lower one, representing the difference between the two frequencies, extending from 58 500 down to 55 800 cycles. In this second stage of modulation there is a relatively wide separation between the two side-bands which facilitates the selection at these higher frequencies of one side-band to the exclusion of the other. Another important advantage is that it allows a range of adjustment of the transmitted frequency without changing filters. This is accomplished by varying the frequency of the oscillator in the second step. In the present case, the frequency desired for transmission is that corresponding to the lower side-band of the second modulator. The lower side-band of from 58 800 is therefore selected by means of the filter indicated. This filter excludes not only the other side-band but also any small residual of 90 000 cycle unmodulated carrier current which may get through the second modulator circuit if it is imperfectly balanced.

Having prepared at low power the side-band currents of desired frequency, it is necessary to amplify them to the required magnitude for application to the transmitting antenna. This amplification is carried out in three stages. The first stage increases the power to about 750 W, and is shown in Fig. 1, together with the modulating circuits. This amplifier employs in its last stage three glass vacuum tubes rated at 250 W each and operating at 1 500 V.

The output of the 750 W amplifier is applied to the input of the larger-power amplifying system beginning with the 15 kW amplifier of Fig. 1. This consists of two water-cooled tubes in parallel, operating at approximately 10 000 V. The output of this amplifier is applied by means of a transformer to the input of the 150 kW amplifier, which consists of two units of ten water-cooled tubes each, all operating in parallel at about 10,000 V.

The high-voltage d.c. supply is furnished by a large vacuum tube rectifier unit rated at 200 kW. It employs water-cooled tubes similar to those used in the power amplifiers except that they are of the two-electrode type. The rectifier operates from a 60-cycle three-phase supply circuit, and utilises both halves of each wave. The two sets of rectified waves are combined by means of an inter-phase reactor which serves to smooth out the resultant current and by distributing the load between tubes of adjacent phases increases the effective load capacity of the rectifier. The ripple is further reduced by the filtering retardation coil and condensers shown.

The final amplifier of 150 kW capacity is shown in Fig. 2. It comprises two units each of 75 kW. Each unit contains ten water-cooled tubes which can be seen mounted in their water jackets. To the right of these units is located the 200 kW rectifier unit shown in Fig. 4. The unit contains actually twelve tubes, there being two tubes for each of the

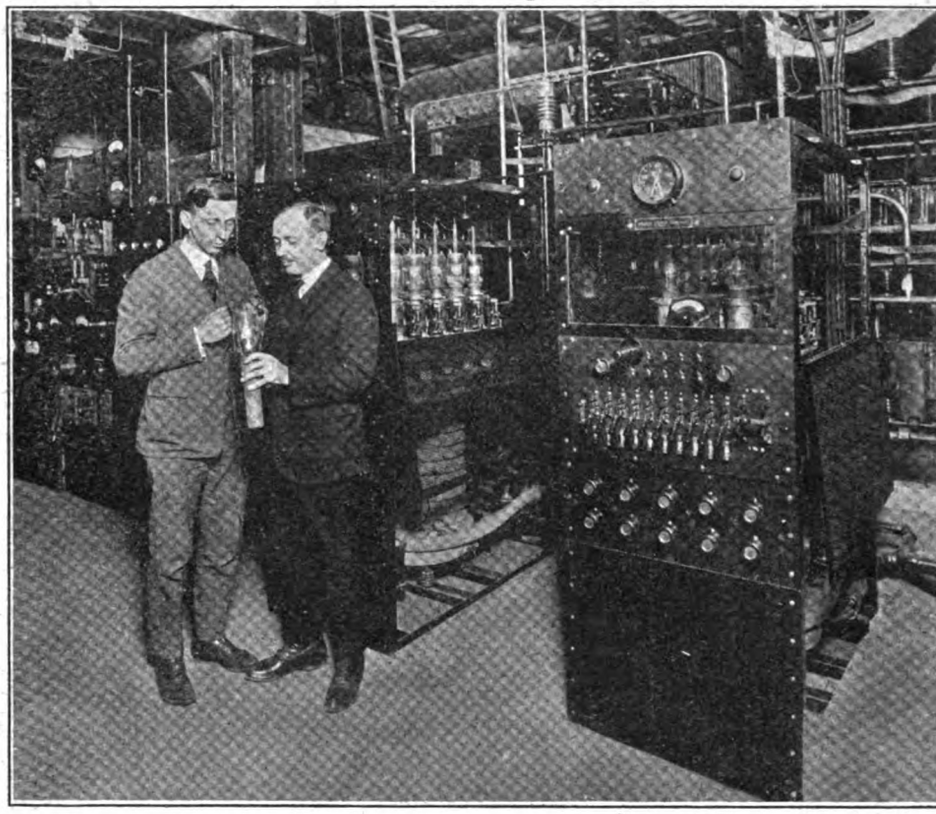

FIG. 2.—VIEW OF THE 150 KW FINAL AMPLIFIER.

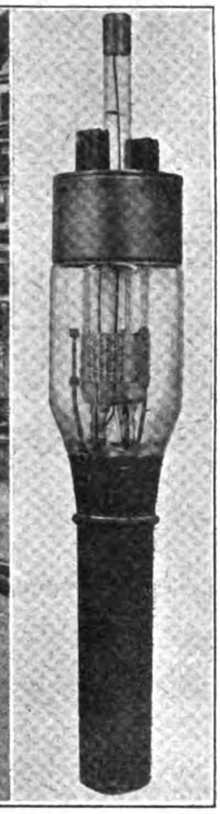

FIG. 3.—THE HIGH POWER TUBE USED IN THE EXPERIMENTS.

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six half-waves. The side-band is first developed by modulation and filtration at low powers, and then its power is built up to a large value in a succession of powerful amplifiers. It will be appreciated, therefore, that the large-power amplifiers, and in particular the water-cooled tubes which are their essential elements, represent one of the major problems of the development.

High-power Tubes.

In the design of high-power tubes for use in this system, the main problem is to ensure the ready disposal of the large

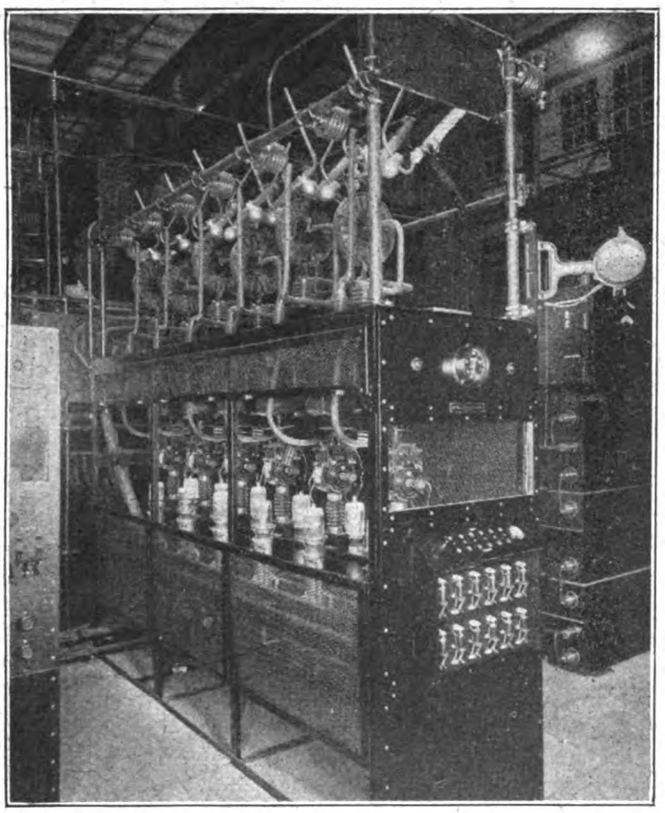

FIG. 4.—VIEW OF THE 200 kW RECTIFIER UNIT.

amounts of heat generated at the anodes. For the conditions of use in the present type of system where the tube is employed as an amplifier, the power which must be disposed of as heat at the anode is of the same order of magnitude as the power which the tube will deliver to the antenna. In the case of the present equipment, therefore, the tube must be so designed as to operate continuously with a heat dissipation at the anode of more than 10 kW. It is obviously difficult to secure so large a dissipation in a tube enclosed with glass walls, and a tube was therefore designed in which the anode forms a part of the wall of the containing vessel and the heat generated in it is removed by circulating water. The tube used is shown in Fig. 3. The lower cylindrical portion is the anode which is drawn from a sheet of copper. The upper portion is of glass, and serves both to support and insulate the grid and filament.

The three principal difficulties met in the construction of these tubes are the making of a vacuum-tight seal between the copper and the glass, the provision of adequate means for conducting through the glass wall the large currents necessary to heat the filament, and the obtaining of the necessary vacuum for high-power operation.

A New Metal to Glass Seal.

The first of these problems was solved by the development of a new metal to glass seal. In making this seal the glass and metal parts are brought into contact while hot, the temperature being high enough for the glass to wet the metal. The part of the metal in contact with the glass is made so thin that the stresses which are set up when the seal cools are not great enough to fracture the glass or to break it away from the metal at the surface of contact. Seals made in this way are sufficiently rugged to stand repeated heating and cooling from the temperature of liquid air to that of molten glass without deterioration.

A seal employing the same principle but different in form is also used at the point where the leads carrying the filament current pass through the glass walls of the tube. The lead is made of copper 0·064 in. in diameter, and passes through the centre of a copper disc, 0·010 in. thick, the joint between the lead and the disc being made vacuum-tight by the use of a high-melting-point solder. The disc is sealed to the end of a glass tube, which is in turn sealed into the glass wall of the vacuum tube.

In exhausting the tubes it has been found necessary to subject all the metal parts to a preliminary heat treatment in a vacuum furnace during which the great bulk of the occluded gases is removed. By this method the time of exhaust can be considerably reduced, but the vacuum conditions to be met are so stringent that the final processes of evacuation must be carefully controlled, and often occupy as much as twelve hours.

The tubes are operated at a plate voltage of 10 000 V, and are capable of delivering 10 kW at this voltage in a suitable oscillatory circuit. For this performance an average electron current of 1.35 A is required. The total electron current that the filament must be capable of supplying to ensure operation is about 6 A.

When the tubes are used to amplify modulated currents with large peak values such as are characteristic of telephone signals, it is essential that the maximum electron current through the tube shall be several times the normal operating current, and therefore to ensure the necessary high quality of transmission these tubes are operated for telephone purposes with an average output of about 5 kW.

The Receiving System.

In the method of transmission ordinarily employed in radio-telephony by which the carrier and both side-bands are sent out from the transmitting station and received at the distant end, detection is readily accomplished merely by permitting all of these components to pass through the detector tube. The detecting action whereby the voice-frequency currents are derived is accomplished by a remodulation of the carrier with each side-band.

With the present eliminated carrier method of transmission the side-band is unaccompanied by any carrier with which to remodulate in the receiving detector. It is necessary, therefore, to supply the detector with current of the carrier frequency obtained from a local source. Thus, in the present experiments, if a current of the original carrier frequency, 55 500 cycles, is supplied to the detector, it will remodulate or "beat" with the received side-band of, say, 55 800 to 58 500 cycles, and a difference-frequency band of 300 to 3 000 cycles—i.e., the voice-frequency band—will result.

The arrangement actually used, however, is not quite so simple as this. It is shown schematically in Fig. 5. Reception is carried out in two steps, the received side-band being stepped down to a lower frequency before it is detected. The stepping-down action is accomplished by combining in the first detector the incoming band of 55 800 to 58 500 cycles with a locally

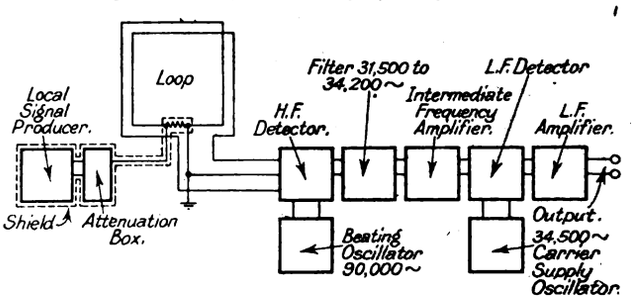

FIG. 5.—DIAGRAM OF ARRANGEMENT USED IN EXPERIMENTS.

generated current of about 90 000 cycles. In the output circuit of the detector the difference-frequency band of 34 200 to 31 500 cycles is selected by a band filter and passed through amplifiers, and thence to the second detector. This detector is supplied with a carrier of 34 500 cycles which, upon "beating" with the selected band, gives in the output of the detector the original voice-frequency band.

Our Erudite Contemporaries.

In a report of a meeting of Cheltenham Electricity Committee, a local newspaper, whose name shall mercifully be suppressed, quoted the chairman as saying that "one of the chief aims of the Commissioners was to standardise the methods of distribution . . . by introducing *the three-face system*. Cheltenham's system was *the single-faced system*." Our contemporary is apparently too unsophisticated to appreciate the possibilities of double-faced methods. The italics are ours.

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Developments in Wireless Reception.*

The Minimisation of Atmospheric Interference.

By JOHN SCOTT-TAGGART.

A difficult stage has been reached in the history of wireless telegraphy, owing to the fact that the ether is rapidly becoming filled up with wireless signals of all wavelengths from 50 to over 20 000 metres. The high frequency tuned amplifier has enabled a high degree of selectivity to be obtained, and note-tuning and the use of reactance have proved useful. The greatest achievement, however, is doubtless the "heterodyne" system of continuous wave reception invented by Fessenden. The full advantages of this system cannot be obtained on the longer wavelengths—which is unfortunate in view of the fact that long wavelengths between 10 000 and just over 20 000 have proved most suitable for communication over long distances. The difficulties of congestion have recently been pointed out by E. F. W. Alexanderson, Chief Engineer of the Radio Corporation of America. He remarks that if wavelengths between 11 000 and 22 000 metres are divided into 2 per cent. bands there are 35 "channels"; if into 1 per cent. bands there are 70 channels. Except in so far as directional reception will permit the number of one-way channels is limited to the number of these bands.

A New Principle.

The two great landmarks in the history of selective wireless reception are the utilisation of resonance phenomena and the reception of continuous waves by means of beats. But the time has come when other devices are needed. The new principle suggested by the author involves the increase at the receiving station, of the frequency difference between desired and undesired currents. The frequency of the incoming currents is increased with the result that the actual frequency difference between currents at different frequencies is also increased. The author illustrates the results of the method by the case of two sets of signals of 15 000 and 15 100 metres, which would undoubtedly lead to jamming. The corresponding frequencies are 20 000 and 19 868. The frequency difference is thus only 132 cycles. But if the frequency is multipled by ten so that the values become 200 000 and 198 680, the difference is 1320; it then becomes roughly, ten times as easy to separate out the two stations.

Solving the Problems of Congestion.

The effect becomes even more marked if the frequency multiplication is 100 instead of 10. But this would not usually be necessary. With a much lower multiplying factor the number of available channels can already be increased sufficiently for our present needs. So far the application of the method to high frequency signals only has been described. But the principle is equally applicable to audio frequencies. Whereas the original difference in frequency might be only 100 (barely perceptible) the final difference may be as much as 10 000—a value which would enable the interfering waves to be completely cut out. Undesired signals of multiple frequency can be arranged to be above or below the audible limits. The invention may also be applied to both the high frequency and the low frequency sides of a wireless receiver.

Reflex Circuits.

The latter part of the paper deals with reflex circuits for broadcast reception. The three-electrode valve has become an indispensable piece of apparatus in modern wireless work, but although the knowledge of its properties as a dual amplifier is ten years old, little use has hitherto been made of this fact. The term implies that the valve amplifies both the high frequency and the low frequency currents at the same time. Dual amplification circuits have the merit of saving one or more stages of low frequency amplification. Unfortunately these additional duties render the valve somewhat unstable. In order to lessen this tendency the author introduces a stabilising resistance of 100 000 Ω, connected across suitable points in the circuit, and connects the transformer, for introducing low frequency currents, into the grid circuit of the valve in the aerial circuit of the usual direct coupled receiver.

Reparations and Wireless Equipment.

The "European Commercial" states that wireless stations are to be established shortly at Nish (Serbia) and Cettinje (Montenegro). Germany has supplied the material on account of reparations.

* Abstract of a Paper read before Section G (Engineering) of the British Association.

What Is Wrong with Radio?

By E. ALEXANDER.

When broadcasting came all who had any experience of new things predicted that here was another great industry just come to the birth. There was every reason for such an optimistic view; it was new, it was good, and it was a necessity or soon must be, just in the same way as pianos and gramophones had become universal necessities in every home. Almost at once, however, unexpected changes and difficulties came, and after an all too short boom period, this promising industry slumped and all but became extinguished, bringing in its train bankruptcy and vast unemployment to the thousands who thought that at last they had secured that necessity to life, bread and butter, or even only bread alone.

The Greatest Cause of Friction.

There is no doubt that Government interference and indecision was one of the greatest causes of this failure, and the attitude of the Press was undoubtedly another considerable contributing factor, while the fact that every Tom, Dick and Harry was allowed to enter into and given trade facilities helped not at all to put the new industry on a firm and reliable basis. There is, however, another element which has received too little attention and which, no doubt, has retarded the popularisation of broadcasting in the home, the home of that great potential buying public. What is this element: is it not ease of control and compatability?

Looking at broadcasting from the sane every-home, drawing-room, dining-room, or any room point of view, does the industry seriously suggest that accumulators are a selling point; does the industry suggest that one unit a receiver, another unit an amplifier, another unit a loud speaker, and *ad infinitum*, are selling points? Is there, in fact, anything comparable in the modern broadcast receiver to a gramophone or even a musical box in compactness and simplicity of operation? Does the industry insist that for the everyman's home tuning is either desirable or essential?

What Everyman Wants.

Specialists scoff when we speak of a "one-handle control"; vested interests expostulate when any self-contained set is mentioned, but THIS IS WHAT THE BUYING EVERYMAN WANTS. Visualise a radio receiver, all contained in about the size of an ordinary portable table or even cabinet gramophone with a one-handle control. THIS WOULD SELL, and could be made on competitive lines with either a gramophone or piano. Hundreds of thousands buy gramophones at £20, £50, £100, and even more, and so they would radio sets, especially as they would not need winding up and record changing. There are technical difficulties in the way, say some. Of course there are, but what are difficulties if they are not to be overcome? It is impossible, says another, to which every thinking electrical man would unhesitatingly say tosh.

The B.B.C. are endeavouring to enable every place in the British Isles to be within easy range of a broadcast station, and it is a mistake to educate the public into the belief that one station is better than another and that they require a set which can pick up any and every station. The noble efforts of Capt. Eckersley on behalf of the trade in his perfection of simultaneous broadcasting puts every station in a position to supply the best programmes as well as programmes of local and topical interest, and this should be taken advantage of to produce an every-home broadcast receiver which can reproduce on a loud speaker, like a gramophone, the local broadcast programme.

Accessories Should Be Banished.

Accessories should, for the everyman, be ruthlessly swept aside and a one-control all-contained set evolved and SOLD. The means of lighting the valve filaments and applying a potential to the plates of the valves can nowadays be done entirely by compact, self-contained batteries which will last easily six months, when it should be a simple matter to replace them like a refill to a pocket flash-lamp, and at quite a small cost. There is no need for the user to see the inside the set at all. The average user of a gramophone never sees it, and repairs, renewals, and the like can and should be looked after like sewing machines or piano tuning, by contract with the maker at regular intervals.

The British manufacturer has no need to follow or copy American or any other practice in the production of his apparatus. He has his own individual public to supply with decidedly British instincts, which in radio is especially noticeable, and he must produce a musical instrument which this public wants, even though it may not yet know that it wants it.

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Electric Welding.

Formation of the Institution of Welding Engineers.

The first meeting of the recently formed Institution of Welding Engineers was held at the Holborn Restaurant on Wednesday, October 10th, when the President (Sir Peter Rylands) delivered his Presidential Address. This was followed by the reading of two Papers dealing respectively with oxy-acetylene and electric welding respectively. We give below an abstract of the Presidential Address and of the paper by Mr. D. T. Smout upon electric welding. The formation of this new Institution marks a definite stage in the progress of welding in this country inasmuch as it provides an organisation which will take in hand in an authoritative manner the care and development of all classes of welding. One of the great needs of welding is the application of more scientific principles, and this is a work which the new Institution will deal with irrespective of the particular type of welding.

The Presidential Address.

Sir Peter Rylands in the course of his Presidential Address said that the future alone could decide whether the Institution was well founded and whether, as was firmly believed, it provides a link at present lacking between British Scientific Societies. The movement had been subjected to the criticism that it overlapped work adequately performed by existing bodies, and that the formation of a definite Welding Institution was unnecessary and even mischievous. In any case they found themselves in good company, and what America and France had found beneficial should be equally advantageous in Britain.

The art of welding impinged upon a field of science not only not covered by any scientific society, but one in which investigation was only in its earlier stages. The final problem to be solved by welders was the achievement of a weld indistinguishable from the adjacent metal. The process by which this might be accomplished, practically, was immaterial from the point of view of the Institution of Welding Engineers. The field was a vast one and far from being fully explored.

Rival Methods.

At the present time there was a healthy rivalry between acetylene and electric welding. But these methods ought to be complementary, experience determining which was best applied to a particular kind of work.

In spite of what had already been accomplished, the art of welding was even yet only in its infancy. The plastic conditions of iron attained at a suitable temperature made it peculiarly adapted to the welding process, and molecular uniformity of the weld, if not really achieved in practice, was sufficiently approached by the process of forging. In welding iron it was uncommon to find that the weld possessed a strength equal to that of the solid metal, and, indeed, this was one of the inherent defects of welding. But, in any case, the plastic condition assumed by wrought iron when at a high temperature as opposed to the absence of it in steel was certainly an advantage from the point of view of fire welding. The lack, however, of this intermediate state in steel had turned out to be an advantage from the point of view of both the acetylene and the electric welder, as these methods of welding were essentially different from that of the smith's weld.

Both the electric arc and the oxy-acetylene methods of welding had their appropriate fields, and it would be one of the important functions of the Institution to assist in the development of both gas and electric methods to their highest efficiency and greatest usage, and as other processes of welding were engendered it would also be the duty of the Institution carefully to investigate these as to their merits or usefulness. From the evidence available at the present time it would appear that the system of gas welding would always prove more convenient in carrying out multitudinous small repairs, while for large constructional work and in other directions the electric process may prove more suitable. Where rapidity of deposition and a minimum of heat diffusion were desirable the electric arc process, of course, had advantages.

Lack of Operators.

It was pretty certain that the development of welding was being retarded by the lack of adequately trained operators. The Institution of Welding Engineers could do a great work in encouraging the proper training of men in developing a definite class of expert operators.

Electric Arc Welding.

In the course of a Paper on "Theory and Facts to Aid in the Choice of an Efficient Electric Arc Welding System." Mr. D. T. Smout said that the commercial efficiency of the arc welding process could be roughly estimated by the relation that the quality of the work possible bore to the cost entailed. The chief factors deciding the quality of the work were four—electrodes, current, the welding machine and the operator. The speed of welding entered into the question of cost provided increased speed were obtainable without loss of efficiency.

Electrodes.

Electrodes could be classed under four distinct headings, namely, heavy slag depositing electrodes, light slag depositing electrodes, flux coated electrodes which deposited no slag, and bare wire. Generally speaking there was a sphere of utility for each type, and provided care were exercised in their selection maximum efficiency in the weld should result. It appeared doubtful whether it would ever be possible to produce an electrode which combined the good points and at the same time eliminated the bad features of each type.

Current (Whether Direct or Alternating).

With direct current, using an electrode coupled to the positive pole, maximum speed of deposition was obtained, but the heating effort was a minimum. A change in polarity resulted in a reversal of these conditions. It follows directly, other factors being equal, that speed of deposition and depth of penetration lay midway between these extremes for alternating current. Greater speed of deposition could be obtained with direct current when using heavy slag depositing wires, but as the penetrative effect with bare wires using the negative connected to the work was too low for efficient welding, it followed that alternating current enabled the deposition of the intermediate types of electrodes to be carried out more efficiently than was possible with direct current.

The Welding Machine.

For welding efficiency, the machine should supply energy to the arc at such a rate that the speed of metal deposition tended to remain constant in spite of all fluctuations except in so far as permanent increase in arc length would result in poor work. There should be no reason why alternating current should not give as stable an arc as direct current.

Conditions imposed by variation in the type of electrode altered the nature of the load. For instance, heavy slag depositing wires demand a higher average arc voltage than bare wires for similar average loads. Not only, therefore, must the machine be adjustable to supply various constant average loads, but there should be means for additional adjustment of the voltage to maintain a constancy of stabilising effect. Not only should the power control feature of the plant or the "governor" be adjustable for various loads, but the speed or voltage should be adjustable to suit the type of electrode.

When the question of method of control was taken up, it was necessary to bear in mind that, in order for the control to function efficiently for the fluctuations of higher frequency, the time constant of the control circuit must be low; in other words, the governing must be sensitive.

Cost and Upkeep.

In general, d.c. motor-generator sets cost more than a.c. plants and their weight often necessitated greater expenditure on cabling to enable low tension welding leads, instead of the machine, to be taken to the welding location. Alternating current plants should require no attention excepting perhaps an occasional clean out. Direct current plants in upkeep were usually expensive in comparison; new brushes and armature repairs might be necessary at any time. Careful maintenance would eliminate a great deal of trouble.

Where portability was necessary, the alternating current machine should find favour, as the weight of a single unit welding machine seldom exceeded 350 lb., whereas some of the smallest motor-generator sets weighed as much as 800 lb.

The efficient selection of type of electrode resulted in maximum welding efficiency at the minimum cost. The amount saved in capital expenditure by purchasing an inferior plant could be easily lost in a very short space of time by having to use expensive electrodes which applied the stabilising factor missing from the plant.

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Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

THE ELECTRON THEORY.

To the Editor of THE ELECTRICIAN.

SIR,—Among the interesting points which Mr. H. M. Sayers raises in his thoughtful article, appearing in THE ELECTRICIAN for September 21st, there are two which seem to stand out in prime importance. I refer first of all to that relating to the propagation of light through space, in connection with which he clearly indicates some difficulty in assuming it to be due to electronic action unless the ether of space is composed of or includes electrons. As to this he remarks that "although the mass of an electron is very small, 1/1 800 of a hydrogen atom it is computed, the aggregate mass of the electrons in, say, the space occupied by the solar system would be a pretty big quantity, and the gravitational effect might not be insignificant," and he goes on to say, "Would such a medium oppose measurable frictional resistance to planetary motions—if it would, that negatives the hypothesis—would the electrons gravitate to the sun and planets and form electron atmospheres around them, or would radiation offset the gravitation?"

Regarding the first of the two questions raised in the last quotation, I must admit that factors are involved which are beyond my powers to elucidate; the most that I would venture to advance being the suggestion that it is conceivable that an electronic condition of the ether may affect the speeds of the rotations and revolutions of the various planets, which otherwise might be greater than they are. As to the second question, it seems to me that it should not be impossible to arrive at some conclusion, as to the relative effects of gravitation and radiation, by calculations based on similar lines to those adopted by astronomers when considering questions as to the existence and conditions of the atmospheres of planets, or their non-existence as in the generally considered state of the moon.

If it should turn out in the case of electrons that gravity prevails over radiation it would seem that beyond the vicinities of the planets there must be enormous distances in space utterly devoid of electrons, or which at most are but sparsely occupied. If gaps exist, the electronic theory as applied to light would seem to fail definitely; if, on the other hand, the intermediate spaces are but thinly occupied, the theory is faced with considerable difficulties over and above which a new question would appear to arise regarding the generally accepted velocity of light. Taking for example the deductions drawn from the observed motions of the satellites of Jupiter, when viewed from the earth at those orbital positions when our globe and Jupiter are in opposition on superior conjunction, whereby computations are made over distances which may be roughly described as 390 millions of miles and 576 millions of miles respectively, it seems appropriate to wonder whether the velocity of light is uniform throughout the entire distance, or whether the results obtained are combinations of varied speeds through space according to the density or attenuity of electrons or other conditions of the ether, and to velocities appropriate to the electronic state of the atmospheres and rather more distant surroundings of the planets. It is true that the velocity of light has been measured within the confines of the earth by means of great refinement with practically similar results; but in dealing with a velocity of so high an order the possibilities of error may be considerable.

The object of these remarks, however, is not necessarily to cast doubt on the accepted computations of the velocity of light, but to draw attention to the fact that such measurements as have been made over short distances upon the earth have been made under conditions which may not be applicable to the ether of space, in which event it might follow that there would be some errors in our conceptions as to astronomical distances, an argument which must not be regarded as an assertion.

The second point to which I would refer relates to Mr. Sayers' remark "that there is considerable evidence that streams of electrons emitted or repelled by the sun cause our auroras and magnetic storms, so there is some reason to accept electrons as part of the space content of the solar system." It seems possible to read this in two ways—viz.: either that electrons are projected in definite streams from the sun, such as from sunspots, or that the space containing the solar system is more or less filled with electrons emitted or radiated in this or some other way. It was established some years ago that magnetic disturbances occurred on the earth when large sunspots, or groups of spots, faced the earth—*i.e.*, passed over the Central Meridian, and Mr. Maunder showed from Greenwich records that there were renewals of disturbances when continuing spots recrossed the Central Meridian, in consequence of solar rotation.

As, however, large sunspots, or groups of spots, have been known to face the earth without affecting seriously terrestrial magnetism when the spots occupied more northerly or southerly latitudes on the sun, the generally accepted theory has been that the earth's magnetism is usually only affected by streams of electrons which happen to be so directed as to hit the earth or its atmosphere. On the other hand, instances have been given by other observers of occasional magnetic storms having occurred when the sunspots have been widely distant from the Central Meridian; such an instance was given by the Rev. A. L. Cortie, of Stonyhurst Observatory, who asserted that on May 20th, 1921, there was a renewal of magnetic disturbances at a time when the spots had by the rotation of the sun moved to a distance of 76 degrees from the Central Meridian.

Notwithstanding cases like this, there is no doubt that, generally speaking, magnetic disturbances usually follow soon after the passage of a spot, or spots, over the Central Meridian—a fact which appears to be rather damaging to any hypothesis that the realms of space are, as a whole, charged with electrons.

If the latter were the case, it seems difficult to understand why the action or effects of a stream of electrons ejected from the sun should be confined to a comparatively thin stream. Even though the electrons ejected may be supposed to act on all free electrons in front, they would, presumably, affect all surrounding ones, which in turn would influence their neighbours, and so on in succession.

If this be true, and it is difficult to divorce the supposition from the general theory of electronic action, it would appear to be far from easy to understand why terrestrial magnetism should not be usually more disturbed by sunspots, regardless of their location; in other words, the effects of solar emanations under the electron theory would, it is thought, be diffused, and not confined to any particular direction.

The incidence of magnetic storms is a problem full of complexity. It is generally recognised that magnetic disturbances follow a course which directly accords with the sunspot cycle, the average period of which is about 11·1 years. The writer pointed out, however, in the course of a paper read before the British Astronomical Association on December 28th, 1921, that with the exception of the magnetic storm of September, 1859, all the greatest of these storms affecting the telegraphs occurred on dates which differed by several years from the periods of maxima and minima, viz.:—

Date of Storm.	Sunspot. Maxima.	Minima.
September 1st, 1859	1860·1	1856·0
August 3rd, 1872	1870·6	1867·2
November 17th, 1882	1883·9	1878·9
February 14th, 1892	1894·1	1889·6
October 31st, 1903	1906·1	1901·7
September 25th, 1909 / August 11th, 1919 / May 15th, 1921	1917·1	1913·1

He also drew attention to a curious point in connection with the solar corona. As is well known, coronal streamers exhibit electrical conditions, in which circumstances it is surprising to find that these streamers usually extend to some thousands of miles only at periods of sunspot maxima, but at periods of sunspot minima they reach into millions of miles, probably exceeding the distance between the sun and the earth; the very opposite of that which we should expect in view of the general coincidence between magnetic disturbances and the sunspot cycles if we exclude the erratic severe storms to which allusion has been made.

The whole subject is an enormous one, and full of fascination. In the electronic theory we perceive much that enhances our knowledge by clearing up some of our earlier difficulties in arriving at a clear conception of the thing with which we have to deal; but the writer joins with Mr. Sayers in thinking that there remain considerable discrepancies which require elucidation.—I am, etc.,

ARTHUR E. COTTERELL.

Beckenham.
October 2nd.

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ELECTRONS AND THE ETHER.

To the Editor of THE ELECTRICIAN.

SIR,—My thanks are due to Mr. Awbery for his endeavour to meet the difficulties of reconciling the electron theory with electro-magnetic theory. But his diagnosis of their origin—"a confusion between ether and matter"—is incorrect, consequently they are not "easily resolved" by any explanations, but left exactly as before.

The statement that the magnetic field in a beam of light is due to the motions of the electrons in the source of light is similar to the statement that the sound of a distant bell is due to the motions of the bell. But if the bell is in a vacuum there is no distant sound, whatever the motions of the bell metal.

The root difficulty is not that the electron theory fails to give a complete account of the mechanism the workings of which are expressed by electro-magnetic theory, but that the partial account of that mechanism which it purports to give appears to conflict with electro-magnetic theory. It is all very well to say that "the electron theory is not concerned with electro-magnetic fields," but unless we are the victims of an illusion, electrostatic and electro-magnetic phenomena are different aspects of the workings of a single mechanism, and no account or description—partial or complete—of that mechanism can be satisfactory while it appears to conflict with our knowledge of those workings.

The present position resembles that of having a knowledge of the movements of an animal but no knowledge of its anatomy beyond the existence of its bones. Ignorant of the very existence of muscles, nerves, and cartilages, we could not reconcile the known facts of movement with the stone-life inertness of the bones.

I faintly hoped that my statement of the apparent conflict might have elicited an intimation of a thinkable connection between the electron and the electro-magnetic theories. Until such a thinkable connection is adumbrated, only a confession of ignorance fits the case.

Unless I have failed to understand Mr. Awbery's explanations altogether, they amount to such a confession.—I am, etc.,

HENRY M. SAYERS.

THE ELECTRICITY AGE.

To the Editor of THE ELECTRICIAN.

SIR,—From Mr. Bowden's reply to my letter in your issue of October 5th, it appears that the practice at Poplar with regard to stand-by coal is—that required to keep the steam range alive, etc., instead of the orthodox conception, viz., that required to keep the plant running idle.

The trouble arises, as Mr. Bowden points out, from mixing up the running plant load factor with the station load factor. With 100 per cent. station load factor these two terms may be identical, but with anything less, say 30 per cent. station load factor, the running plant load factor may be, say, 70 per cent., depending on the sizes of generating units and the character of the load.

The point of Mr. Bowden's article is apparently to demonstrate what may be expected from 100 per cent. station load factor, from the actual results obtained with 30 per cent. load factor.

Now the actual results at 30 per cent. station load factor are given as 2·223 lb. per kWh "running coal" (which, by the way, is a mixture of running and stand-by coal), and this is obtained from plant operating at something under 100 per cent. running plant load factor. When 100 per cent. station load factor is obtained, 100 per cent. running plant load factor may result, and the "running coal" per kWh should be less than 2·223 lb. It appears, therefore, that Mr. Bowden's estimate is too high.

Mr. Bowden takes exception to my reference to his article as an "interesting speculation," but he will see from the above that I am not seeking to discourage his scheme of hot-water supply. On the contrary, if he will take "running coal" as that required to produce current, after the machines are running (it may be perhaps under 2 lb.), and charge all the rest as "stand-by coal," this "stand-by coal" may be distributed amongst consumers according to the degree in which they compel its consumption, and a tariff at a competitive price, with gas for hot water, may result. And this without achieving 100 per cent. station load factor.

As to the 100 per cent. station load factor, candidly I do not see much promise. Mr. Bell of Hammersmith has for years been working on these lines and has encountered several practical difficulties, though he only aims at 100 per cent. load factor in domestic houses. 100 per cent. load factor in an important section of the demand is quite a possibility, and worthy of the best efforts in producing suitable apparatus, and in framing sound and attractive tariffs.—I am, etc.,

J. RUTHERFORD BLAIKIE.

Bedford.
October 12th.

Houses for Heroes.

Hackney's Latest Electrical Enterprise.

The houses at Wattisfield Road, Clapton, which are to be officially opened by H.R.H. the Duke of Connaught to-morrow (Saturday), are Hackney's contribution to the problem of providing living accommodation for those who fought and suffered in the Great War. They are built round a tastefully laid out quadrangle facing the South Mill Fields and consist of six cottages and two blocks of two flats. The chairman and Council of the Disabled Soldiers' and Sailors' (Hackney) Foundation are to be congratulated not only on the form of war memorial that they have chosen, but on having the enterprise to equip these houses according to "all-electric" ideas.

Both houses and flats have the same accommodation, a living room and three bedrooms. There is one bedroom on the ground floor for the use of the disabled man; there are no front steps and all doors are made wide enough to admit a wheel chair. Accommodation for eight of these wheel chairs is provided in a suitable garage, and this will be necessary as all the occupants of these houses, with the exception of one, have had the misfortune to lose a leg.

The All-Electric Idea.

As the houses are "all-electric," chimneys are unnecessary, a fact which has reduced the cost of construction. The electrical equipment consists of a light in every room, a cooker, a water heater, a copper for laundry purposes and a heater which can be moved from room to room. As a concession to the Englishman's love of an open fire, a grate is provided in the sitting room, the heat from which can be used to heat water during the winter months.

All the electrical work has been carried out by the Hackney Borough Electricity Department, under the supervision of Mr. L. L. Robinson, borough electrical engineer, and the materials employed are of the very best quality. Payment for the electricity used will be by means of two pre-payment meters at the rate of 8d. per unit for light and 1½d. for heating and cooking. These rates will cover the cost of erecting, the rent and maintenance of the electrical installation. The rent of the houses is 6s. 6d. per week, a sum which about covers the rates.

The money necessary for the foundation of this interesting scheme has been subscribed locally and the whole forms an example which might be followed in other parts of the country, especially where electricity is available.

Imperial Research.

Lord Salisbury on the Need for Co-operation.

In the course of a statement to the Imperial Economic Conference with regard to the Department of Scientific and Industrial Research, Lord SALISBURY, Lord President of the Council, said that the whole attitude of the Government towards research had changed during the last twenty years. Research, it had become more and more accepted, was an essential element in the industrial progress of the country, and there had grown up in Great Britain an organisation which was gradually developing and becoming perfected. In connection with research, there was first the broad question of standards, then direct work for the Government service, and finally work for commercial and industrial purposes. As regards the latter, private enterprise was more likely to be more efficient than a Government Department. On the other hand, the latter had access to information which was not available to private firms, they were able to call upon the services of experts more easily and to undertake research that was not immediately remunerative. The Government wanted to get the Dominions to contribute to the common stock of the knowledge that was being acquired, and they could contribute, owing to the differences in climate, soil and opportunities, data which could not be obtained in this country. He sketched the organisation that now existed for research purposes.

In the course of the discussion the view was expressed that the utmost research should be undertaken both in the Dominions and in this country. A Committee was set up to inquire into the best method of pooling information and making it available Imperially. It was stated up till now there had been a good deal of overlapping, and an insufficient communication of information.

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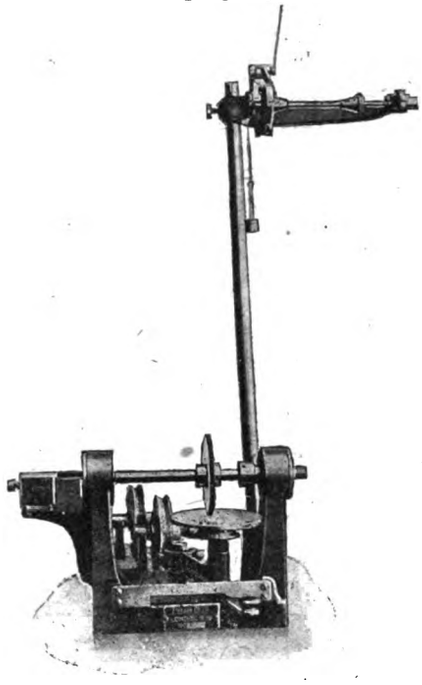
A High Speed Winding Machine for Small Wires.

A neat type of variable speed winding machine which will wind almost any type of transformer, telephone or other small coil for electrical purposes, has been devised by the PLESSEY CO., of Vicarage Lane, Ilford. The chief feature of this machine which is illustrated herewith, is the variable speed friction drive which consists of a driving disc held in a pivoted gun-metal bearing so that both vertical and horizontal movement of the disc is obtainable. The disc drives a friction wheel which consists of a leather disc clamped to a steel pulley mounted on the coil winding spindle.

The first disc which is driven by a leather belt and pulley is at starting moved up into contact with the friction wheel, contact being at first made between the periphery of the wheel and the centre



VIEW OF PLESSEY HIGH SPEED WINDING MACHINE.

of the disc. By means of a handle the disc is then given a horizontal motion outwards towards its circumference so that a smooth acceleration up to a maximum speed of 2 000 revs. per min. is obtained. The disc and pulley are in one piece so that the pull of the belt serves to tighten the contact between the wheel and disc.

It is claimed that the uniform acceleration thus obtained eliminates breakages and that fine wire (No. 48 gauge) can be wound at high speed.

The spindle (which runs in ball bearings) carries the coil winding mandrel at one end, and at the other a trip counter is fitted which is driven through a 3 to 1 reduction gear. The unrolling bracket has a porcelain guide and adjustable tension device which exerts an even pull on the running wire. The unrolling bracket allows a bobbin of wire 3 in. in diam. by 3½ in. long to be used, and the nose of the coil winding spindle is screwed ½ in. B.S.F. for the coil mandrels.

A New Seal for Meters and Other Apparatus.

The problem of the design and manufacture of seals for securing meters and other apparatus, as well as packages of all kinds, from tampering, is one which attempts have been made to solve more or less successfully in many ways. On meters the lead disc type of seal has, of course, been usually employed, but it is not "tamper proof," and would probably be discarded if a reliable substitute could be found. This substitute, it is claimed, is provided by the stud locking seal made by the DECORATED METAL MANUFACTURING CO.

This seal in embryo is a metal strip 0·5 in. wide and about 4 in. long. At one end of the strip are three studs, the two outer ones being female and the centre one male. This centre stud is slotted and in the slot is placed the sealing wire. For securing purposes the outer female stud is folded over the first stud and its containing wire and is capped by the third stud. The combination is then crushed together by a special tool, so that the shoulders of the slotted male stud are forced inward and firmly hold the wire. The other two studs are also forced together so that a triple protection is provided.

A second type of seal consists of a similar strip of metal with a male and female stud at one end and a hole at the other. The inner, or male stud, is passed through the hole and is then capped with the outer stud, the whole being crushed together. It is claimed that this type of stud is particularly efficient for use on meters.

A New Way of Lighting Work Benches.

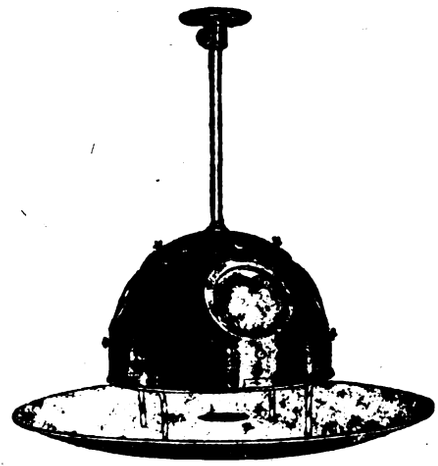
The B.T.H. Universal Bench Light.

The satisfactory and economical lighting of work benches has always been something of a problem. That operatives in the winter often lose a great deal of time every day through inefficient lighting is well known, while, to be completely effective as a substitute for good daylight, artificial illumination must be of high intensity, glareless and properly directed. It is not always easy to combine these three characteristics.

In an attempt to solve these related problems THE BRITISH THOMSON-HOUSTON CO. have evolved, after prolonged and careful investigation, a bench light standard called the "Universal Bench Light." This device is, it is claimed, an improvement on anything of its kind now in use. It is especially suitable for the illumination of machines that are employed in groups on benches, as in boot and clothing factories where the eyes of the machinist are of necessity fixed on one spot, and where the closeness of the work requires powerful but glareless illumination. The main features of this equipment are given below.

The equipment which we illustrate is designed to perform a triple function—firstly, the illumination of the working points at high intensity; secondly, the illumination of the bench at medium intensity; thirdly, the general illumination of the room at low intensity.

The fitting consists of two essential portions:—(A) The body, containing lampholder and furnished with four condensing lenses spaced radially round the lamp, this body being mounted on an adjustable support or stem intended for attachment to the top of the bench; and (B) an over-reflector, fixed on the top and slightly above the body, diffusing the upward light over the bench and having a central opening fitted with diffusing glass for the general illumination of the apartment.



GENERAL VIEW OF THE B.T.H. UNIVERSAL BENCH LIGHT.

The body consists of an aluminium spinning with an all-porcelain lampholder mounted on a central tube (an extension of the stem) and having four openings placed in pairs diametrically opposite one another. Each of these openings is provided with an adjustable housing carrying condensing lens and diffusing glass at such a distance from the lamp that the lamp filament (occupying a central position) is focused by the lens and a powerful beam of light consequently projected therefrom. Universal adjustment (to a limited degree) permits of the direction of the beam being altered to some extent. The stem, which is rigidly attached to this body, passes through a base-plate (for attachment to the bench) and is capable of vertical and rotary adjustment therein.

Four stalks attached to the body support the over-reflector so that it is carried in such a position that the upward light from the lamp can pass up, and is then reflected down by the reflector, without the lamp, itself being visible from normal positions. As already mentioned, a diffusing glass is fixed in an opening in the centre of this reflector, which permits a small amount of the light from the lamp to pass directly upwards to illuminate the ceiling or roof of the room.

When the fitting is fixed in its correct position, four concentrated beams of light are obtained, one of which may be directed to the working point of each of four machines. By this means a high intensity of light (in the neighbourhood of 60 foot candles) is projected on the working points of four machines, while at the same time the bench is generally illuminated all from a single lamp.

This device is at present made in one size only, suitable for 100 W projector type lamp. The standard finish is grey enamel, with the reflecting parts white and the small parts nickel plated.

Although Belgian offers were slightly lower, Dundee Electricity Committee has accepted BRITISH OFFERS TO SUPPLY CABLE. The following were the respective prices for three lots of cable:—Belgian, £100; British, £101 10s.; Belgian, £242; British, £255 4s.; Belgian, £171 10s.; British, £188 10s.

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Merchandise to Sell and Profit By.

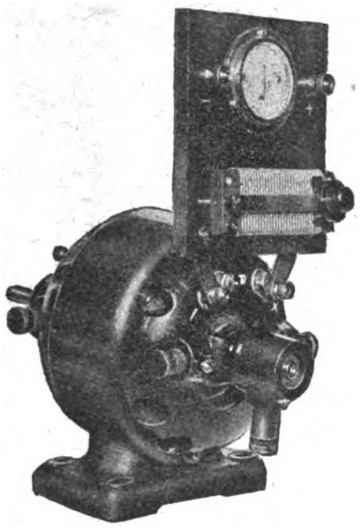
In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

The "Ella" Converter.

We recently referred to the Ella converter for charging accumulators from d.c. circuits, and gave some particulars of the machine. We have now been advised by LIONEL ROBINSON AND CO., the distributors, that they are in a position to supply this convertor with a control panel. In our opinion this new development is a step in the right direction, not only from an electrical point of view, but from the aspect that it will add to the usefulness and

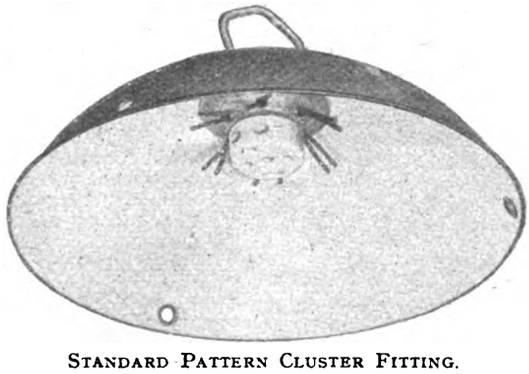


ONE OF THE PATTERNS OF "ELLA" CONVERTER.

"domesticity" of the machine, particularly as the control panel is supplied at a comparatively small addition to the list price. The design of the converter has not been altered in any way from the machine which we described in these columns quite recently. Two types of control panels can be supplied, known as No. 1 and No. 2 respectively. No. 1 is fitted with an ammeter, as shown in our illustration, and No. 2 panel is fitted with a voltmeter in addition.

D. and S. Cargo Clusters.

The knowledge of how to buy the right goods in the right market will make more than anything else for success on the contracting and retailing sides of the industry. Sales propaganda, advertising, and the like are all rendered ineffectual if the buyer does not know where to buy. Every item in the programme must be purchased with discrimination and care. Cargo clusters, although they are so well



STANDARD PATTERN CLUSTER FITTING.

known, and are almost a "bread and cheese" line, are no exception. It is for this reason that we draw attention to the range of cargo clusters manufactured by DORMAN AND SMITH in their new catalogue No. 99, which they recently issued. There is an almost inexhaustible range of types and sizes for every job. The fitting we illustrate is the standard pattern Y type cluster fitting. The handle and body are of galvanised iron, and the reflector is of sheet steel enamelled blue on the outside and white on the inside. An insulating gland is provided for the outgoing cable, and the wiring terminals are enclosed in a substantial porcelain block.

More Business from Moorwood.

It cannot be said that immersion heaters are finding a market with the public and that in consequence they are a good line of merchandise to sell and profit by. This is due to the fact that electrical contractors and retailers themselves do not appreciate the domestic usefulness of these heaters, and therefore no serious attempt is being made to put them before the public. In fact, this is one of the many pieces of electrical apparatus which is regarded too narrowly as electrical apparatus instead of as domestic labour saving devices. The principle of the several types of immersion heaters on the market is well known, and need not be commented upon here. One of the most useful and novel adaptations of the heater which has come to our notice is the "Moorwood" clip pattern, which we illustrate. As will be seen, the complete device consists of an immersion heater, which is clipped to the side of a pail or tank by means of the holder shown. This holder maintains the heater in an upright position in the centre of the pail, and not only serves to keep the heater in position, but ensures a good distribution of heat. A short length of flexible metallic tubing

MOORWOOD "CLIP" IMMERSION HEATER.

prevents the connection flexible from trailing in the liquid being heated. MOORWOODS, LTD., the manufacturers of this device, claim that the heater will boil one gallon of water in twenty minutes. It is of interest to mention that the list price of the device, complete with clip or holder, is 40s.

"Mistake-proof" Switch Gear.

We illustrate the Prescot "mistake-proof" combined ironclad switch and fuse, which has just been placed upon the market by BRITISH INSULATED AND HELSBY CABLES. It has been primarily designed for house service work, but this is not the limit of its usefulness and it will be found to be a compact piece of switch gear for general employment. It has a quick break action, and the design of the whole unit is such that it is impossible to open the cover of the fuse chamber while the switch is on or to switch on while the cover is open. Further, all live parts are adequately protected, so that when the hinge cover on the fuse chamber is open they cannot be touched. Judging from the makers' catalogue, No. B183, the switch is only made in four capacities, namely, one size for circuits up to 250 V and three for circuits up to 600 V. Many varying combinations can be supplied for feeder cable entries for various types of cables. There are no less than four different combinations offered, and in each case the switch can be supplied with the feeder cable fittings arranged for cables entering vertically, horizontally, and straight through horizontally. The range also includes three sizes for circuits up to 500 V in 50 A and 150 A sizes. Each of these capacities can be supplied with varying combinations of cable fittings. It is of interest for us to draw attention to the fact that the manufacturers classify this new piece of switch gear as "mistake-proof." In our opinion this is an advance on the use of the word

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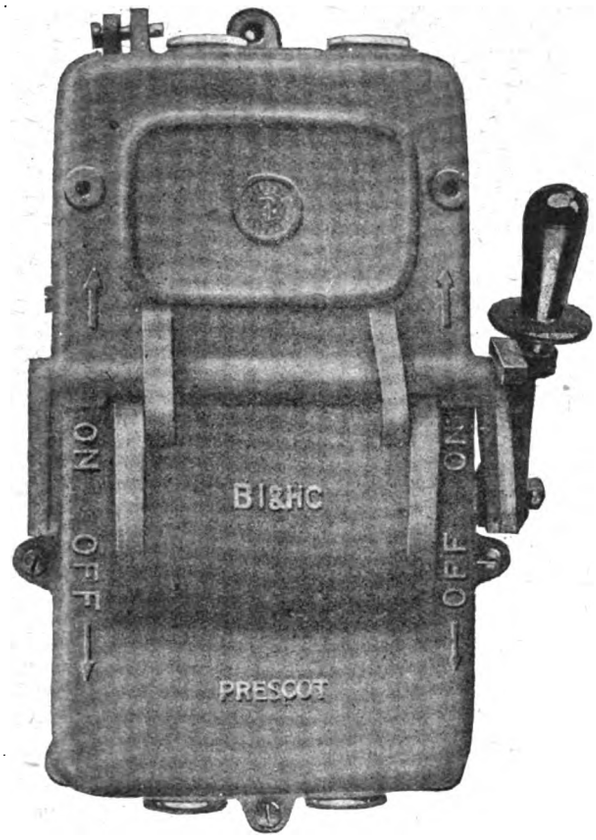
" fool-proof." This latter word has been used so much over the past few years that its real meaning has been lost, and, strictly speaking, it is questionable whether it is possible to make a piece of apparatus that is really fool-proof, that is to say, proof against fools. Further,

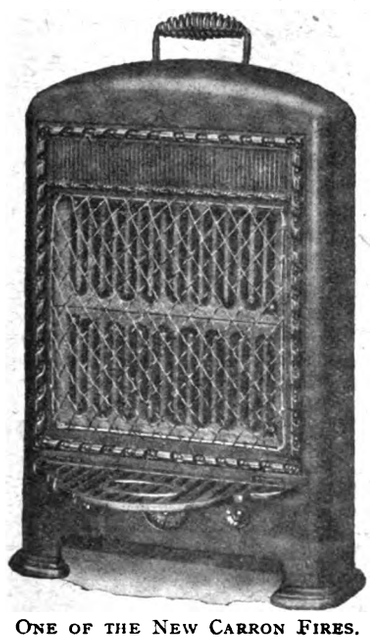


PRESCOT " MISTAKE-PROOF " SWITCH.

it has become an increasing practice to put on the market apparatus poor in quality and detail all under the cover of the word " fool-proof."

Carron Fires.

In our review of recent electric fires in the Autumn Trade Promotion Number of THE ELECTRICIAN, we referred to the fires manufactured by the CARRON Co. We made mention of two new



ONE OF THE NEW CARRON FIRES.

designs and gave brief particulars of them, but we were not able to illustrate the fires. We now illustrate the new Carron Co. 229 fire. The design is homely and will appeal to domestic buyers who must have " something different."

The most recent publicity issued by GENERAL ELECTRIC Co. includes a folder bearing No. F3079, describing with prices the " Gecoray " reflector for shop window lighting.

"Burco" Washing Boiler.

We welcome news from manufacturers that they are marketing a new electric boiler or washer. We have expressed the view ere this that any contribution towards new or perfected apparatus to the solution of the problem of water boiling by electricity is worthy of mention. Time and experience must, of course, be the main

THE LATEST ELECTRIC GEYSER BOILER.

factors on which any new apparatus will be judged, but, none the less, new apparatus merits the attention of all who are concerned with this side of electrical merchandising and contracting work. The " Burco " boiler which we illustrate can be briefly described, but further information can be gleaned from the price list of the manufacturers, BURNLEY COMPONENTS, LTD. The boiler holds approximately nine gallons, the pan and condenser being made of solid copper. The maximum loading is 3 kW, with 7-heat regulation.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

" Highlow " electric radiators are described in a new price list No. 923, just published by ARCHIBALD LOW AND SONS.

The Cambridge Projection Unipivot is the subject of a mailing card which the CAMBRIDGE AND PAUL INSTRUMENT Co have just published.

We are indebted to A. H. HUNT for advising us of the issue of a new leaflet, No. 142, describing " Hellesen " low tension dry batteries for valves.

Buyers who have need to know the latest development in the art of sawing metal will welcome the booklet published by EDWARD G. HERBERT. It describes the " Radipor " method of sawing.

The routine records of any buyer's office are not complete unless

Readers of THE ELECTRICIAN who look forward to the regular issue of the " M and C. Machine Mining," should not delay in securing a copy of the descriptive publication just issued by MAVOR AND COULSON.

they include the name of JENSON AND NICHOLSON as one of the best sources of supply for insulating varnishes, enamels, etc. The company have recently published a new booklet on this subject.

The MULLARD RADIO VALVE Co. announce the issue of publication MW1, describing the Mullard Wecovalve. The commercial development of this new valve is a sign post to the great future for wireless merchandising. We shall comment on this subject in more appropriate columns at an early date.

Test Room engineers and buyers interested in test room apparatus will realise at once the usefulness of the test room rheostat which DONOVAN AND Co. have just placed upon the market. We hope to give a more detailed description of the rheostat at an early date ; in the meantime the manufacturers will be pleased to forward illustrated sheet No. 24 923 on request.

SIEMENS BROS. AND Co. announce the issue of two catalogues which will be of more than passing interest to many readers of THE ELECTRICIAN. Catalogue No. 595, entitled " Accessories for wireless installations," is in perfect apposition to what the trade wants in first-class wireless merchandise. We hope to refer to some of the lines in this list in our " Merchandise to sell and profit by " columns at a very early date. " Paper-insulated cables " is the subject of catalogue No. 150.

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Empire Cable and Wireless Services.

Postmaster-General's Statement on the Position.

At the Imperial Economic Conference on Tuesday the proceedings included a discussion on industrial research and a statement by the Postmaster-General on the Empire's cable and wireless services in which the point was made that the proper function of wireless was to supplement rather than to supplant communication by cable. The conference took the view that the development of communications should be pressed forward and expressed the opinion that in any concessions given in the Empire to private enterprise in respect of cable or wireless services, preference should be given to British-owned companies. It was also resolved that all possible notice should be given by the Governments of the Empire to the State-owned Atlantic cable route which has now been provided.

Opening the discussion on industrial research, Lord Salisbury reviewed the work of the Department of Scientific and Industrial Research and pointed out that, unlike private enterprise, the Government could pursue failures which ultimately became successes for a length of time which would be impossible under commercial conditions. A committee was appointed to consider how the work of the Department could best be made available to the whole Empire.

Development of Cable Service.

Reviewing the developments made or contemplated in the cable services, the Postmaster-General claimed that our telegraphic communications had been restored almost, if not quite, to pre-war regularity and efficiency. He referred to the problem of providing an alternative route between Vancouver and Fanning Island, and between Fanning Island and Fiji. Experiments had been carried out by the Pacific Cable Board to test the possibility of a wireless service as an alternative means of communication between Vancouver and either Fiji or Fanning, and in the light of these experiments the Board would be able to decide whether wireless or a duplication of the cable was the most promising policy. Additional capacity, whether by wireless or cable, was urgently required on this route, and although the present traffic could be carried efficiently, the absence of spare capacity was a bar to the reduction of rates.

Dealing with recent improvements in the Far East cables, the Postmaster-General said it was difficult to over-estimate the debt the Empire owed to the Eastern Telegraph Co. and its associated companies, who were the pioneers of British cable enterprise. It was a significant example of the enterprise which the company had always shown that it should have been able and ready to spend the sums, running into several millions, involved in the provision of two new cables almost to the farthest ends of the Empire.

North West Indies Cable.

Cable communications were not so satisfactory in the West Indies, continued Sir Worthington-Evans, but a new scheme had been practically agreed upon which involved the provision of a new cable from Turk's Island to Barbados, whence it would bifurcate to Trinidad and to British Guiana. The smaller islands would be served by a number of wireless stations subsidiary to the cable, which would connect with a central station at Barbados. The new cable would also connect with Canada *via* the Halifax-Bermuda cable. Tenders were on the point of being invited for the cable required, and he hoped the order would be placed in a few weeks' time.

Reduction of Rates.

Generally speaking, the cable companies had willingly fallen in with the Imperial and Colonial Governments' policy of gradual rate reductions, but developments in this direction had been hampered by the war and by the economic factors governing post-war operations. After referring to recent reductions, the Postmaster-General hoped that the process of reduction would continue. He also hoped that the Canadian and Australian Prime Ministers would send all the traffic over which they had control *via* the Imperial route, which was certainly not inferior to its competitors, either in speed or in accuracy.

Proper Function of Wireless.

While there could be no fundamental difference of opinion as to the importance of wireless services, some enthusiasts anticipated that wireless would supplant communication by cable, but he thought its proper function and probable development was rather to supplement than to supplant cable communication. In the present stage of wireless science it certainly did not provide either as accurate, or as reliable, or as swift communication as cables, and it was, moreover, open to interception. All, however, recognised its enormous potentialities, and the provision of up-to-date wireless service would increase the existing capacity of our means of Imperial communication, and tend ultimately to the reduction of rates.

The Government and the Marconi Co.

Dealing with the negotations between the Government and the Marconi Co., the Postmaster-General said he did not wish to press a scheme of joint working on the company if they were definitely opposed to it, and he had indicated that the Government would be prepared to divide the services on what might be called a regional basis, so that the services for Canada and South Africa, for example, should be conducted by the Government stations, leaving those for India and Australia to be conducted by the Marconi Co.'s station. The Government station was to be erected partly for commercial and partly for strategic reasons. It was essential that in parting with the monopoly which the Government possessed by statute it should secure that a sufficient amount of commercial traffic was reserved for the station to operate. Provided this was secured, he would be ready to meet, as far as possible, any views which the Marconi Co. submitted.

Imperial Telegraphy and the Press.

Empire Press Unions' Wireless Protest.

With a view to the improvement of Press communication by cable and wireless telegraphy throughout the British Empire, the Council of the Empire Press Union met on Tuesday and agreed that the Union should have an opportunity of laying its views before the Imperial Conference. Mr. Robert Donald, who presided, said the British Empire had apparently lost any chance in the near future of getting the supremacy of wireless in the Pacific, and it had lost its position in the Far East and in Europe. The longer the delay the more difficult it was to get favourable wave lengths. They were being divided up, and we were not in it. Anyone in East Australia had to get news by French and German wireless. Lord Burnham described the present position as deplorable. If the Government's wireless enterprise was not likely for some years to be easy and profitable to operate, why should not the Government allow it to be undertaken by private enterprise? If the Government reserved the right of purchase after a number of years he thought the public interest would be safeguarded.

Developing Empire Trade.

Fine Reception of F.B.I. Empire Resources Survey.

Business men of all grades have received with interest the announcement made last week that the Federation of British Industries, with Ernest Benn, Ltd. (Benn Brothers) as publishers, are compiling a large survey, in twelve volumes, of the Empire's resources.

The field which will be covered by the twelve volumes is enormous, and the comprehensive manner in which the needs of producers, manufacturers and merchants will be catered for has been widely commended. The work is planned to cover the whole Empire, and is arranged as far as possible by industries. Within these industrial groupings, to each of which a separate volume will be given, the products, the requirements, and the undeveloped resources of the different parts of the Empire will be treated.

The paramount aim of the Federation and of the publishers is to help directly and immediately in the development of Inter-Imperial Trade, and no information will be included in the Survey which is not felt to be of practical value to producers, manufacturers, merchants or bankers within the Empire. It will be at once apparent in view of the interest which will be aroused by the British Empire Exhibition next year, and the fillip that Inter-Imperial trade will receive as the result of the deliberations of the overseas Premiers, now in London, that this publication is most opportune.

It has been suggested in some quarters that the interests of those who deal mainly in manufactured articles are inadequately provided for in the scheme. This, however, is quite incorrect, as all the relevant manufactured materials will be included.

There will be a limited space in each of the volumes for advertisements.

Life of Chloride Accumulators.

Reliability for Country House Lighting.

As indicating the long life and reliability of Chloride accumulators for country house lighting, the following extracts from a letter recently received by a Manchester firm of manufacturers is of interest:—"My storage battery of 15 cells, 7 plates, S type, put in April, 1909, has given me the greatest satisfaction and no trouble, but unfortunately about 18 months' ago I found it impossible to run the plant, and the cells were left standing. I have commenced to run it again, and so far the cells seem wonderful; now would you advise me to put a little acid in? They have had nothing but distilled water all these years. If they need acid will you kindly forward me a carboy. A month or two after I closed the plant down an electrical expert who saw the cells would hardly believe me when I told him the number of years they had been in; they were in such perfect condition, although they had been in the hands of an amateur all the time."

Reminiscences of a Pioneer.

Honours for the Prevention of Electric Lighting.

In the autumn number of the "M. and C. Apprentices' Magazine," Mr. Henry Edmunds continues his interesting reminiscences of the development of electricity for lighting and industrial purposes. He relates how in 1892 he had occasion to call at a house in the Herne Hill district. While waiting to see the owner of the house his attention was drawn to an illuminated address on the wall, in which there appeared to be some reference to electric lighting. He was much startled, he states, to read that the gentleman who had received this address was thanked on behalf of the district for his successful efforts in preventing the introduction of electric lighting into that locality!

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Electrical Trade in September.

Exports Increased by £188 250.

We give below, in a new and more convenient form, our monthly summary of the Board of Trade returns of imports and exports of electrical goods. The increases and decreases are not stated as heretofore, but these can easily be arrived at by comparing the first and second columns of figures to ascertain the differences for the month, and by comparing the third and fourth columns to find those for the nine months from January to September inclusive.

It will be noticed that the imports for the month under review show a large percentage of increase, but it is satisfactory to note that the exports, which also show a considerable increase, are much greater in volume. The same remarks apply in some degree to the figures for the nine months, the aggregate exports amounting to over 8¾ million pounds, compared with imports valued at less than 2½ millions. It appears, therefore, that Great Britain is holding her own in the world's markets so far as electrical goods are concerned.

Bigger Imports of Telephone Apparatus.

	Month of September.		Nine Months.	
	1922.	1923.	1922.	1923.
	£	£	£	£
Electrical Machinery	7 144	100 938	983 220	779 729
Electric Wires and Cables, Insulated—				
Rubber Insulated (other than Telegraph or Telephone)	13 506	13 260	80 511	87 126
Insulation other than Rubber (not other than Telegraph or Telephone)	12 031	21 973	58 945	109 376
Telegraph and Telephone Wires and Cables (not Submarine)	1 997	3 423	21 149	64 690
Submarine Telegraph and Telephone Cables	—	—	—	—
Telegraph and Telephone Instruments and Apparatus (except wireless valves)	23 899	42 067	191 073	377 193
Carbons	1 172	8 776	24 857	57 163
Electric Glow Lamps and parts	14 375	17 912	123 419	135 236
Arc Lamps and Searchlights	493	193	782	2 882
Parts of Arc Lamps and Searchlights	1 302	636	9 351	10 275
Batteries and parts	18 613	17 992	77 101	103 136
Electrical Instruments, Scientific and Commercial (including ammeters, voltmeters, etc.) and House Service Meters	5 233	6 693	50 087	70 401
Switchboards	—	—	2 426	1 927
Electrical Goods and Apparatus, all other Sorts	36 867	84 303	358 762	620 703
Total of Electrical Machinery, Apparatus and Material	136 632	318 166	1 981 683	2 419 837

Improvement in Wire and Cable Exports.

	Month of September.		Nine Months.	
	1922.	1923.	1922.	1923.
	£	£	£	£
Electrical Machinery—				
Railway and Tramway Motors	19 484	30 855	136 790	239 809
Other Motors and Generators	117 614	166 596	1 667 365	1 404 831
All other Sorts	116 767	137 615	1 418 154	1 133 176
Electric Wires and Cables Insulated—				
Rubber Insulated (other than Telegraph or Telephone	61 463	104 415	489 608	763 899
Insulations other than Rubber (other than Telegraph or Telephone)	64 077	74 084	773 272	666 958
Telegraph and Telephone Wires and Cables (not Submarine)	30 818	63 362	421 029	636 150
Submarine Telegraph and Telephone Cables	4 956	46 223	251 705	583 681
Telegraph and Telephone Instruments and Apparatus (except Wireless Valves)	154 215	107 557	1 451 590	1 324 503
Carbons	6 691	4 093	39 610	46 751
Electric Glow Lamps	28 503	35 258	283 298	244 294
Arc Lamps and Searchlights	350	211	4 590	5 366
Parts of Arc Lamps and Searchlights	343	45	5 027	1 719
Batteries and Parts	44 014	46 030	350 660	390 615
Electrical Instruments, Scientific and Commercial (including Ammeters, Voltmeters, etc.) and House Service Meters	19 840	28 504	244 894	245 327
Switchboards	8 961	9 239	180 411	81 577
Electrical Goods and Apparatus, all other Sorts	99 911	163 173	885 746	1 045 626
Total of Electrical Machinery, Apparatus and Material	778 007	966 260	8 304 649	8 817 282

Electricity on the Continent.

Some Impressions of a Recent Tour.

Lecturing last week on "Trade on the Continent," Mr. T. M. Sparks, Editor of "The Hardware Trade Journal," mentioned that many of the Viennese shops made very excellent window displays of electrical equipment, particularly lighting fittings and stoves. The design of many of the lighting schemes was of a high order, and some of the shades were remarkably good. Referring to the strange mixture of Eastern and Western ideas in Croatia, Mr. Sparks said that Zagreb had a very fine electric tramway system. In Italy, he was very interested to observe the extensive use to which electricity had been put. Not only was this evidenced in Rome and its outlying districts, but in Venice and Florence. Everyone seemed to use electricity, the exploitation of water-power resources having made its generation very cheap. The lecturer mentioned an interesting combination of ancient and modern in the Michael Angelo bridge over the Arno in Florence, the features of which are thrown into relief at night by the most modern form of lighting—electricity.

Grants for Electricity Undertakings.

Financial Assistance for Public Utility Works.

As previously announced in THE ELECTRICIAN, the Government has formulated proposals designed to provide employment in depressed industries by stimulating the acceleration of work by companies operating undertakings of a public utility character.

It has accordingly been decided to extend to such companies as are prepared to commence during the coming winter works that would not otherwise be undertaken at the present time, financial assistance in respect of revenue-producing works similar to those undertaken by local authorities. Such works would include electricity, tramways, gas, water, docks, harbours and canals.

Qualification for the Grant

The terms on which Government assistance will be granted to approved works are as follows:—(1) Works which would not be proceeded with at the present time, apart from the pressing need for relieving unemployment, are alone eligible. (2) The works in respect of which assistance is desired must be of a public utility character, *e.g.*, electricity, tramways, gas, water, docks, harbours and canals. (3) The works must be of such a nature as will afford employment during the coming winter in industries at present affected by severe unemployment. (4) The Committee will require to satisfy themselves as to the reasonableness of the tender accepted for the works. It will be a condition of all contracts that the material employed shall be of British manufacture. (5) Assistance will be limited to a maximum of 50 per cent. of the interest on the expenditure, as and when incurred, out of capital raised, and will normally be given only for the period during which the expenditure is not reasonably remunerative. (6) The undertaking will normally be required to submit to such limitations as to the distribution of profits, etc., during the period of assistance as may be necessary to secure in the opinion of the Committee that no undue advantage is taken of such assistance. Each case will in this respect be considered separately upon its merits. (7) The approval of the Committee will be required for the terms on which the capital is raised. (8) The Committee will require to be satisfied in such manner as may be mutually arranged without interfering with the company's responsibility for the execution of the works, that the work will be, or is being, satisfactorily carried out and in accordance with the foregoing conditions.

All applications should be addressed to the Secretary, Unemployment Grants Committee, 23, Buckingham Gate, London, S.W.1.

Lighting of Cinematograph Theatres.

Issue of New Home Office Regulations.

The Home Office has just issued revised Cinematograph Regulations, which can be obtained from H.M. Stationery Office (4d. net). The Regulations come into force at once, but in the case of buildings already licensed will not take full effect until the time of the renewal of the licences. In such cases, the licensee will only be required to comply with the provisions of the old Regulations.

In regard to electrical installations, the new Regulations provide that the safety lighting for the auditorium and any part of the building to which the public are admitted shall be supplied from a separate source from that of the general lighting of the premises and shall not be controllable from the enclosure. Regulation 14 is to a large extent new, and provides, *inter alia*, that the electrical installation shall be in charge of a competent person, whether the operator or another, and places upon the competent person the responsibility of seeing, before the beginning of a performance, that the electrical apparatus, including the projector circuits, is in proper working order. The new Regulation 15 consolidates the repealed Regulations (11, 12, and 13) relating to the use of electric light, limelight, and acetylene, and contains a number of new provisions which experience has shown to be necessary.

London Electrical Workers' Strike.

Early Resumption of Work Likely.

The strike of employees of Mann, Egerton and Co., who are working on the contract for the electrical re-conditioning of the Government offices in Whitehall, announced in our previous issue, seemed likely at the beginning of the week to involve further complications. An official of the Electrical Trades' Union informed a Press representative that "in the event of any 'blacklegs' being introduced to take the place of the men engaged in the dispute, the whole of the Office of Works engineering staff would become involved. This, he said, would affect all Government and Royal establishments under the jurisdiction of the First Commissioner of Works. The point taken up by the National Federated Electrical Association was that under their rules, as agreed with the Union, no stoppage of work must take place in the event of a dispute until the matter had been referred to a joint committee for investigation.

Although no definite agreement had been reached at the time of going to press, a representative of THE ELECTRICIAN was given to understand on Wednesday evening that the men would return to work on Thursday.

Members of the the Electrical Trades' Union employed by the Fulham Council are threatening to strike in sympathy with the Council's dustmen who are already on strike. It is understood that notices to cease work next Wednesday will be issued.

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Legal Intelligence.

Winding-up Orders.

Compulsory Liquidation of Wireless Firms.

In the Winding-up Court on Tuesday, Mr. Justice Romer made an order for the compulsory liquidation of Wireless Installations, Ltd., upon the petition of Rotax Motor Accessories, Ltd., Willesden, judgment creditors for £88 and costs. Counsel for the company said he could not oppose the petition so far as the company was concerned, but he wanted an adjournment on behalf of the debenture holders as negotiations were pending with a view to the company being reconstructed.

Mr. Justice Romer also made an order for the compulsory liquidation of Mitchell's Electrical and Wireless, Ltd., upon the petition of J. Stone & Co., Ltd., judgment creditors for £91.

False Pretences at Burnley.

Obtaining Telephone Wire by a Trick.

At Burnley, Harry Rowe, telephone wirer, pleaded guilty to obtaining by a trick from Ronald B. Beattie, electrician, a quantity of cable wire. He also admitted two charges of obtaining goods by false pretences from Mr. Beattie and Mr. W. Burrell. It was stated that Beattie went into shops and represented himself as an employee of a firm in order to obtain goods. The accused was placed on probation for two years.

Arising out of the case the police applied for an order against Mr. Cyril K. Hanbury, electrical contractor, Padiham Road, for the restitution of two coils of wire bought from accused. Mr. Cummings said Hanbury had no reason to believe Rowe had not come by the wire honestly. The Bench made the order asked for, and ordered Hanbury to pay £2 16s. costs, this including £2 2s. advocate's fee. The Chairman said the Justices considered he had shown negligence in making the purchases without full inquiry.

Unpaid Electric Light Bill.

Alleged Damage by an Electricity Supply Company.

In the Mayor's and City of London Court on Tuesday a claim was made by the County of London Electric Supply Co., Moorgate Court, Moorgate Place, against Mr. H. J. Pudney, 12, Melbourne Grove, East Dulwich, for £1 5s. for electrical energy supplied. Mr. H. Strouts, solicitor for the plaintiffs, said that the defendant wanted to raise a counter-claim, but none had been filed. The defendant said that his counter-claim was for the sum of 30s., part of an account which the water company had made him pay, and which was in respect of a burst water pipe, the damage having been done, defendant alleged, when the plaintiffs connected their main to his place. The defendant said 2½ years ago plaintiffs' traveller went to his shop and asked him if he would have electric light put in; this he agreed to. After the plaintiffs had done their work the water company came along and forced him to have a new stop-cock because of a leak. When this work was done it was discovered not to be the stop-cock but a burst pipe. He left the water company and the plaintiffs to fight the matter out. He contended that the burst pipe was damage caused by the plaintiffs. Mr. Registrar Dell said the defendant had to prove that the plaintiffs were responsible for the damage before he could recover against them. After hearing evidence for the plaintiffs the Registrar said he would strike the counter-claim out, judgment being entered for the plaintiffs for the amount claimed.

Wimbledon Council *v.* Mulholland.

The Right to a Supply of Electricity.

Arising out of a dispute between Wimbledon Borough Council and Mr. J. B. Mulholland, the proprietor of the local theatre, with regard to the supply of electricity by the Corporation to the theatre, Mr. Mulholland recently applied to the High Court for an order to restore the supply to his premises. The case came before Mr. Justice McCardie, but no report of the proceedings was available for publication at the time.

At a meeting of the Wimbledon Council the Town Clerk, Mr. H. Emerson Smith, said, in reply to inquiries as to the result of the proceedings, that the note on counsel's brief read: "By consent. Injunction discharged on defendants undertaking to continue until the trial of the action or further order, the supply of electricity to the plaintiff's theatre as heretofore until the plaintiff instals a suitable transformer for a limited supply, and thereafter a limited supply. The plaintiff undertakes to apply forthwith, under section 23 of the Electricity (Supply) Act, 1922, to the Electricity Commissioners or the proper authority for the appointment of an arbitrator, and to pay as from September 30th, 1923, for electricity so supplied whatever sum the said arbitrator awards as the proper sum to be paid for the stand-by supply for the plaintiff by the defendants. The arbitrator to determine what sum should have been paid to the defendants for electricity supplied between September 12th and October 1st, 1923. All costs in the cause."

A Bogus Electrician.

Series of Thefts from London Houses.

Sentence of twelve months' hard labour was passed at Westminster on Wednesday on George A. Wells, who stole valuables from houses to which he gained admission by representing himself as an electrician. He pleaded guilty to seven other similar charges.

North Wales Electricity Supply.

First Meeting of Joint Authority.

The first meeting of the North Wales and South Cheshire Joint Electricity Authority was held at Llandudno Town Hall last Friday.

Sir Harry Haward, who mentioned that this was the first joint authority established under the provisions of the Electricity Supply Acts, said the Commissioners were satisfied that the engineering developments at Cwm Dyli and Dolgarrog and the proposed development at Maentwrog were sound. The adoption of the North Wales Power Co.'s scheme would assure not only an ample supply of electricity to meet the requirements in the company's present area of supply, but a sufficient surplus for distribution to the rest of the district. They were further of opinion that it was only by such additional outlets for the Power Co.'s electrical energy that it was possible fully to develop the water power resources of North Wales on an economical basis. The Power Co. was undertaking very great responsibilities, and would need and should receive all the assistance which the Joint Authority could give it.

Mr. Arthur Hewitt, the chairman of the Llandudno Council, was unanimously elected chairman of the joint authority until April 1st, 1926, and Colonel F. A. Cortez Leigh (L.M. and S. Railway) was appointed vice-chairman for the same period. Mr. A. Conolly, clerk to the Llandudno Urban District Council, agreed to act as clerk *pro. tem.*

A resolution was adopted by which the joint authority approved of the transfer to the Power Co. of the powers, rights, and obligations specified in the Commissioners' Order of 1923, subject to the commissioners being satisfied that the Treasury would guarantee the loan to the Power Co.

*** Outlining the Government's schemes for alleviating unemployment on Tuesday, Sir Montague Barlow mentioned that the North Wales Power Co. would receive a guarantee up to £1 600 000.

Wireless Transmission.

A Useful Non-technical Treatise for Amateurs.

The subject of wireless transmission is one that has not apparently been dealt with in any of the text books, either technical or popular, which have hitherto been published. The publication of a new book on "The Principles and Practice of Wireless Transmission," by Mr. G. Parr, demonstrator in electrical engineering at the Finsbury Technical College (Ernest Benn, Ltd. (Benn Brothers), 5s. net), is therefore particularly opportune.

Written for the non-technical man in non-technical language, the work fulfils the author's object of bringing the subject down to the comprehension of the average amateur. In simple narrative form Mr. Parr explains what electric currents and electro-magnetism are, and deals with waves and wave motion, oscillation, and the difference between spark and continuous wave transmission. The working of thermionic valves is clearly explained, and there is a chapter on wireless telephony and the construction and use of the microphone.

Institution Notes.

On the nomination of the University of Bristol, Mr. ALEXANDER GEORGE OATES has been awarded an Industrial Bursary by the Royal Commission for the Exhibition of 1861.

The Yorkshire Centre of the INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION visited Rotherham last Thursday, when the party was conducted over the "Prince of Wales" power station by Mr. E. E. Cross.

Prof. J. A. Fleming will give a course of six lectures on "IONIC AND THERMIONIC VALVES" at University College, London, on Wednesdays at 5, beginning October 24th. The course is open to a limited number. A syllabus of the lectures and particulars as to fees can be obtained on application to the Secretary, University College, London, W.C.1.

As announced in our previous issue, the London meetings of the INSTITUTION OF ELECTRICAL ENGINEERS will be held at 6 p.m. throughout the session. An exception will, however, be made on November 29th when a joint discussion is to be held with the Physical Society on the subject of "Loud Speaking Telephones." On that occasion the meeting will take place in two sessions from 5.30 p.m. to 7.0 p.m. and from 8.0 p.m. to 9.30 p.m.

Newport's Electrical Exhibition.

Increased Use of Electric Cookers.

Organised by Mr. A. Nicholls Moore for the Newport Town Council electricity committee, an exhibition of domestic electrical appliances was opened by the Mayor of Newport at the Pavilion, Stow Hill, on Saturday last, and continued during the week ending to-morrow (Saturday). The number of exhibitors from all parts of the country was large. Special mention was made by Alderman Moxon of the assistance given by the G.E.C., Callender's Cable and Construction Co., and Messrs. Newton, of Derby, in organising the exhibition. He detailed, too, something of the progress made in convincing the Newport public of the advantages of electrical domestic equipment. In 1912 the council installed some dozen electric cookers, but in the past four or five months they had installed nearly 70.

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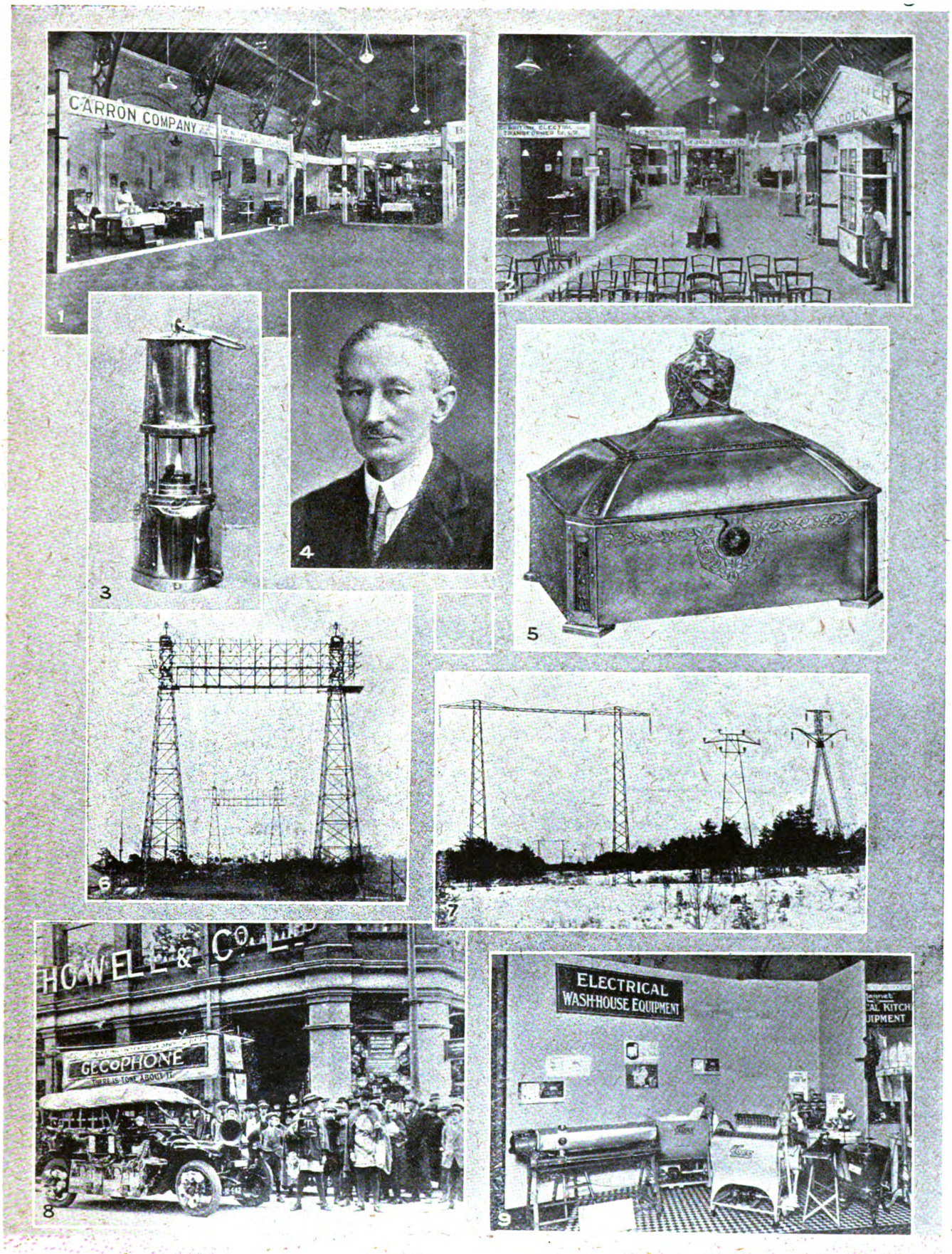

ELECTRICAL NEWS IN PICTURES.

1 and 2. Displays at the Lincoln Electrical Exhibition.
3. A new combined oil and electric miner's lamp (p. 438).
4. Prof. W. J. Lyons, elected President of the Radio Association of Ireland (p. 441).
5. The Casket presented to Lord Derby at Barton (p. 438).
6 and 7. Views of the transmission lines from Trollhättans (Sweden) Power Station.
8. A prize-winning vehicle in the Cardiff Shopping Week Pageant.
9. Electrical wash-house equipment is seen in this corner of Waring and Gillow's Domestic Appliances Exhibition.

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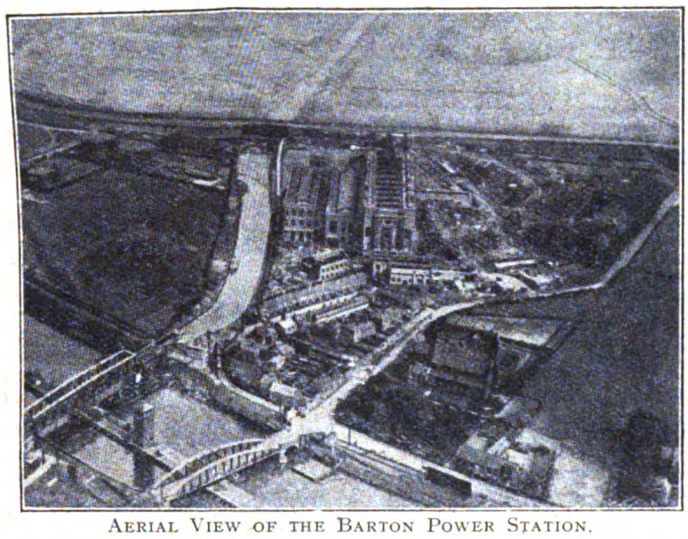
The Barton Power Station.

Tribute to the Chief Electrical Engineer.

Following the formal opening of the Barton Power Station last week, Lord Derby was the guest of the Manchester Electricity Department at a luncheon in the Town Hall, when he was presented by Sir Philip Nash, on behalf of the principal contractors, with a silver casket, made at the Manchester School of Art, containing an illuminated address. The table decorations were supplied by the Manchester Parks' Committee, and the special illuminations were arranged by the Metropolitan-Vickers Electrical Co.

Replying to the toast of his health, proposed by Alderman W. Walker, deputy chairman of the Electricity Committee, Lord Derby



AERIAL VIEW OF THE BARTON POWER STATION.

disclaimed any title to receive the casket, and said it was rightly due to Mr. S. L. Pearce, the chief electrical engineer, who, more than any other man, was responsible for designing and constructing the station. "I am not," he added, "going to ask Mr. Pearce to share the gift with me. I am going to ask him to be its custodian while he lives, and then, at his death, to restore it to my family. He will accept it from me, I am sure, as a tribute that I, as a Lancashire man, want to pay to a great Lancashire engineer."

Proposing "The Manchester Electricity Undertaking," Sir John Snell said he believed that the increased use of electricity would hasten our emergence from the present economic problems.

All-British Wireless.

White City Exhibition Opens on November 8th.

What will probably be the largest Wireless Exhibition ever held will open at the White City, London, on November 8th, and will remain open until November 21st.

This All-British Wireless Exhibition and Convention is being organised in conjunction with the National Association of Radio Manufacturers.

Apart from the actual exhibits, comprising almost every conceivable form of wireless apparatus, there will be a series of lectures and demonstrations by special arrangement with the British Broadcasting Co. The exhibition organisers are Bertram Day and Co., 9 and 10, Charing Cross, London, S.W.1.

The preliminary list of exhibitors includes:—Ashley Wireless Telegraph Co.; Auckland's Wireless, Ltd.; Abbey Industries, Ltd.; Autoveyors, Ltd.; Auto Sundries, Ltd.; Amalgamated Press, Ltd.; British Thomson-Houston Co.; British L. M. Ericsson Manufacturing Co.; Burndept, Ltd.; S. G. Brown, Ltd.; J. Burns, Ltd.; Bowyer-Lowe Co.; Beldam Tyre Co.; British Ebonite Co.; Brown Bros.; T. C. Ball; J. A. Coomes, Ltd.; Canadian Brandes, Ltd.; Chloride Electrical Storage Co.; Cossor Valve Co.; L. J. Chambers and Co.; Climax Patents, Ltd.; Cassell and Co.; Dubilier Condenser Co.; Davenport Wireless, Ltd.; Bertram Day and Co.; Diamond Wireless, Ltd.; Edison Swan Electric Co.; Ever Ready Co.; Eagle Engineering Co.; Economic Car Light, Ltd.; Fuller's United Electric Works; Falk, Stadelmann and Co.; Fallon Condenser Co.; General Electric Co.; General Radio Co.; A. Graham and Co.; A. W. Gamage, Ltd.; Hart Accumulator Co.; W. J. Henderson and Co.; Hestavox, Ltd.; J. E. Hough, Ltd.; Hart Collins, Ltd.; Harwell, Ltd.; Igranic Electric Co.; Sydney, Jones and Co.; Marconi's Wireless Telegraph Co.; L. McMichael, Ltd.; Metropolitan Vickers Electrical Co.; Mullard Radio Valve Co.; Marconi Scientific Instrument Co.; J. McClelland and Co.; J. MacDonald and Co.; Percival Marshall and Co.; National Wireless and Electrical Co.; Odhams Press, Ltd.; W. G. Pye and Co.; the Peto Scott Co.; A. Preen and Co.; Peronet, Ltd.; Radio Communication Co.; Radio Instruments, Ltd.; Rogers, Foster and Howell; Rawlplug Co.; Radio Press, Ltd.; Radio Supplies, Ltd.; Radiax, Ltd.; Sterling Telephone Co.; Siemens Brothers and Co.; Solidite Manufacturing Co.; Telephone Manufacturing Co.; W. Vanstone, Ltd.; Western Electric Co.; and Wilton Wireless, Ltd.

Imperial Notes.

AUSTRALIA.

Wireless Convention's Broadcasting Regulations.

The Postmaster-General of the Commonwealth of Australia recently called together a Wireless Convention to prepare regulations covering broadcasting in Australia. This Convention has now concluded its labours and a recommendation has been placed before the Postmaster-General for approval. We shall shortly hear, therefore, of the final regulations which will be adopted, and a broadcasting service will no doubt follow at an early date.

In order to demonstrate the possibilities of wireless broadcasting in Australia some interesting experiments were recently carried out on the occasion of the recent State Conference at Hawkesbury College, Sydney, New South Wales. At the invitation of Sir Joseph Carruthers, the President of the New South Wales Chamber of Agriculture, the Amalgamated Wireless Australia, Ltd., transmitted a complete musical programme, the Acting Premier of the States and other officials speaking a few words. The receiving end was organised by the British General Electric Co., a "Gecophone" listening-in set being installed. Mr. Hugo Hirst, managing director of the British General Electric Co., broadcast a message predicting a bright and prosperous future for broadcasting in Australia.

SOUTH AFRICA.

Power for South African Goldfields.

The South African Electricity Commission has reported that the water power available at Sabie, in the Transvaal, is 9 000 H.P. The Commission realises the urgent necessity for a large power supply to enable the goldfields to maintain their present prosperity.

CANADA.

Vancouver's Hydro-electric Power Resources.

Vancouver City is assured of unlimited cheap power for its public services and industrial operations, says a statement issued by the Canadian Official Press Bureau. A survey just completed shows that potential hydro-electric development, aggregating more than 2 000 000 H.P., exists within a radius of 60 miles of Vancouver.

The biggest factor in this potential energy is Lake Garibaldi. The lake is fed by glaciers all the year round, has a natural outlet from a subterranean passage about 3 300 feet above sea level, and without enormous expense or involved engineering operations several power stations could be developed which would be wholly independent of seasonal conditions. Vancouver City Council, at whose instance the survey has been made, is now considering ways and means of developing this water power for the service of the community. It is claimed that within a short time the city will rival Winnipeg, at present the largest producer and user of cheap hydro-electric engergy in Western Canada.

INDIA.

Hydro-Electric Progress in the Punjab.

The actual work in connection with the Mandi hydro-electric scheme is expected to start next spring. Applications for 18 000 kW have been received from existing consumers in the Punjab. The scheme will provide street lighting in over 20 towns.

Business Items.

HOLWORTHY PATENTS, LTD., of 6, Iddesleigh House, Caxton Street, London, S.W.1, have removed to 66, Victoria Street, London, S.W.1.

The STOCKPORT LAMP CO., electric lamp makers, of Archer Street, Buxton Road, Great Moor, Stockport, announce that they are giving up business.

The ENTERPRISE MANUFACTURING CO., Electric House, Grape Street, London, W.C.2, have issued a list of special nett factors' prices for their "Infinity" brand of cables and flexibles.

THE BRUSH ELECTRICAL ENGINEERING CO., Loughborough, announces the opening of new offices at Sheffield and Birmingham. The Sheffield office is under the management of Mr. C. E. Brotherton, at 32, White Building, Fitzalan Square, while Mr. Malcolm Brown has charge of the Birmingham office, at Phœnix Chambers, Colmore Row.

WALKER VEHICLES, LTD., have acquired from the Walker Vehicle Co., of Chicago, the sole manufacturing rights for their battery vehicles for here and the British Dominions, other than Canada. These vehicles, together with the Railodok industrial electric trucks, are being entirely manufactured at their Windsor Works, Slough, by G. D. Peters, Ltd., of Caxton House, Westminster, London, S.W., and for whom Walker Vehicles, Ltd., are the sole selling agents.

New Miner's Safety Lamp.

Combination of Electricity and Oil.

Two Sheffield workmen, Mr. J. T. Whitehouse and Mr. T. Brashawe, have invented a miner's combination oil-electric safety lamp, which, though compact, is claimed to be capable of giving a guaranteed working light for 22 hours continuously. When the oil light is in use the electric lamp drops automatically into a recess in the base of the lamp. When, on the other hand, the electric lamp is in use, the oil light is extinguished automatically and the electric lamp is installed in its place.

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Electricity Supply.

Extensions and Developments.

SUTTON COLDFIELD Corporation has decided upon substantial cable extensions.

BEDWELLTY Urban Council proposes to erect a transformer station at Blackwood.

ULVERSTON Electricity Committee is negotiating for premises for use as a transformer station.

SHEFFIELD Electricity Committee proposes to spend £10 000 to encourage the use of electricity in working class dwellings.

Over £10 000 is to be expended at BIRMINGHAM in lighting elementary schools, hitherto lighted by gas, with electricity.

It is estimated that in the next two years a further expenditure upon underground mains of £45 000 will be made at BLACKPOOL.

WHITEHAVEN Town Council has applied to the Electricity Commissioners for a loan of £1 500 for meters, and £2 500 for services.

HACKNEY Council has decided to spend a further £10 000, making £15 000 in all, on the free wiring of houses and the installation of meters.

Progress is being made by DOVER Electricity Committee in its negotiations for a bulk supply to Deal, Walmer and Sandwich. The possibility of extending the plant is being considered.

STEPNEY (London) Council is recommended to apply to the London County Council for a loan of £60 000 for the electricity department, at 4½ per cent. interest per annum, and for a further loan of £65 000, which will be required next month, at the same rate of interest.

BIRMINGHAM Corporation has approved unemployment relief works including main laying in outer parts of Birmingham, £30 500; installation of electric lighting at elementary schools, £10 850; and additional high tension mains between Nechells and Summer Lane generating stations.

HACKNEY (London) Borough Council is recommended to approve the expenditure of £26 000 upon the erection of electrical showrooms and offices upon the site Nos. 18 to 24 Lower Clapton Road, and a proposal to apply to the Electricity Commissioners for permission to borrow the amount.

MAIDSTONE Town Council has applied to the Electricity Commissioners for a loan of £47 000 for the installation of a 2 000 kW turbine and accessories and two tube boilers and accessories, and for a loan of £658, excess expenditure in connection with the installation of a new turbine.

The Works Committee of the MERSEY DOCKS and Harbour Board recommends that in order to complete the whole of the work of electrifying the northern section of the docks the engineer be authorised to proceed at once with the electrification of the sheds on the west sides of the Alexandra and Langton Docks, at an estimated cost of £9 251.

MARLBOROUGH Town Council has entered into an agreement with Marlborough College for the installation of additional plant at the College Generating Station for a public supply of electricity. The agreement is to continue for ten years, and may be determined by either party at the end of that period by two years' previous notice. The estimated cost of the plant is £3 500.

BLACKBURN Town Council is being asked to sanction schemes for the extension of the electricity undertaking by the erection of sub-stations at Eccles Mill, Furthergate Mill, Audley Hall Mills, Bank Mills, Havelock Works, Moorgate Works, and in Wensley Fold and Hall Street districts. The cost, with the necessary feeder cables, is estimated at £40 000. The work is intended to provide relief for the unemployed.

LONDON County Council Highways Committee reports that Mr. J. H. Rider has advised the provision of a new 15 000 kW generating set at the Greenwich power station, that the Electricity Commission has assented to the expenditure, and that tenders have been invited. The Council recommends that the arrangement for mutual emergency supplies between the Greenwich station and the London Electric Supply Corporation's Deptford station be modified so as to permit of a supply up to 10 000 kW either way.

Alterations in Charges.

DERBY Town Council has reduced the charges for electricity for lighting to 5½d. per kWh up to 3 000 kWh per quarter, and to 5d. for consumption in excess of that figure.

WHITBY Urban Council has reduced the charge for electricity for heating and cooking to 3d. per kWh up to 100 kWh per quarter, 2d from 100 to 200 kWh, and 1½d. beyond.

GRANTHAM Town Council has decided to apply to the Ministry of Transport for a revision of the prices charged for electricity by the Electric Light Co. The present charge for lighting is 10d. per kWh.

LUTON Council has decided to reduce its charges for electricity to the pre-war level. It is claimed that Luton was the last undertaking to increase its tariff and will be the first to regain the pre-war level, which was the third lowest in the country.

BURY ST. EDMUNDS Town Council has adopted the following scale of charges for electricity for power: Up to 500 kWh per quarter, 5½d.; 500 to 2 500, 3¾d.; 2 500 to 5 000, 3½d.; 5 000 to 7 500, 3d.; 7 500 to 10 000, 2½d.; beyond, 2d. (less 15 per cent.)

Tapping New Areas.

DROITWICH SPA Council has been informed by the Shropshire, Worcestershire and Staffordshire Electric Power Co. that a supply of electricity for lighting should be available within the next six months.

DRONFIELD Urban Council has informed the Electricity Commissioners that the Council contemplates applying for a provisional order as soon as there is a possibility of securing a supply of electricity. Sheffield Corporation has expressed willingness to give a supply.

Topsham Electricity Supply Co. has applied to the Electricity Commissioners for a Special Order to generate and supply electricity in the parish of TOPSHAM, in the rural district of St. Thomas, Devon.

Orders and Miscellaneous.

BULKINGTON Urban Council has accepted the offer of the Leicestershire and Warwickshire Electric Power Co., for public lighting.

HACKNEY Borough Council proposes revising its prices for the charging of electric vehicles. For energy supplied to private consumers from a circuit which is used solely for charging the batteries of electric vehicles subject to certain restrictions, a charge of 1d. per kWh is suggested. For charging batteries of electrical vehicles at the council's charging station at 90 to 110 V (minimum 2s. per vehicle charged), 2d. per kWh is proposed.

Personal Items.

Dr. B. HODGSON, late of H.M. Signal Experimental Establishment, is now engaged in the research laboratory of the Mullard Radio Valve Co.

Mr. JOHN ANNAN BRYCE, a director of the Metropolitan-Vickers Electrical Co. and a number of other companies, and brother of the late Lord Bryce, left £30 870.

Sir PHILIP NASH, chairman of the Metropolitan-Vickers Electrical Co., is a director of the Associated Anglo-Atlantic Corporation, a new £1 000 000 finance company.

Dr. THOMAS ADDISON, who recently retired from the Pacific Coast managership of the General Electric Co. (U.S.A.), after 33 years' association with the company, is visiting Europe.

Mr. E. E. STOCKENS, district manager of the Mid-Lancashire Telephone Area, with headquarters at Blackburn, is retiring on November 2nd, after having spent his life in the telephone service.

Mr. MASASHICHI FUKAGAWA, an official of the Tokyo Electric Power Co., is reported to be paying a visit to this country. Mr. Fukagawa's address is not known by the Consulate General of Japan.

Mr. J. G. MCCLENNAN, head of the department of physics at the University of Toronto, has declined an offer from Queen's College, Belfast, to take up the position of Vice-Chancellor and President of the College.

Describing the Niagara Falls power station in the "Daily News," Mr. A. Emil Davies mentions that Sir ADAM BECK, who guides the destinies of the Ontario Hydro-Electric Power Commission, receives no remuneration for his services.

Prof. Frederick C. Lea, who succeeds Dr. W. Ripper as Professor of Mechanical Engineering and Head of the Engineering Dept. of the University of Sheffield, had, before he took up teaching work, several years' experience in electrical engineering.

Mr. E. B. MALLORY, manager of the Radio Sales Department of the Westinghouse Electric and Manufacturing Co., New York, has accepted an invitation to be chairman of the Radio Communication Committee of the American Marine Congress which will be held in New York from November 5th to 10th inclusive. Mr. Mallory is now chairman of the radio section of the Associated Manufacturers of Electrical Apparatus.

Obituary.

Mr. James Young Bowman.

We regret to record the death, which took place on October 7th at the age of 49 years, of Mr. JAMES YOUNG BOWMAN, who had for the past eleven years been electrical engineer to Pease and Partners, at Esh Colliery, County Durham. Previously he was in the electrical department of Armstrong, Whitworth and Co.

Dr. John Allen Harker.

The scientific world has suffered a great loss by the death after a few days' illness of Dr. John Allen Harker, which occurred last week. Born at Alston, Cumberland, in 1870, Dr. Harker was educated at Stockport Grammar School and at the Universities of Manchester and Tübingen, and was a Dalton Chemical Scholar and Berkeley Fellow in Physics of the Owens College, Manchester. In 1900 he became assistant at the National Physical Laboratory, where he remained for 16 years, being made Chief Assistant, and acting as Deputy to the Director the last eight years of this period. From 1916 to 1921 he was Director of Research to the Ministry of Munitions and a member and organiser of the Nitrogen Products Committee, and he supervised the Ministry's research laboratories from 1916 to 1920. In 1922 he became a partner in the firm of J. F. Crowley and Partners, consulting engineers, Victoria Street, Westminster, and from that time has been engaged in reporting and carrying out experimental work in connection with various electro-chemical processes in different parts of the world, and particularly in connection with nitrogen fixation, on which he was an outstanding authority. He was elected a Member of the Royal Society in 1910, was a Vice-President of the Faraday Society, and a member of council of the Physical Society of London. He was the author of a number of papers, chiefly on thermal and electrical subjects, in the "Proceedings" of the Royal Society, the "Philosophical Magazine" and THE ELECTRICIAN.

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Tenders Invited and Accepted.

GREAT BRITAIN.

BIGGLESWADE URBAN COUNCIL.—Installation and operation of a public electricity supply scheme. Particulars from the Clerk.

GUILDFORD GUARDIANS.—Preparation of specifications for the installation of electric light at the Institution.

BALBY PARISH CHURCH, NEAR DONCASTER, October 20th.—Electric light wiring and fitting. Particulars from Mr. F. Pickering, 24, Tickhill Road, Doncaster.

DOVER CORPORATION, November 12th.—Supply and laying of 8 miles of e.h.t. three-core paper insulated cables. Particulars from the Borough Electrical Engineer.

MANCHESTER WATERWORKS COMMITTEE, October 22nd.—1½ miles of l.t. paper insulated lead covered and steel tape armoured cables. Specification from the Secretary, Waterworks Offices, Town Hall, Manchester.

CHEADLE AND GATLEY URBAN DISTRICT COUNCIL, October 25th.—Gasfilled metal filament lamps for street lighting. Specification can be obtained by British makers, without payment of deposit, from Mr. C. H. Wordingham, 7, Victoria Street, Westminster, S.W.1, and 33, Brazennose Street, Manchester.

AUSTRALIA.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS, November 21st.*—1 000 kW sub-station units.

SYDNEY CITY COUNCIL, January 21st.*—High tension split conductor feeder panels.

IRELAND.

WICKLOW COUNTY BOARD OF HEALTH, October 22nd.—Wiring and fitting the County Hospital for electric lighting. Particulars can be obtained at the Hospital.

BELFAST IMPROVEMENT COMMITTEE, October 23rd.—Electric wiring and fitting in the Ulster Hall. Specifications from the City Surveyor.

SUNDERLAND CORPORATION has accepted the tender of Herbert Morris, Ltd., for a 20-ton crane.

The tender of Moncrieff Bros. for wiring houses, £183, has been accepted by LEVEN TOWN COUNCIL.

LEEDS CORPORATION is recommended to accept the tender of A. Reyrolle and Co. for switchgear, at £19 300.

The tender of Baxter and Caunter for a balancer, at £324 10s., has been accepted by MAIDENHEAD CORPORATION.

KINGSTON-ON-THAMES BOARD OF GUARDIANS has accepted the tender of Medways Safety Lift Co. for a lift at £739.

BLACKBURN CORPORATION has approved the tender of Renshaw and Marsden for electrical wiring in the Free Library.

MALVERN URBAN COUNCIL has accepted the tender of Superheater Units, Ltd., for superheaters for two Lancashire boilers.

Ransomes, Sims & Jefferies' tender for five 4-ton Orwell electric vehicles has been accepted by WARRINGTON CORPORATION.

GILLINGHAM TOWN COUNCIL has accepted the tender of the Hackbridge Transformer Co. for a 150 kW transformer at £144.

DUMFRIES CORPORATION has accepted the tender of the Metropolitan-Vickers Electrical Co. for a main switch board at £1 190.

CHESTERFIELD CORPORATION has accepted the tender of Musgrave & Co. for induced draught plant for the electricity works at £834.

LEYTON URBAN COUNCIL has accepted the tender of G. H. Turner & Co. for completion of electric wiring, etc., at Canterbury Road school.

The tender of Callender's Cable and Construction Co. for cables, at £3 998, has been accepted by NEWCASTLE-UNDER-LYME CORPORATION.

Callender's Cable and Construction Co. has secured a contract for extensions of mains at £1 574 18s. 2d. for SLEAFORD URBAN COUNCIL.

DONCASTER CORPORATION has accepted the tender of Reyrolle and Co. for high pressure switchgear for controlling new rotary converter, at £280.

The tender of F. S. Jackson for electric wiring in connection with Beechwood Road housing scheme, of £530, has been accepted by HALIFAX CORPORATION.

The tender of Aiton and Co., for steam, feed, blow-down and drain piping for Newton Abbot power station, at £1 765, has been accepted by TORQUAY CORPORATION.

The tender of the New Conveyor Co. for coal-handling plant for the boiler house at Ferryhill power station, at £1 296, has been accepted by ABERDEEN CORPORATION.

CHURCH STRETTON URBAN COUNCIL has accepted the tender of the Electric Supply Co. for lighting eight public lamps for five years at £5 15s. per lamp per annum.

The tender of the Pulsometer Engineering Co. for a centrifugal pump, with electric motor and automatic control gear, at £550, has been accepted by MARGATE CORPORATION.

LAUNCESTON BOARD OF GUARDIANS has accepted the tender of F. Chapman for electric light wiring in the Institution, at £95 12s. 6d. Six tenders were received, the lowest being £81.

Callender's Cable and Construction Co. has received an order from NEWCASTLE (Staffs) Corporation for cable for electricity supply to the Knutton Manor Mining Co., at £3 998.

HALIFAX CORPORATION is recommended to accept the tenders of the British Thomson-Houston Co. for a 10 000 kW turbo-alternator, £28 502, and Worthington-Simpson, Ltd., for a condenser, £13 685.

CARDIFF CORPORATION has accepted the tender of the Enfield Ediswan Cable Works for 23 500 yds. of cable in connection with the extension of the electricity supply system to Llanishen, at £9 194 11s. 9d.

CARDIFF ELECTRICITY COMMITTEE has accepted the tender of the Enfield Ediswan Cable Works for 23 500 yards of British standard cable, in connection with the Llanishen lighting and power supply extension scheme at £9 194 11s. 9d.

THE SOUTHERN RAILWAY ADMINISTRATION has placed an order with Gillespie Partners for Elwell-Parker dock type elevating platform electric trucks. Similar trucks have been used at Southampton Docks for 18 months.

LONDON COUNTY COUNCIL is recommended to accept the tender of the Enfield Cable Works (lowest tender of five), for alterations to l.t. cables in connection with the proposed supply of power for the Tooley Street tramways from the Bermondsey Council's station, at £2 775 17s. 4d. The highest tender was £3 893 11s. 11d.

STEPNEY (LONDON) BOROUGH COUNCIL has accepted the tenders of the Universal Electrical Manufacturing Co. (lowest tender of seven), for 30 disconnecting boxes at £80 5s. 10d. (highest tender, £162); and Middleton Bros., for an electrically-driven 5-ton runway hoist, for Limehouse power station, £285 (highest tender, £795).

* Particulars from Department of Overseas Trade.

Manchester Electro-Harmonic Society.

Arrangements for the Coming Season.

The Manchester Electro-Harmonic Society will open its fifth successive season on Friday, October 26th. Although the Society is of later origin, it is a counterpart of the London Electro-Harmonic Society, and is fulfilling worthily the object for which such social functions are designed—*i.e.*, to unite in intercourse and high-class entertainment members of every section of the electrical industry in Lancashire. A hearty invitation is extended to all members of the electrical profession who may be visiting Manchester, on any of the dates when concerts have been arranged. The venue is the Albion Hotel, Piccadilly, and the concerts commence at 7.30 p.m. Mr. S. L. Pearce, chief electrical engineer of Manchester, is the President of the Society, and he will preside at the first concert. The Committee has been working to improve the membership, and it is encouraging to learn that about 250 members have already been enrolled. Mr. W. J. Smith is again hon. musical director, and this itself is a guarantee that the concerts will be maintained at the high level already established in previous seasons. The artistes for the first concert will be: Miss Olga Telba (soprano), Mr. Bridge Peters (baritone), Mr. Ernest Thorley ('cellist), Mr. Ben Mackay (entertainer), Mr. Ernest Cookson (solo pianoforte and accompanist).

Arrangements are completed for the second concert, and a number of equally well-known artistes are due to appear. Visiting friends are asked to make a note of the following dates: October 26th, November 23rd, December 21st (1923), January 18th, February 15th, March 21st (1924). No ticket is necessary for admission, the ordinary professional qualification being sufficient. Should it be possible to give advance information of intention to be present on any particular occasion, communications may be forwarded to either of the following: Mr. W. Kirkham (hon. secretary), 47, Peter Street; Mr. C. E. Leak (asst. hon. secretary), 196, Deansgate, Manchester.

The Stinnes Group in Switzerland.

Control of Important Electrical Firms.

Since the Stinnes group established a branch office at Zurich many leading Swiss electrical concerns have come under complete or partial control of the Stinnes group.

The chief among these, states the Lausanne correspondent of the "Daily Mail," are the Swiss General Electric Co., with which are affiliated the Electro Bank of Zurich, the Baden Electricity Co., and the Watt engineering firm in Glarus. By the absorption of the Electro Bank, Stinnes obtains the controlling interests in the following important electrical combines:—The Swiss Central Electric Co. of Lucerne; Laufenburg Electric Forces; the electro-chemical industrial works of Bodio, and the Watt company at Glarus.

In addition the bank is largely interested in similar enterprises in Venice, Naples, Madrid, Lisbon, Strasbourg, Constantinople, and Finland, and in the Paris Central Electric Power Co.

By the fusion of the Baden Motor Co. with the Columbus Electrical Works, Stinnes extended his influence to South America, where he is credited with the intention of obtaining complete control of the chief electrical enterprises.

E.T.U. Mass Meeting at Aberdeen.

"Electrical Contractors Taking Mean Advantage."

Addressing a mass meeting of electrical workers at Aberdeen last week, Mr. Thomas Stewart, national organiser of the Electrical Trades' Union, dealt with the position the electrical contractors had taken up since they ceased to be represented on the National Joint Industrial Council, and gave comparisons of the wages paid to electricians in England with those paid in Scotland. The electrical contractors, he contended, were taking a mean advantage of the position, and they could only expect the workers to retaliate at some future time. It is understood that another mass meeting will be held on Sunday

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Electric Traction.

Tramway Extensions and Developments.

NOTTINGHAM tramway improvements to cost £52 000 are to be undertaken immediately.

BLACKPOOL Tramways Committee is considering the desirability of relaying the tramway track in Central Drive.

Tramway track reconstruction at NEWPORT to cost £4 000 has been approved by the Unemployment Grants Committee.

PONTYPRIDD Tramways Committee has declined the offer of the Rhondda Tramways Co. to lease the Council's tramway undertaking.

EDINBURGH Tramways Committee is to seek powers to continue the tramways from Bernard Street, through Salamander Street, to Seafield.

The Potteries Electric Tramway Co. has declined to fall in with a suggestion of the STOKE-ON-TRENT Watch Committee to institute a co-ordination scheme with omnibus companies as to general running and timetables.

Fares, Receipts and Passengers.

New penny tram stages come into operation in NOTTINGHAM on Sunday.

LIVERPOOL Corporation reports a profit of £174 000 on the municipal tramways.

The weekly transferable pass system will be extended to all tramway routes in BRADFORD.

Cheaper fares and increased facilities are being offered to SHEFFIELD tramway passengers.

For three months a system of penny fares over certain short distances is to be tried in CARDIFF.

HASLINGDEN tramways report a net profit for the past year of £411, compared with a net loss of £619 the previous year, and a net profit of £1 585 in 1920–21.

A sub-committee of EDINBURGH Tramways Committee has decided to recommend that season tickets on the tram and 'bus services in the city be issued on four or five routes for a period of six months as an experiment.

Reductions in fares are held accountable for the falling off in the receipts of BOURNEMOUTH tramways, the total from April 1st to August 1st last amounting to £68 146, compared with £76 227 for the corresponding period last year.

Electric Railway Items.

A bay line is being provided at WILLESDEN High Level Station to accommodate the electric train service between Willesden and Earl's Court.

The LONDON Tube Railway system, which has already received a guarantee up to £6 000 000, is now to have a further £6 000 000 guaranteed under the Government's scheme for alleviating unemployment.

The LONDON & NORTH EASTERN RAILWAY states that exhaustive consideration is being given to the question of the electrification of the Great Northern section suburban lines from King's Cross as far north as Welwyn Garden City and Hertford. One of the reasons for the time which is being taken in arriving at a satisfactory solution of this problem is the necessity for the preparation of elaborate specifications.

Miscellaneous Traction News.

In connection with an appeal for hospital funds, a LIVERPOOL tramcar specially illuminated with over 5 000 electric lamps made a tour of the city last Saturday.

About thirty uniformed members of the READING Corporation Tramways attended the funeral of Mr. William James Tuckwell, who was 45 years of age, and who had been with the service since 1914.

Five hundred LONDON County Council tramwaymen marched past the Cenotaph on Sunday and deposited wreaths. Mr. Coventry Fell and other officials of the tramways department were present.

The NEWPORT Council has decided that the Electricity and Tramways Committee shall, in future be exempted from possible veto by the General Purposes Committee in the matter of increases granted by them in salaries, bonus and wages.

As the rails used on the BURNLEY tramway system did not receive the approval of the British Engineering Standards Association, the Town Clerk wrote the Ministry of Transport on the subject. The Ministry replied that the Association was unable to recommend the reinstatement of the rails. The Tramways Committee has informed the Ministry of its regret at the action of the Association.

Speaking Films.

A Danish Contribution to the Problem.

In our issue of June 18th, 1923, we called attention to the demonstration of a speaking film which had been invented by Dr. Lee de Forest. Since that date this device seems to have been re-invented by two Swiss engineers, and now it is announced by "The Times" Copenhagen correspondent that a similar arrangement has been demonstrated by Messrs. Axel Petersen and Arnold Poulsen in that city.

The Petersen-Poulsen arrangement differs from that of Lee de Forest in that the voice film is separate from the picture film. This separation, it is claimed, overcomes the synchronising difficulty to which we referred in describing the former invention.

Wireless News.

Retailers' Complaints against Manufacturers.

We have received the following statement from the Wireless Retailers' Association:—"In view of the statements which have recently appeared in the Press from the British Broadcasting Co. and from other quarters, the committee of the Wireless Retailers' Association considers it desirable that one or two additional facts should be realised by the public.

"The first is that the protection which has been given to British manufacturers is not protection in the accepted sense of the word, but the absolute prohibition of the use by the public of manufactures of overseas origin. However good the articles may be, the public may not purchase them, even though prepared to pay an import duty.

"The second is that manufacturers have profited by the monopoly conditions created by the first agreement between the Postmaster-General and the B.B.C. to impose oppressive terms on retailers, the complaint from firms both large and small being that out of the ample profits made by manufacturers the small percentage allowed to retailers is insufficient to make their businesses pay. That the new agreement excluding imports is to be similarly utilised may be gathered from the fact that, following close on the statement of the Postmaster-General, comes the information that manufacturers purpose not only to reaffirm their present inadequate terms to retailers but in some cases actually to reduce them.

"It is as a result of the monopoly that much of the disorganisation existing in the trade has occurred, and the adoption of the recommendations of the Broadcasting Committee is, and will remain, an urgent need."

The statement that the margin allowed to retailers is too small was corroborated this week by a member of a well-known manufacturing firm, who informed a representative of THE ELECTRICIAN that he was strongly of the opinion that the 20 per cent. basis was bad policy, as it was impossible for retailers to include service to the public on those terms. It was, he said, essential that the retailer should be able to give the fullest service to his customers, and if British manufacturers would offer a reasonable discount he thought the retail trade would be more disposed to push British-made apparatus. Although it would not be possible to give such good terms as certain foreign manufacturers were giving, steps should be taken with a view to arriving at a compromise which would be of benefit to manufacturer and dealer alike.

Radio Society's Transmitter and Relay Section.

The Radio Society of Great Britain announces the formation of a new Transmitter and Relay Section, as the British Wireless Relay League has been merged in the Radio Society of Great Britain. The objects of the Section are (1) to promote intercommunication between experimenters and thus assist them to improve their apparatus; (2) to join hands with similar organisations overseas; (3) to investigate the quality of the transmissions in various directions at different hours; (4) to establish a collection of wavemeters and other useful apparatus for loan within the Section.

It is stated that, in supporting the Section the Radio Society will protect the principle of "freedom for experiment." All persons holding experimental licences are eligible for election to the Section.

Automatic Wireless Alarms at Sea.

The Wireless Telegraphy Committee, which was appointed by the International Shipping Committee of 1921 to examine questions of wireless telegraphy at sea, met in London last week, when a number of important questions affecting the carriage of wireless apparatus on board ship were discussed. The following resolution was passed:—It is desirable that the Maritime States should take steps to convene an International Conference for the consideration of wireless problems, and pending the proposed conference all Maritime States are urged not to apply to foreign vessels regulations more onerous than those in the Convention of 1914. In the meantime the Governments of the Maritime States should be invited to give the closest study to the problem of perfecting the automatic alarm device—discussed at the 1921 Conference—within the next six months.

The Committee has noted the progress which has been made towards the perfecting of an automatic device and alarm signal, and repeats that the international approval of this device is the most urgent problem of wireless telegraphy to-day.

Interim Licence Period Extended

Although Monday was the last day on which application could be made for licences to cover unlicensed receiving sets, the Post Office has now decided to extend the period until October 31st, in order to admit of outstanding inquiries being dealt with, and to remove any excuse for failure to take out a licence. It will be recollected that the Postmaster-General stated recently that the number of unauthorised listeners-in was 200 000. It has been estimated that 170 000 interim licences have already been issued.

The Radio Association of Ireland.

An association with the above title has been established in Dublin under the presidency of Prof. W. J. Lyons. Membership will be open to the following classes:—(*a*) Persons who are professionally involved in wireless; (*b*) manufacturers, distributors and agents; (*c*) amateurs and experimenters; (*d*) representatives from the universities and technical colleges, scientifically interested; and (*e*) Post Office and Army units connected with wireless services.

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Telegraph and Telephone Notes.

The Post Office reports that considerable delay was caused to TELEPHONE TRAFFIC in the western part of the London telephone area and adjacent towns in the toll area through the breakdown last Thursday of an underground cable at Stanmore, into which water had penetrated.

" Bishopsgate " is to be the first of the NEW AUTOMATIC TELEPHONE EXCHANGES in the City of London area. The present exchange of this name, which was opened some eighteen months ago, is temporarily housed in the " Clerkenwell " building, but plans have now been completed for a large new building which is to be erected in Little Pearl Street. Estimates for the erection are now being obtained, and the work should be started early in November.

In his REPORT ON TELEPHONE PROGRESS in the Manchester and South-East Lancashire District, Mr. W. J. Medlyn, the superintending engineer, states that the number of telephones rose from 32 946 in 1912 to 56 645 in 1923, an increase of 23 699 or 72 per cent. in eleven years. In regard to underground cable extensions he points out that during the past eleven years the total underground wire mileage has risen from 75 476 to 182 148, an increase of 141 per cent. A considerable network of underground telegraph and telephone cables already connects Manchester with other important industrial centres, and further extensions of the system are being made.

Miscellaneous.

WARRINGTON Council has decided to purchase five four-ton Orwell electric vehicles for local sanitary work.

The EXHIBITION OF DOMESTIC ELECTRICAL APPLIANCES by Waring and Gillow, Ltd. closes to-morrow (Saturday).

The number of insured WORKPEOPLE IN THE ELECTRICAL ENGINEERING INDUSTRY who were unemployed at the end of August was 4 009.

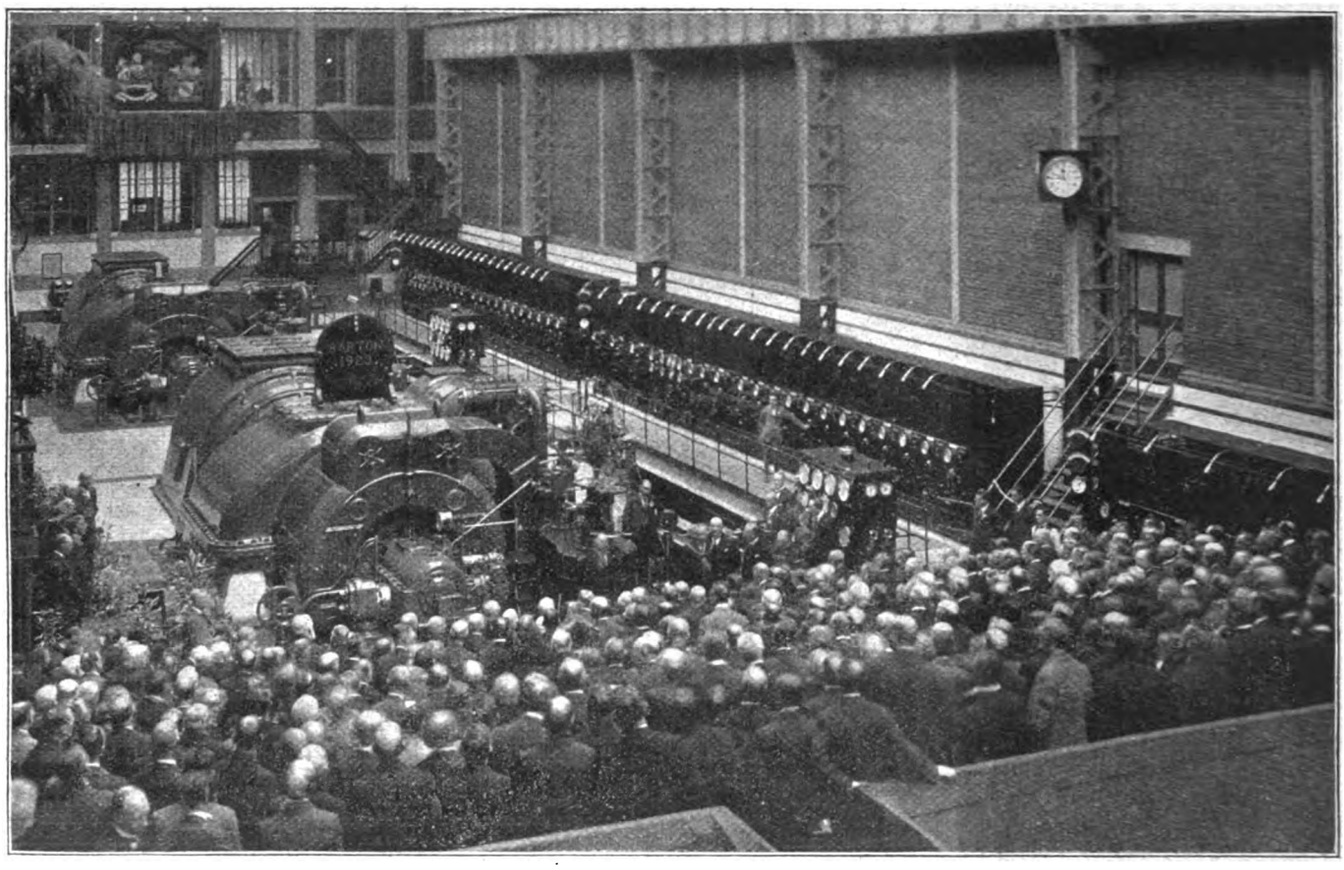
For the first time in electrical history POWER GENERATED FROM HEATED MERCURY has been applied to commercial service in Connecticut (U.S.A.).

HACKNEY (London) Council has purchased for £5 000 a site in Lower Clapton Road for electricity showrooms. There is also room for the erection of a sub-station.

EXPORTS OF ELECTRICAL GOODS from the United States during July of this year exceeded the shipments made in the corresponding month of 1922 by nearly $1 700 000.

Barking Council is reported to have placed an order for £60 000 WORTH OF TRANSFORMERS with a Swedish company because their tender was 17 per cent. below that for the corresponding British apparatus.

On his return from a tour of Europe, Mr. Arthur Williams, general commercial manager of the New York Edison Co., expressed the



THE OFFICIAL OPENING OF THE BARTON POWER STATION.

Work on the new cable to Birmingham is well advanced and the section of this cable between Manchester and Macclesfield has recently been brought into use, thus affording much needed relief in the handling of traffic between those two centres. An additional cable is also being laid to improve the service between Manchester, Disley, New Mills, Whaley Bridge and Buxton. The work of providing an additional cable containing 160 lines between Manchester and Liverpool is well advanced. An underground cable is being extended from Oldham to Leeds, to improve the service between Manchester and the Yorkshire centres. A new cable from Manchester to Glossop is nearly completed and the extension of the pipe track from Eccles to Atherton and Leigh is approaching completion. The laying of six additional pipes between Manchester and Stockport has recently been completed. A new pipe track has been completed for extending the Manchester-Warrington cable to Northwich. A scheme for direct underground service between Manchester Wigan, Ormskirk and Southport is included in next year's programme. In addition to main line communications, many large extensions of the underground system serving local telephone subscribers have been effected, and the work is still steadily progressing. Concurrently with the extension of the underground system, overhead wires are being recovered, and it is interesting to note that during the past eleven years 13 000 miles of open wire in the district have been cut down. In the concentrated business areas in the city the overhead system of wire distribution is being entirely displaced by underground.

opinion that in a short time every available source of WATER POWER IN EUROPE would be utilised.

TO ENCOURAGE TECHNICAL EDUCATION, John Thompson, Ltd., Wolverhampton, have announced that technical appointments in the company will be open to youths in their service who acquire technical qualifications by their own exertions.

In view of the publication of a report in the lay Press to the effect that a fire at a flour mill was caused by " the fusing of an electric wire," Mr. S. A. Windle, of the Doncaster Corporation electricity works, has been authorised by the millers to state that there was no evidence whatever to show that the outbreak was due to electricity.

The OSRAM-G.E.C. LAMP WORKS FIRE BRIGADE, under Chief Officer Jessop, has won the contest for five men, open to the United Kingdom, held under the auspices of the London Private Fire Brigades' Association. The Osram Lamps Works Fire Brigade is also the holder of the Corporation of London Silver Shield for Private Fire Brigades.

Reporting on German trade in September, Mr. J. W. F. Thelwall, Commercial Secretary at Berlin, states that the POSITION OF THE ELECTRICAL INDUSTRY became worse, particularly as the cutting off of the Occupied Territory has greatly restricted the market for its products. Customers could no longer raise the requisite capital for new orders. Practically no extensions of industrial plant and overland power stations are being carried out. Prices have exceeded those of the world's markets.

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Companies' Reports, Dividends, etc.

ELECTRICAL UTILITIES CO.—Announcement is made of the declaration of a dividend of 1¼ per cent. on the preferred stock for the year ended September 30th.

ASSOCIATED FIRE ALARMS.—The directors recommend the payment of a dividend of 5 per cent., less tax, on the ordinary shares for the year, payable on October 17th. The annual meeting was held on Tuesday.

STOTHERT AND PITT.—For the year ended June 30th last, the profit was £11 380, plus £7 020 brought forward. The directors recommend the payment of a dividend of 5 per cent. free of tax, on the ordinary shares, carrying £5 804 forward. The annual meeting will be held at Bath on October 22nd, at 3.30 p.m.

PARSONS MARINE STEAM TURBINE CO.—Although the company has not, since the last report, been able to secure any order for marine turbine installations, further orders, states the report to June 30th last, have been placed with the company by C. A. Parsons and Co., for the manufacture of turbines, etc., for use in connection with land installations. The net profit was £22 073, plus £29 211 brought in, making £51 284. The directors recommend a dividend of 10 per cent. for the year free of tax, carrying forward £30 156.

TRAFFORD PARK ESTATES.—The profit and loss account for the year shows a balance of £37 913, and the profit on redemption of chief rents during the year amounts to £18 528, making a total of £56 441. Deducting the amount of £18 217, which has been placed to reserve in accordance with agreement with the trustees for the debenture-holders, and £10 449 income-tax and corporation profits tax, attributable to profit on redemption of chief rents, leaves—with the balance brought forward from last year, £107 359—an available balance of £135 134. The directors recommend the payment of a dividend at the rate of 6 per cent. per annum, amounting to £39 000, carrying forward the balance of £96 134.

Traction Companies' Results.

ILLINOIS CENTRAL RAILROAD.—Application has been made to the New York Stock Exchange for permission to issue $12 022 000 seven per cent. preferred stock, the proceeds to be used for the electrification of lines within Chicago.

MADRAS ELECTRIC TRAMWAYS.—An interim dividend at 6 per cent. per annum, less tax at 4s. 9d., in respect of the profits for the year ending December 31st next, will be paid upon presentation of coupon No. 23 at the Royal Bank of Scotland, 3, Bishopsgate, London, E.C.2.

DUMBARTON BURGH AND COUNTY TRAMWAYS CO.—The profit for the year, together with the balance brought forward, after providing for debenture stocks, amounts to £3 237, from which has been appropriated for sinking fund instalment for redemption of debenture stock £2 428, leaving a balance of £808, which the directors propose to carry forward to next year. The traffic receipts for the year amounted to £28 649, compared with £34 888 for the previous year, a decrease of £6 239. The decrease is accounted for by the adverse trade conditions which have prevailed throughout the year. Substantial reductions in expenditure have been effected, and the directors are continuing their efforts to this end. The sum of £2 428 9s. 3d. has been applied in redemption of debenture stock, enabling the company to purchase £3 030 stock, making the total amount redeemed at the date of closing the accounts £26 960.

Cable, Telegraph and Telephone Companies.

CALLENDER'S CABLE AND CONSTRUCTION CO.—An interim dividend is announced at the rate of 10 per cent. per annum, or 1s. per share, less tax.

ANGLO-AMERICAN TELEGRAPH CO.—Quarterly dividends have been declared of 15s. per cent. on the ordinary and 30s. per cent. on the preference stock; both dividends are payable less tax.

UNITED RIVER PLATE TELEPHONE CO.—An interim dividend of 3 per cent. (3s. per share) free of tax, has been declared on the ordinary shares for the half-year. A similar distribution was made a year ago.

Supply and Lighting.

INTERNATIONAL LIGHT AND POWER CO.—The report for the year to June 30th last states that the income amounted to £60 290, from which there have to be deducted the charges for debenture service, interest, income-tax, administration expenses, etc., amounting to £33 522, leaving a balance of £26 767, to which must be added £24 015 brought forward. Deducting £2 500 transferred to reserve for contingencies account, and £20 000 which has been written off the loans advanced to the subsidiary companies, there remains £28 283 to be carried forward. During the year the special loan, which at the close of the preceding financial year stood at £20 000, has been repaid. The directors report that, unless present circumstances alter materially, the company's cash position will permit of a commencement being made towards the payment of accrued arrears of preference dividend early in 1924. With the exception of the Mérida undertaking the subsidiary companies have yielded satisfactory returns and their development has fulfilled expectations for the year. A meeting will be held at 9, Cloak Lane, London, E.C., on October 22nd, at 3.30 p.m., to consider the directors' report to be submitted to the ordinary general meeting to be held in Canada.

Stock Exchange Quotations.

THE Stock Exchange Committee has granted official quotations to 94 000 £1 fully paid ordinary shares of the Madras Electric Supply Corporation, scrip, fully paid, for £1 250 000 6 per cent. first mortgage debentures of the Lima Light, Power and Tramways Co.: 12 743 $100 shares of the capital stock of the Pennsylvania Water and Power Co.; and £200 000 first mortgage 30-year 6½ per cent. sinking fund debenture stock of the St. Maurice Power Co.

New Companies.

RELIANCE SPECIALITIES, LTD.—Private. Cap., £2 000 in £1 shares. Manufacturers and salesmen of electrical and mechanical devices, etc. Reg. office: 2, Nelson Road, Blackpool.

CHORLEY RUBBER (1923), LTD.—Private. Cap., £5 000 in £1 shares. Manufacturers of indiarubber, asbestos, gutta percha, etc. Reg. office: Weldbank Works, Whittam Road, Chorley.

BENNETT AND METHVEN, LTD.—Private. Cap., £1 000 in £1 shares. Wireless and component part manufacturers, etc. Reg. office: 83, Grove Hill Road, Denmark Park, London, S.E.5.

WESTMINSTER RADIOPHONE CO., LTD.—Private. Cap., £5 000 in 4 750 shares of £1 and 5 000 shares of 1s. Business indicated by title. Reg. office: 110, Victoria Street, Westminster, London.

TRANSIT SIGNS, LTD.—Private. Cap., £2 000 in £1 shares. To acquire from R. Stark and others the benefit of a certain existing invention relating to illuminated signs, manufacturers of illuminated signs, etc. Reg. office: Exchange Buildings, Exeter Road, Bootle, Liverpool.

CLIMAX PATENTS, LTD.—Private. Cap., £1 000 in 8 000 ordinary shares of 1s. each and 600 10 per cent. cumulative participating preference shares of £1 each. Wireless, electrical and general engineers, etc. Reg. office: 182, Church Street, Kensington, London, W.8.

BISHOPTON ELECTRICITY SUPPLY CO., LTD.—Registered in Edinburgh. Cap., £100 in 1s. shares. Contractors for the supply and distribution of electricity in Bishopton District, Parish of Erskine, Renfrewshire, and elsewhere. Reg. office: 94, Hope Street, Glasgow.

ELECTROMOBILE ENGINEERING CO. (WEST BROMWICH), LTD.—Private. Cap., £2 000 in £1 shares. Electrical engineers, electric light and power installers, manufacturers and repairers of all electrical engineering plant, etc. Reg. office: 402, High Street, West Bromwich.

MIDLAND VALVES, LTD.—Private. Cap., £500 in £1 shares. Manufacturers of and dealers in wireless telegraphy and telephony instruments, thermionic valves, electric light bulbs and wireless apparatus, etc. Solicitors: Forsyth, Bettinson and Co., 36, Cannon Street, Birmingham.

FRY AND CO., LTD.—Private. Cap., £2 100 in £1 shares. To acquire the business of Fry and Co., electrical engineers, repairers and manufacturers of and dealers in electrical, magnetic, telegraphic, telephonic and other appliances and apparatus, etc. Reg. office: Maskell St. Works, Maskell Street, Rusholme Road, Manchester.

NEFA CO., LTD.—Private. Cap., £1 000 in £1 shares. Wholesale and retail dealers in and manufacturers of electrical appliances of all kinds, manufacturers of and dealers in domestic appliances, telephones, and all apparatus for the generation, accumulation or distribution of electricity, etc. Reg. office: 27, Queen Victoria Street, London, E.C.4.

HESTAVOX, LTD.—Private. Cap., £5,000 in £1 shares. To take over the business of electrical engineers carried on as the Hestâ Engineering Co., manufacturers of and dealers in and agents for instruments, apparatus, accessories and materials used in connection with radio or wireless or other telegraphy and telephony, etc. Reg. office: 32, Palmerston Road, Acton, London, W.3.

STELLA CONDUIT CO., LTD.—Private. Cap., £20,000 in £1 shares, To take over from the Stella Conduit Co., Ltd., or its liquidator, certain works, plant, machinery and other assets at Highfield Works. Bilston, Staffs, and to carry on the business of makers of and dealers in metal or other conduits, tubes and fittings of all kinds, makers of electric fittings, etc. Reg. office: Highfield Works, Bilston, Staffs.

A.F.A. ACCUMULATORS, LTD.—Private. Cap., 5 000 in £1 shares. To acquire the business of E. G. Lind and Co., makers of electrical accumulators and primary and secondary cells, etc. Provision is made that so long as the Accumulatoren-Fabrik-Aktiengesellschaft hold not less than 1 000 shares, they may be represented on the directorate. Reg. office: 58A, Buckingham Palace Road, Westminster, London, S.W.1.

"Mechanical Road Transport."

An Original and Sound Book.

A book on "Mechanical Road Transport," by Mr. C. G. Conradi, will be published by Macdonald and Evans early next week. The volume is one of the reconstructive technical series which is being issued under the general editorship of Mr. G. W. de Tunzelman. Mr. Conradi's aim in writing this book has been to produce a comprehensive treatise dealing generally with the subject of mechanical road transport from the commercial point of view, and it is intended to appeal to all those whose business includes the transport of goods, as well as to country surveyors, engineers and designers and students. We are interested to see that electric and petrol electric vehicles receive consideration. In a foreword, Dr. H. S. Hele-Shaw calls attention to the originality and soundness of the author's practical conclusions.

In another volume in the same series, which is shortly to be published, Mr. L. C. Harvey will deal with pulverised fuel.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

CLAR-O-PHON RADIO CO., LTD., 9, Bridge Street, Westminster £16 9s. 6d. September 5th.

GREENHALGHS (a firm), Nelson House, Burnley, electricians. £20 3s. 6d. July 31st.

HECKLES BROS., 30, Thackeray Street, Liverpool, electricians £32 15s. 9d. September 7th.

KING WIRELESS CO., 129, Park Road, Hockley, Birmingham manufacturers. £11 13s. 4d. September 3rd.

MITCHELLS ELECTRICAL AND WIRELESS, LTD., 3, McDermott Road, Peckham. £15 1s. September 7th.

SPARKS ELECTRICAL CO., 115, Hammersmith Road, engineers. £15 1s. 7d. September 12th.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

BURFORD ELECTRIC LIGHT AND POWER CO., LTD. Registered October 3rd, £270 mortgage, to H. T. Birks and another, 4, Bedford Row, W.C., solicitors; charged on Burford Mills, etc., Burford; also registered October 3rd, £1,000 2nd debenture to Miss A. B. Naldor, Layham House, near Hadleigh (Suffolk), and another; general charge. *£1,500. September 18th, 1922.

CRAFT (FRANK) (CASTLEFORD), LTD., electric lighting contractors. Registered October 6th, debenture, to Lloyds Bank, Ltd., securing all moneys due or to become due to the bank; general charge. *Nil. December 31st, 1922.

THREE STAR ACCUMULATORS, LTD., London, N. Registered October 2nd; mortgage to bank; charged on premises in Rosebery Avenue, Tottenham. *Nil. December 31st, 1922.

WHITSTABLE ELECTRIC CO., LTD. Registered September 25th, £2 000 debentures part of £10 000; general charge. *£5 366 13s. 4d. December 23rd, 1918.

Satisfactions.

CARMARTHEN ELECTRIC SUPPLY CO., LTD. Satisfaction registered October 5th, £1 000, registered November 6th, 1922.

ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., Birmingham.—Satisfaction registered October 2nd, £130 000, registered January 15th, 1903.

ORMSKIRK ELECTRIC SUPPLY CO., LTD. Satisfaction registered September 25th, £2 300, registered September 12th, 1913.

PREMIER ELECTRICAL ENGINEERING CO., LTD., Stalybridge.—Satisfaction registered September 27th, £200, registered August 18th, 1923.

RANGOON ELECTRIC TRAMWAY AND SUPPLY CO., LTD., London, E.C. Satisfaction registered September 19th, £9 179 part of amounts registered February 15th, 1906, December 31st, 1908, and November 18th, 1913.

REASON MANUFACTURING CO., LTD., Brighton, electrical engineers. Satisfactions registered September 18th, £2 650, part of amount outstanding July 1st, 1908; and £1 000, registered January 2nd, 1912.

ORFORD ELECTRIC LIGHT AND POWER CO., LTD.—Satisfaction registered September 11th, £1 250, registered November 12th, 1912, to September 11th, 1923.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

Companies Winding-Up Voluntarily.

PURDY, A. G., and CLARK, J. M., trading as PURDY AND CLARK, electrical, wireless and general engineers, 295, Goswell Road, London, E.C.1. A meeting of the creditors was held on October 5th, when debtors estimated their liabilities at a little over £300 and the assets were stated at approximately £60. Mr. Clark said that no books had ever been kept and he could not say what the turnover had been or whether any gross profit had been made. Mr. Clark added that the bailiffs had been in possession and had taken approximately £43 worth of stock, etc., away. Creditors had been pressing for about 18 months and they had paid out £97 for costs during the last year or two. No resolution was passed, and debtors stated that they would not be able to raise any money to file their petition in bankruptcy

YORKSHIRE AND DISTRICT ELECTRIC LAMP REPAIRING CO., LTD.—At the statutory meeting at Sheffield of creditors in this voluntary winding-up, the liquidator, Mr. Horace Cawood, said the reason of the failure of the company was the action taken by one of the big companies for an injunction claiming that the business of the company was an infringement of their patent. This was fought by the directors and a victory gained in the interim injunction, but in the general action in the High Court a verdict was given against the company. The debenture holders immediately appointed him as a receiver, but the assets, all of which (except the property which has been or was being taken possession of by the mortgagees) had been realised, were not expected to amount to much, if any, more than would be sufficient to meet the costs and preferential creditors. The property was offered by auction but was not sold.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-up Voluntarily.

ELECTRIC BLASTING APPARATUS CO., LTD. P. J Cory, Nobel House, Buckingham Gate, London, S.W.1, appointed liquidator. Meeting of creditors at the registered offices, Nobel House, Buckingham Gate, London, S.W.1, on Wednesday, October 17th, at 2.30 p.m.

Bankruptcy Information.

MATSON, Frederick John, lately carrying on business at Asquith Street, Woodhouse, Leeds, as an automobile electrical engineer, under the style of the SUNNYVALE ENGINEERING CO., but now at 24, Rider Road, Woodhouse, Leeds, as an automobile electrical engineer, under the style of the MAGAN-DYNAMO CO. Receiving order, October 9th. Debtor's petition.

THORPE, Francis Bertram, electrical engineer, 1a, West Laithe Gate, Doncaster. Receiving order, October 12th. Debtor's petition.

WHITELOCK, Ernest William James, 4, Leagrave Road, Luton, in the county of Bedford, and also 7, Cheapside, Luton, electrical engineer. First meeting, October 20th, 11 a.m., Official Receiver's Office, The Parade, Northampton. Public examination, November 22nd, 11.30 a.m., Court House, Luton.

Notice of Dividend.

WEEKS, William Edward, 59, Victoria Street, and 12, Filton Avenue, Horfield, Bristol, electrical dealer. First and final dividend of 4s. 5d. per £, payable October 17th, Office of the Trustee, 18, Nicholas Street, Bristol.

Notices of Intended Dividends.

MEARNS, Edward Enoch, 14, St. Bede's Road, East Boldon, Durham, electrical contractor. Last day for receiving proofs, October 24th. Trustee, C. Woollett, Official Receiver, Pearl Buildings, 4, Northumberland Street, Newcastle-upon-Tyne.

ROGERS, Philip Marsden, trading as the LONGBRIDGE ENGINEERING CO., Great Darkgate Street, Aberystwyth. Last day for receiving proofs, October 20th. Trustee, H. W. Thomas, 4, Queen Street, Carmarthen.

Applications for Discharge.

GORDON, Malcolm Thomas Birch, at present employed at 165, King Street, Hammersmith, traveller, and lately carrying on business at 20, Western Broadway, King Street, Hammersmith, London, electrical and general merchant, under the style of THOMAS GORDON. Hearing, November 9th, 11 a.m. Bankruptcy Buildings, Carey Street, London, W.C.2.

SNELL, George Harry Bertram, carrying on business in partnership with Leslie Philip Howse, under the style of HOWSE AND SNELL, 6 and 8, Duke Street, Margate, electrical engineers. Hearing, November 6th, 11 a.m., The Guildhall, Canterbury.

Partnerships Dissolved.

DICKSON AND CO. (James DICKSON and John Miller NORWELL), electrical, mechanical and automobile engineers, 522, Manchester Road, Hollinwood, near Manchester, by mutual consent as from September 1st, 1923. Debts received and paid by J. M. Norwell, who will carry on the business under the name of Norwell, Dickson and Co.

EASBY AND DAVIES (Frederick Vincent EASBY and George Blandford DAVIES), electrical, mechanical and motor engineers.

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Little Thomas Lane, Redcliffe Street, Bristol, by mutual consent as from September 7th, 1923.

ELECTRIC LIGHT, MOTOR AND ENGINEERING CO. (Thomas MANSON, John Foote KENDAL and George Alfred EDWARDS), mechanical and electrical engineers and contractors, 7, Victoria Square, Truro, by mutual consent as from February 28th, 1923. Debts received and paid by G. A. Edwards, who will carry on the business as "The Truro Electric Light, Motor and Engineering Co.

FOREST RADIO COMPANY (Samuel Thomas SIMMONDS and Charles William HINE), electrical engineers, Blenheim Road, Wood Green, and 71, Fleet Street, E.C., by mutual consent as from September 12th, 1923.

MEAGHER AND RATCLIFFE (Walter Denis MEAGHER and Thomas Henry RATCLIFFE), magneto coil and accumulator specialists and repairers and motor factors, 221, Deansgate Manchester, by mutual consent as from August 25th, 1923.

Bankruptcy Proceedings.

BRITISH RADIOPHONE CO., Bulwell, Nottingham, makers of wireless apparatus. At the adjourned public examination recently of Norman Williams, Mabel Williams, and Walter Cook, trading as above (see THE ELECTRICIAN, 20/7/23, p. 75), debtor N. Williams admitted having received a cheque for £200 in respect of an order which he did not complete, and further stated that he could not fulfil other subsequent orders. He admitted that unless they had the money in advance they could not get the material to meet the orders. Mabel Williams admitted having previously been a partner in her husband's business until a receiving order was made against him, but she declared she had no separate assets or liabilities. She had had no active control in the business. On behalf of Cook, an application was made to dispense with his public examination on account of ill-health. The examination was closed.

STOCKEN, Cyril Walter, and FINK, Conway, trading as the WYNDHAM RADIO SUPPLIES, 80, Redcliffe Street, Bristol. The public examination of these debtors was held on October 12th, at the Guildhall, Bristol. The statement of affairs showed a deficiency of £407. It appeared that debtor Fink commenced business as an electric lamp factor in London without capital, and as the business was not a success he agreed to pay his liabilities of about £130 by instalments. Debtors started trading together at Narrow Wine Street, Bristol, in 1922 without capital, Fink still owing the money. They stated that they did not become aware of their position until July, when they were pressed by creditors. The examination was adjourned.

After Business Hours.

B.T.-H. London Club.

The B.T.-H. London Club had an enjoyable whist drive and dance at Anderton's Hotel, London, last Friday. The prizes were presented by Mr. F. W. Leevers, and Mr. F. H. Howell and Mr. J. E. Arnold acted as M.C.s.

Rubber Trade Golfers

A golf match between the Institution of Rubber Industry and the Rubber Trade Association, played at Eltham on October 11th, resulted in a win for the Association by 9½ to 2½ in the singles and 3½ to 2 in the foursomes.

Callender's Employees in Opera.

Callender's "Anchor" Cable Works Musical Society, Leigh, established four years ago, attracted crowded houses to the local Hippodrome every night last week to see their performance of "The Gondoliers." On the Wednesday night Sir Tom Callender, and several members of the London and Leigh management, were present, while over 1 200 school children attended the Friday performance, which was under the patronage of the Mayor and Mayoress of Leigh. The week's "show" was an unqualified success, and fully justified the "Anchor" Society's commendable enterprise.

The Kelvin Lodge Ladies' Festival.

The annual ladies' festival of the Kelvin Lodge, No. 3 736, was held at the Connaught Rooms on October 5th, when the W.M., Mr. Philip C. Ebner, and Mrs. Ebner welcomed a party of over one hundred members of the Lodge, their wives and friends. An enjoyable musical programme was provided by W.Bro. Ralph Norris, and each lady received as a gift a charming memento of the occasion, as well as a box of chocolates. Altogether it was just the sort of happy evening for which this well known electrical lodge has gained such a reputation.

The Installation Meeting of the Kelvin Lodge, No. 3 736, will be held at Mark Masons' Hall on Friday, October 26th, at 5 p.m., when Mr. A. Forbes Dick is due to be installed as W.M. for the ensuing twelve months.

Forty Years Ago.

"The Electrician," October 20th, 1883.

THE FERRANTI DYNAMO.—A thousand-light machine, constructed upon the Ferranti system, was shown in action at the works of the company, Appold Street, Finsbury, on Wednesday evening last. The trial was with 840 Swan 20 candle-power 100 V lamps (nominal), and seemed in every way satisfactory. A number of diagrams were taken from the engine—one by Fowler, of Leeds—and the figures obtained from these, as well as the purely electrical data, together with illustrations of the machine, will be given next week.

* * *

NEW FORM OF ARC LAMP.—A large number of new lamps, called the double disc lamp, are now being manufactured at Messrs. Crompton and Co.'s Arc Works, at Chelmsford. The peculiarity of the lamp is its simple mechanical construction, complicated clockwork being dispensed with, and the whole being controlled by one solenoid, wound differentially so that the lamps can be worked in series to any number in the same circuit. This improvement is due to Mr. T. C. Crabb, and was patented in May last. The lamp has been successfully tested on the exterior of the Arc Works. It has two sets of carbons, so that when one carbon is consumed the other automatically becomes lighted, without the slightest break in the illumination. The two carbons will burn 17 or 18 hours without being replaced.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Raw Materials for the Furniture Trade"; "Furniture with a Future"; "Modern Pottery"; "Bathroom Equipment."

THE CHEMICAL AGE.—"Chemistry at the British Empire Exhibition"; "Improved Chemical Export Trade"; "Manufacture of Nitric Acid and Nitrates."

THE EUROPEAN COMMERCIAL.—"Measures for Improving Swiss Foreign Trade"; "The Port of Hull: a Centre of Anglo-Continental Trade"; "International Price Comparisons."

THE FRUIT GROWER.—"Diseases of Glasshouse Plants: Dr. Bewley's Book Reviewed"; "Apple Imports and their Moral"; "Root Stock Investigations," by H. G. Hulton.

THE GAS WORLD.—"Gas Supply of Manila: Proposed Amalgamation of Gas Companies"; "Gas Appliance Sales in the United States."

THE HARDWARE TRADE JOURNAL.—"The Cycle and Motor-Cycle Show" (Illustrated); "Locks and Lock-makers"; "Our Overseas Trade in Hardware."

Books Received.

"Wireless Facts and Figures." By A. V. Ballhatchet. (London: Percival Marshall and Co.) Pp. 52. 6d. net.

"Elementary Electricity." By S. G. Starling. (London: Longmans, Green and Co.) Pp. 248. 3s. 6d. net.

"Successful Wireless Reception." By Paul D. Tyers. (London: Percival Marshall and Co.) Pp. 87. 1s. 6d. net.

Prices of Metals, Chemicals, etc.

TUESDAY, October 16th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£63 10 0	—	£1
Electro Wirebars ..	„	£65 0 0	—	£1
H.C. Wire, basis ..	per lb.	9 7/8 d.	—	⅛d.
Sheet	„	9⅝d.	—	¼d.
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 0 7/16 d.	—	1⅛d.
Brass 60/40—				
Rod, basis	„	7½d.	—	—
Sheet, basis	„	10d.	—	—
Wire, basis	„	10¼d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 2 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
Lead Pig—				
English	„	£28 10 0	15s.	—
Foreign or Colonial	„	£27 0 0	10s.	—
Tin—				
Ingot	„	£202 10 0	—	£3 5 0
Wire, basis	per lb.	2s. 8d.	—	½d.
Aluminium Ingots ..	per ton	£120 0 0	£5	—
Spelter	„	£32 7 6	—	7s. 6d.
Mercury	per bottle	£9 5 0	—	—

Sulphur (Flowers)—Ton £8 10s. *Sodium Chlorate*—Per lb. 2½d.
„ (Roll-Brimstone)—„ £8 10s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. „ £25 10s. per ton, £7 10s.
Boric Acid (Crystals). „ £48 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2⅛d.; plantation 1st latex, 1s. 1⅝d. to 1s. 2⅛d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

202 801 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.) Electric heating devices. (4/7/22.)
202 806 T. MATHER. Electrical measuring instruments. (8/7/22.)
202 815 A. G. DAVIES. Electric switches. (22/7/22.)
202 818 E. W. PATTISON. (Dictograph Products Corporation.) Telephone receivers. (27/7/22.)
184 195 GES. FUR DRAHTLOSE TELEGRAPHIE. Means for controlling the voltage of the alternating current supplied to a valve generator. (5/8/21.)
202 833 J. B. HANSELL, and METROPOLITAN-VICKERS ELECTRICAL CO. Electric switches. (16/8/22.)
202 842 G. A. CHEETHAM, and METROPOLITAN-VICKERS ELECTRICAL CO. Automatic electrical substation systems. (24/8/22.)
202 845 K. F. BLASER, and E. BLASER. Alternating current and continuous current converters. (25/8/22.)
185 761 O. PLEITSCHER. Combined electric lamps and magneto electric generators therefor. (11/9/21.)
186 933 A. RENAUDIN. Method of and appliances for suspending aerial electric conductors. (8/10/21.)
202 873 BRITISH THOMSON-HOUSTON CO., A. P. YOUNG, and A. T. STACE. Head attachment gear for telephone receivers. (16/10/22.)
202 881 HOOVER SUCTION SWEEPER CO. Electric switches. (24/10/22).
202 882 J. P. SCOTT. Electrolytic apparatus. (24/10/22.)
202 885 F. H. ROYCE, and ROLLS-ROYCE, LTD. Electrical ignition apparatus for internal combustion engines. (25/10/22.)
202 897 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.) Electric switches. (4/12/22.)
202 901 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.) Protective arrangements for electric distribution systems. (18/12/22.)
202 903 A. R. ANGUS. Control of trains. (20/4/22.) (Divided application on 190 503.)
191 056 AUTOMATIC TELEPHONE MANUFACTURING CO. Calling devices of the dial type for use in automatic telephone systems. (30/12/21.)
202 928 H. A. DAYNES, and CAMBRIDGE AND PAULL INSTRUMENT CO. Thermo-electric pyrometers. (25/4/23.)
202 929 H. WADE. (GOULD STORAGE BATTERY CO.) Manufacture of storage battery separators. (20/4/22.) (Divided Application on 200 913.)
202 937 W. FENTON. Lamps for motor cars, illuminating photographic studios, theatre spot-lights, search-lights, lighthouses, and the like. (19/9/22.) (Divided Application on 201 956.)
201 186 SOC. FRANCAISE RADIO ELECTRIQUE. Printing telegraphs. (29/3/21.) (Divided Application to 177 769.)
190 991 SOC. LA METALLURGIQUE ELECTRIQUE. Protective cut-out arrangements for electric distribution systems. (28/12/21.)
178 862 C. L. FARRAND and W. H. DAVIS. Telephone receivers and like instruments. (23/4/21.)
179 186 C. E. BENNETT. Apparatus for detecting defective electrical insulator units in a series subjected to a high alternating tension. (30/4/21.)
203 023 EVERSHED AND VIGNOLES and J. C. NEEDHAM. Method of and means for establishing electrical connection between movable contacts. (24/5/22.)
203 045 F. E. PERNOT and L. J. RICH. Multiplex telegraphy. (31/5/22.)
181 022 B.O.E. (BUREAU D'ORGANISATION ECONOMIQUE.) Metallic-vapour electric rectifier with automatic intensification and maintenance of the vacuum. (2/6/21.)
203 052 W. T. DITCHAM. Electrical condensers. (31/5/22.)
203 053 H. J. ROUND. Wireless telegraph receiving circuits. (31/5/22.)
203 063 C. A. COLEMAN. Method and means for automatically lighting electric street and other lamps, and switches therefor. (6/6/22.)
203 067 H. D. NYBERG. Galvanic cells with gas depolarisation. (6/6/22.)
182 105 E. HABANN. Thermionic tubes. (24/6/21.)
181 711 MORKRUM CO. Printing telegraph receiver. (13/6/21.)
203 090 W. J. POLYBLANK. Electric couplings. (15/6/22.)
203 093 ELECTRIC CONTROL, LTD., and O. ELLEFSEN. Electric converting machinery or apparatus. (16/6/22.) (Cognate Application 34 784/22.)
183 808 INSTRUMENTFABRIEKEN-HANDEL VOORHEEN P. J. KIPP AND ZONEN. Movable system for electric measuring instruments. (28/7/21.)
203 097 W. R. BULLIMORE. Thermionic valves. (22/6/22.)
203 101 FERGUSON PAILIN, LTD., and G. PAILIN. Electric switches, circuit breakers, and the like. (23/6/22.)
183 438 WESTERN ELECTRIC CO., LTD. Telephone systems and apparatus for use therein. (21/7/21.)
203 121 S. G. BROWN. Telephone receivers. (6/7/22.)
203 129 WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO., INC.). Control circuits particularly for use in automatic telephone systems. (13/7/22.)
203 131 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Automatic reclosing circuit breaker systems. (13/7/22.)
185 100 HASLER AKT.-GES. VORM TELEGRAPHEN-WERKSTATTE VON G. HASLER. Electric relay. (24/8/21.)
203 164 AUTOMATIC TELEPHONE MANUFACTURING CO. and A. E. HUDD. Railway signalling systems. (16/8/22.)
203 180 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electro-magnets. (28/8/22.)
203 185 E. J. MCCORMACK. Collapsible electric heaters. (1/9/22.)
186 597 H. P. MCCOLL. Electric switch actuating mechanism. (29/9/21.)
185 426 LANDIS AND GYR, AKT.-GES. Electric switch as applied to time switches in particular. (3/9/21.)
203 189 S. B. MORGAN. Magnetic separators. (6/9/22.)
185 753 BRITISH THOMSON-HOUSTON CO. Electron discharge apparatus. (8/9/21.)
203 198 A. E. WRIGHT. Electric heaters or driers. (22/9/22.)
186 349 WESTERN ELECTRIC CO. Electrical conductors. (22/9/21.)
203 201 C. R. HARDY and HART ACCUMULATOR CO. Anti-spilling constructions for electric batteries. (26/9/22.)
186 630 PROGRESS AKT.-GES. Plug-and-socket coupling for electrical installations. (30/9/21.)
193 002 AUTOMATIC TELEPHONE MANUFACTURING CO. Telephone systems. (11/2/22.)
203 210 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electric motors. (6/10/22.)
187 233 BRITISH THOMSON-HOUSTON CO. Electron discharge devices. (13/10/21.)
192 682 AUTOMATIC TELEPHONE MANUFACTURING CO. Telephone systems. (4/2/22.)
203 221 F. G. GALE. Electric welding machines. (23/10/22.)
203 223 W. DORNIG. Speed regulators for electric motors. (24/10/22.)
203 244 BRITISH THOMSON-HOUSTON CO. (INTERNATIONAL GENERAL ELECTRIC CO., INC.). Electric heating devices. (29/11/22.)

APPLICATIONS FOR PATENTS.

October 1st.

24 318 H. W. COLE. Frame aerials.
24 326 F. H. BLAXLEY. Condensers for wireless telegraphy, etc.
24 346 A. ORLING. Electric contact breakers.
24 362 W. L. DENTON and G. A. HORTON. Electric coil.
24 413 G. MCCULLOCH. Electric lamps for motor cars.

October 2nd.

24 423 F. TIDY. Rubber caps for telephone receivers.
24 432 T. J. SOUTHALL. Antiseptic lining for telephone mouthpieces.
24 441 W. S. DIMES. Operation of electric motor-car horn
24 448 F. H. GROVE. Distributors or switch mechanisms for controlling electric circuits.
24 453 AUSTIN MOTOR CO. Device for indicating condition of battery.
24 455 C. KRATT and T. MCCLELLAND. Recording apparatus for wireless messages.
24 466 W. J. DAVIES. Frame aerials for wireless apparatus.
24 468 WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO., INC.). Radio repeating systems.
24 485 G HUNTER. Magneto machines.
24 488 ENGLISH ELECTRIC CO. and SIR J. A. F. ASPINALL. Electric traction systems.
24 491 BRITISH THOMSON-HOUSTON CO. and F. P. WHITAKER. Control of synchronous motors.
24 498 C. A. VANDERVELL AND CO. and F. L. HOLLISTER. Electric lighting and ignition machines for automobiles.
24 510 BAYERISCHE ELEKTRIZITATS INDUSTRIE ROTT UND CO. Electric starters (2/10/22, Germany).

October 3rd.

24 520 H. BRANTOM. Micrometer variable condenser.
24 521 A. M. TAYLOR. Method of transmitting capacity currents in underground cables.
24 555 A. J. BEALE and W. H. EDEY. Electric light fitting.
24 566 G. T. BEILBY. Electrolytic cells with mercury electrodes.
24 587 E. L. CHAMPION and A. A. G. H. TERRISSE. Apparatus for cleaning tramrails (25/11/22, France).
24 596 F. L. HOLLISTER. Dynamo-electric machines.
24 597 RADIATIVE CO. Telephone apparatus (31/1/23, U.S.).
24 613 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Insulating material.
24 614 BRITISH THOMSON-HOUSTON CO. and H. C. HASTINGS. Motor control.

October 4th.

24 668 O. EKMAN. Electric junction boxes, etc.
24 689 R. W. HORSFALL. Electric locking devices for railway carriage doors.
24 693 WEDEKIND & CO., L. J. GOLDHILL, H. M. and L. P. LINDEN. Wireless receiving apparatus.
24 699 T. E. WEBSTER and W. S. WORTHINGTON. Wireless receiving apparatus.
24 709 E. E. EAKINS. Storage batteries.
24 712 COVENTRY AUTOMATIC TELEPHONES, LTD., and W. CORNELL. Telephone systems.
24 713 COVENTRY AUTOMATIC TELEPHONES, LTD., and J. E. COLLYER. Telephone systems.
24 738 METROPOLITAN-VICKERS ELECTRICAL CO. Motor control (4/10/22 U.S.)
24 748 F. W. WALLIS. Connections for oscillatory circuits.
24 750 AKT.-GES. BROWN, BOVERI ET CIE. Apparatus for closing automatic electric switches (9/10/22, Germany).

October 5th.

24 767 F. E. STRATTEN. Variable resistance and potentiometer.
24 810 A. F. SYKES. Electromagnetic sound transmitters and receivers.
24 815 L. MCBLAIN. Electrical apparatus for generating ozone.
24 819 WESTERN ELECTRIC CO. (DEAKIN). Automatic telephone systems.
24 835 J. H. COLLINGS and S. D. WHITE. Electric light fittings.
24 856 GES. FUR DRAKTLOSE TELEGRAPHIE. A.C. circuits (13/10/22, Germany).
24 857 RELAY AUTOMATIC TELEPHONE CO. and E. J. C. ROUSSEAUX. Telephone trunking schemes.
24 858 SOC. FRANCAISE RADIO-ELECTRIQUE. Method of regulating speed of high-frequency alternator (9/10/22, France).
24 860 H. WADE (PHILIPS' GLOEILAMPENFABRIEKEN). Glow cathode X-ray tubes.
24 861 TELEPHONE MANUFACTURING CO. and L. F. BARNES. Electric condensers.

October 6th.

24 874 W. J. TAYLOR. Wireless telephone receiver.
24 900 G. A. MITCHELL. Wireless receiving sets.
24 901 G. A. MITCHELL. Wireless transmitting and receiving sets.
24 902 A. T. DAVIES. Incandescent electric illumination.
24 908 E. E. AND R. W. SCOTT. Distribution of current for lighting on roundabouts, etc.

Arrangements for the Week.

FRIDAY, OCTOBER 19th (To-day).

THE INSTITUTION OF MECHANICAL ENGINEERS.

6 *p.m.* At the Institution, Storey's Gate, St. James's Park, London. General meeting. Presidential Address by Sir John Dewrance.

INSTITUTE OF METALS (SCOTTISH LOCAL SECTION).

7.30 *p.m.* At the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow. Prof. H. C. H. Carpenter on "Large Metallic Crystals and some of their Properties."

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At the Institution, 30, Victoria Street, Westminster, S.W.1. Lecturette by Mr. F. W. Dye on "The Gas Boiler (or Circulator) and its Applications."

NORTH EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.

7.30 *p.m.* Fortieth Annual General Meeting. In the Lecture Theatre of the Literary and Philosophical Society, Westgate Road, Newcastle-on-Tyne. Paper by Dr. Guy D. Bengough on "The Causes of Rapid Corrosion of Condenser Tubes."

MONDAY, OCTOBER 22nd,

THE INSTITUTE OF PHYSICS.

5.30 *p.m.* In the Hall of the Institution of Electrical Engineers, Victoria Embankment, London, W.C.2. Lecture on "The Physicist in the Textile Industries," by Dr. A. E. Oxley.

THE INSTITUTION OF ELECTRICAL ENGINEERS (NORTH EASTERN CENTRE).

7.30 *p.m.* At Armstrong College, Newcastle-on-Tyne. Inaugural address by the Chairman, Mr. T. Carter.

WEDNESDAY, OCTOBER 24th.

UNIVERSITY OF LONDON, UNIVERSITY COLLEGE.

5 *p.m.* At the University College, Gower Street, London, W.C.1. First lecture by Professor J. A. Fleming on "Ionic and Thermionic Valves."

MANCHESTER WIRELESS SOCIETY.

8 *p.m* In the Council Chamber, Houldsworth Hall, 90, Deansgate, Manchester. Lecture by Mr. Y. W. P. Evans on "The Construction of the Cossor Valve."

FRIDAY, OCTOBER 26th.

THE NEWCOMEN SOCIETY.

5.30 *p.m.* In Prince Henry's Room, 17, Fleet Street, London, E.C. Presidential address by Mr. Lough St. L. Pendred on "The Value of the History of Technology."

THE JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At the Institution, 30, Victoria Street, Westminster, S.W.1. Lecturette by Mr. A. V. Ballhatchet on "Crystals for Wireless Reception."

The Editorial, Advertisement and Publishing Offices of "THE ELECTRICIAN" are at 8, Bouverie Street, London, E.C.4. Telegrams: Benbrotric, Fleet, London. Telephone: City 9852 (6 lines).

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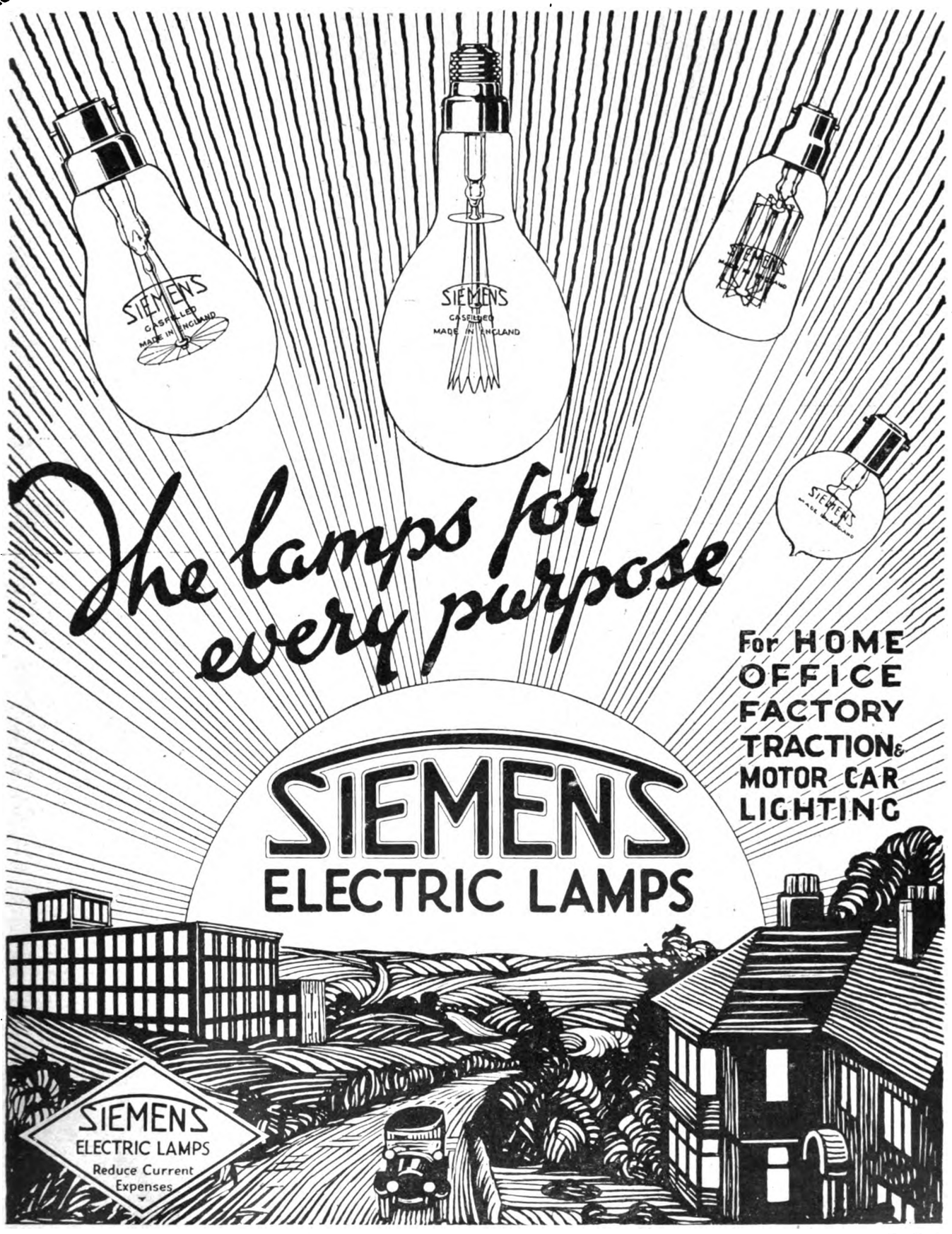

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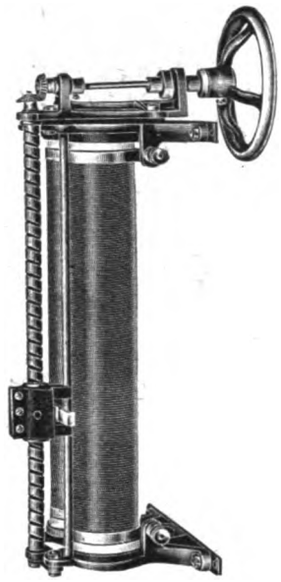

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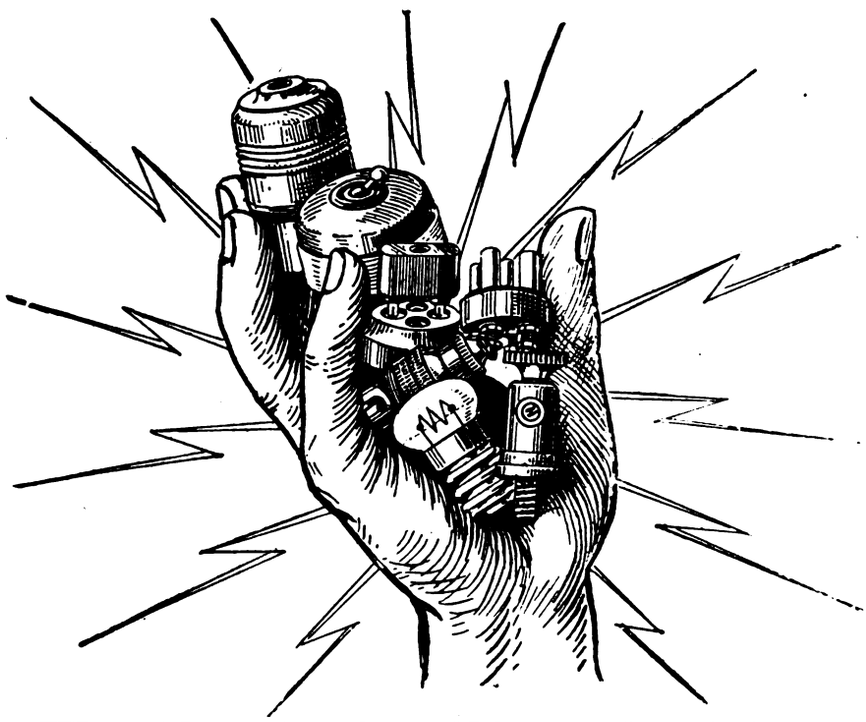

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THE ELECTRICIAN

ESTABLISHED 1861.

THE OLDEST WEEKLY ILLUSTRATED JOURNAL OF

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Notes of the Week.

Imperial Wireless.

It is evident from the official account of the speeches made at the Imperial Economic Conference on the subject of the Empire's wireless service that the overseas representatives do not agree with the Postmaster-General on the advantage of Government ownership and operation. In Canada there are in fact Marconi stations at Montreal and Vancouver which would form a link in the Imperial chain. Mr. Bruce was puzzled as to why the negotiations between the Post Office and the Marconi Co. had broken down. Sir Laming Worthington Evans explained that it was due to disagreement as to who was to control the distribution of the messages between the two Marconi stations and the Post Office station, and that what the company required was a license to communicate all over the world irrespective of any Government station. In a statement issued earlier in the week Mr. Godfrey Isaacs said that the Post Office proposal would mean a large capital expenditure without any effective control of the conduct of the service. The Company would agree to pooling if it could secure the management of its own business, or failing that a non-exclusive license which would enable them to create a world-wide system of wireless communication. Mr. Godfrey Isaacs points out in a further statement however that the difficulty which the Postmaster-General has been under the impression is standing in the way of agreement does not exist. We hope, therefore, that the license will be issued and a commencement made with the provision of the stations necessary to furnish the Empire with a modern wireless telegraph service. It is high time.

Dielectric Phenomena in Cables.

Under the title "How Serious is Ionization in Cables?" the "Electrical World" discusses in a leading article the advances that have been made in the manufacture of super-tension cables during the past twelve months. It shows how the progress of reducing insulation thickness and the raising of operating voltage is based on empirical results in a field of knowledge where experts differ and where even the nature of the phenomena is not understood. One of the important points is that of ionisation, and the article, referring to the excellent analysis by a Continental engineer which we summarised in our issue of August 18th, 1922, concludes that "our friends on the other side have a little the edge on us." To the psychologically minded the comparison of the present attitude of American and European, particularly British, engineers on the subject of cable development makes an interesting study. A paper on cable theory is a *rara avis* in our Institution, while the American transactions are crowded with relevant contributions; and only a few months ago a number of leading American engineers, representing among other interests the cable purchaser, paid a visit to this country and the Continent to glean information on some of these factors so vital to the development of electrical enterprise. We know that in this country ionisation and allied problems are receiving the closest attention at the hands of the cable makers, and the paucity of public utterances on the subject must not be interpreted as showing indifference. Whether it indicates a characteristic modesty or an anxiety to know before saying we are unable to decide; but in any case we do agree with our contemporary that the acquisition and dissemination of exact knowledge of these various phenomena is of supreme importance at the present stage in the progress of electrical transmission.

A Lesson from Hackney.

The all-electric houses at Hackney which were formally opened by the Duke of Connaught on Saturday, are interesting for more than one reason. They will allow a class of inhabitant which is often supposed to be outside

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our purview to obtain all the benefits of the domestic electric idea. As payment for the installation and the equipment is included in the moderate prices charged for the electricity used, another presumed insuperable obstacle is overcome. The species of consumer that is wisely provided with a prepayment meter is catered for, though the current usually dealt with by this type of apparatus is greatly exceeded. And shoddiness, both in the wiring and the fittings, has been rigorously eschewed. The most important detail about the equipment of these houses is, however, the generosity which has been displayed with regard to the number of points. In each room, besides the usual, and too often the only, lighting fitting there is a power plug, and looped out from it a lighting plug. These plugs are placed in the most convenient position in the room, and the latter is fused so that another usual objection to this arrangement is overcome. If the domestic electric idea is ever to be more than an idea, those responsible for the wiring of houses must realise that more outlets are required. Their provision will not add greatly to the first cost, and the extra expenditure will be more than repaid in the greater consumption and the greater demand for apparatus.

Electricity a Necessity.

THOUGH all credit is due to Mr. L. L. ROBINSON for his latest enterprise, it is only fair to state that he is not the only one. The annual report of the city electrical engineer of Bradford, Mr. T. ROLES, states that during the past year greatly increased demands have been made for electricity for general domestic purposes, and that applications to considerable numbers are being received for supplies to houses with a rateable value of £14 and under. Most of these consumers have elected to be charged at the special domestic rates, and are using both irons and fires. As Mr. ROLES rightly points out, the adoption of electricity in these houses, which are of small size and often of the back-to-back type, establishes beyond question the fact that electricity is now regarded by the public as a necessity. Cooking is becoming more and more popular, and there is every reason to suppose that in the near future there will be a considerable extension of use of electricity for this purpose. The moral for many electrical engineers on all this: Go thou and do likewise.

Collieries and Housing Schemes.

IN their recent annual report, the Electricity Commissioners called attention to the large amount of energy which was being generated by certain power users, such as collieries, for their own purposes. The suggestion is also put forward that arrangements might be made with such consumers for surplus, reciprocal or standby supply. Such undertakings, if we may use a word hallowed to different purposes, have other uses. Most collieries possess, as part of their organisation, a housing scheme for the accommodation of their workers, and the outcry for better living conditions and other reasons are causing these schemes to be largely extended. The houses that are now being built provide yet another chance for the development of the electric idea, and the presence of cheap electricity close at hand should make its realisation easy. We believe such a scheme is being worked out. All the new houses are to be wired, and the cost of the electricity used is to be included in the rent. The colliery company will undertake the necessary maintenance, and will of course supply the energy. Propaganda is to be undertaken to secure as many consumers as possible before supply is available, but services will in any case be provided to all houses to take care of subsequent changes of heart. The idea cuts across many of our preconceived notions, but it is none the worse for that. It would help to ameliorate conditions where they are often bad and to extend the use of electricity for domestic purposes.

Automatic Telephony on Railways.

IN a paper on "Automatic Telephone Switchboards" read before a recent meeting of the Institution of Railway Signal Engineers, Mr. W. J. THORROWGOOD gave an account of the advantages which would accrue to railway companies from the greater use of automatic telephony on their systems. These advantages may be summarised under eleven headings: Simplicity of operation; the apparatus is always ready to answer a call; saves time in calling; no operators required; certainty of action; no wrong numbers; efficient and economical; continuity of service night and day—no holidays, no sick leave, no meals or rest hours; no favouritism; the first caller is the first one put through; when once the connection is established, it cannot be interrupted and the conversation is quite secret; if any trouble arises in dialing, the caller is automatically switched on to the manual operator in about 20 secs., who puts the matter right; any fault in the switchboard is reported to the lineman automatically within two minutes. Mr. THORROWGOOD not only prescribes but takes his own medicine, and it will be remembered that we recently described the installation at Waterloo, while other similar equipment at Southampton and Eastleigh was dealt with in the Paper. Modern methods of railway operation require for their success that there shall be easy and certain communication between strategic points on the system. The telephone, which can be used by everyone after a little instruction, obviously fulfils these requirements, while the automatic telephone, owing to the saving in labour which it allows, is a step further towards the ideal. Progress in the use of the automatic telephone on the Post Office system has been retarded owing to great traffic and commercial difficulties attending the conversion, not from any technical shortcomings. From this point of view the railways are in a more favourable position, and we hope, therefore, that the example set by the Southern Railway will be widely followed.

Shop Window Lighting and Increased Business.

THE "long-hour" lighting of shop windows (and by long-hour we mean something not much less than twenty-four hours a day) is a subject in which all sections of the electrical industry should interest themselves. The contractor because it will mean more installation work and maintenance; for once one or two shopkeepers in a town are converted, the others will follow like sheep. The supply engineer because it will increase his output, reduce his load factor, and get down his coal costs. The manufacturer and wholesaler because it will increase the demand for equipment. While all will be interested because long-hour shop-window lighting is one of the best ways of increasing the retail trade of the country. The reason is clear: lighted shop windows attract onlookers, and the number thus attracted is some measure of the number of buyers; otherwise, why have shop windows? That lighted shop windows do attract buyers is strikingly illustrated by the results of some experiments given by Messrs. W. STURROCK and J. M. SHUTE in a Paper read before the American Illuminating Engineering Society. These experiments were made simultaneously in a number of shops in different parts of the country. The same method of lighting was used in every case, and the illumination was adjusted to 15, 40, 65, 85 and 100 foot candles. While the results obtained varied a little, all pointed to the same conclusion: that not only does illumination draw, but increased illumination draws more. Increasing the illumination from 15 to 40 foot candles, for instance, increased the drawing power by 33 per cent., while 100 foot candles doubled it. The use of coloured light increased the drawing power by 40 per cent. It must not be forgotten that the influence of good lighting remains after the customers have entered the shop, and this provides another outlet for trade to which universal attention should be given.

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The Third Party in Industry.

We have often referred in these columns to the importance of organising the salaried classes in the industry, not only in the interests of the individuals forming these classes, but as a safeguard to industrial peace. The Society of Technical Engineers, in spite of much opposition from both the employers and the manual workers, has done much good work in this direction, and we are glad to learn that their activities are to be extended. While still pursuing their settled policy of improving the conditions under which staff work is carried on and creating some machinery for the relations between administrative and technical workers and employees on the one hand and manual workers on the other, the Society are now suggesting the formation of staff councils in every engineering firm where the size of the staff allows this to be done. Where possible the councils will be representative of the staff as a whole; but it is hoped that in large firms technical committees will be formed. These councils will not have any official connection with the Society, though the latter will aid and advise in their formation. It is, however, evident that both the councils and the Society will be striving simultaneously towards the same object, and our hope, therefore, is that they will be set in operation without delay for the good of industry as a whole.

Thunderstorms.

Dr. ALEXANDER RUSSELL'S Presidential Address to the Institution of Electrical Engineers last week is at once the admiration and despair of the commentator. There are, as we pointed out, when Mr. LLEWELYN ATKINSON delivered his address three years ago, more than one kind of presidential emanation of varying interest and value; and of varying appeal to electrical engineers as a whole. Strictly speaking, Dr. RUSSELL'S address falls into none of these classes, though perhaps it could be with most justice relegated to the second, in which the speaker deals with progress in the particular branch of science or industry with which he is most familiar. Unfortunately for the purposes of classification, Dr. RUSSELL'S interests are wide and he felt called upon to comment rather briefly on a number of subjects with a view to bringing up to date our technical knowledge upon them, but without giving any but the most succinct conclusion on any one of them.

The electrical journals have been rather unjustly assailed, for, on the one hand, failing to realise that the success of the electrical industry depends on selling electricity, and on the other, neglecting as of no value the advances that are always being made in pure science and technology. Our own conscience is clear on both these points. In our opinion both these activities are not only of equal value but are complementary, and our object in life is to record the advances that are being made in both.

A Storm and Its Causes.

But even were it not our bounden duty to comment on the Presidential Address we should make no apology for doing so, nor for calling attention to what we think are the most interesting paragraphs in it. Our readers will not have forgotten that on the night of July 9th-10th last a thunderstorm of exceptional violence visited the London district. So extraordinary was it in more than one way that the man in the street began to ask how thunderstorms were caused, and our daily contemporaries made valiant attempts to supply explanations. Most of these explanations were a greater tribute to the powers of imagination of the writers than to their knowledge of meteorological phenomena. Some of them ascribed the storm to a species of nebular ju-jitsu; others thought it due to broadcasting or to electricity supply. Indeed, the explanations were harder to understand than the storm, and the real causes of a most interesting electrical exhibition were left in obscurity. In providing a clear discussion of what really happens during a thunderstorm Dr. RUSSELL has supplied (we apologise) a long felt want.

Conditions in the Upper Atmosphere.

The Meteorological Office has shown that if the temperature of the air at earth level is 10° C. it falls uniformly as we go upwards for a distance of six miles, at which height it reaches a temperature of about −53° C. Above this the temperature is almost constant to a height of 12 miles. Clouds only appear in the lower layer, and there is very little moisture in the upper layer. On a calm day the electric potential gradient diminishes as we rise. It varies at the earth's level from 100 V to 500 V per ft. In fine weather the potential difference between the ground and a height of six miles is about 1 000 000 V, and above that the potential gradient is practically zero, so that the isothermal layer is also an equipotential layer. The voltage between the earth and the equipotential layer is too small to produce a lightning flash, which requires thousands of millions of volts.

The surface of the earth is generally at negative potential, though sometimes it is slightly positive, and, owing to the vertical potential gradient, the electrons from the earth move upward and act like a vertical air current, the electric strength varying from 28 kV per cm. at the earth's surface to 2·1 kV per cm. at a height of twelve miles. At a height of three miles the temperature is below freezing point and the electric strength is only about half what it is at the earth's surface. At a height of 30 miles it would attain a minimum value and then would rapidly increase to 30 times that at ground level.

The Function of Earth-Air Currents.

Owing to the small potential difference produced by the ordinary earth-air electric current its most important function is to assist in starting the storm. A thunderstorm usually travels over considerable distances and keeps on generating prodigious quantities of electrical energy, functioning like an electrostatic machine driven by a very powerful motor. The air in the centre of a thundercloud is practically always moving upwards with considerable velocity, and at about a height of six miles there are many free electrons owing to ionisation. If the humidity is high vapour condenses round these electrons to form globules of water, which coalesce to form larger drops, which have a positive charge. If the vertical velocity of the air is greater than 17 miles per hour some of the drops are blown upwards and sometimes break into smaller drops, which usually have a negative charge. As the air gusts vary the positively charged large drops, or hailstones, descend and electrical energy is stored in the atmosphere. On the upper part of the cloud is a negatively charged layer, and on the lower a positively charged layer. The falling drops keep on increasing the potential difference between these until it gets so high that a disruptive discharge ensues. There is plenty of energy available as the work done by an inch of rain falling a mile is equal to 0·01 kWh per sq. ft. of the earth's surface.

Lightning Protection.

The special interest of this discussion to electrical engineers, as Dr. RUSSELL rightly points out, is how best to protect buildings, apparatus and power lines from lightning flashes or the gradual accumulation of electric charges. The principles laid down by Sir OLIVER LODGE in 1889 still hold good, but it is highly desirable that a record of curious lightning phenomena should be kept. These records will aid in the elucidation of problems which at present are by no means generally understood.

We have discussed this part of Dr. RUSSELL'S address at some length because it deals with a subject which, though important, has for one reason or another recently been forced into the background. The remainder of his remarks, which deal with more current problems, is none the less interesting and worthy of study because we can find in it nothing to criticise.

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Dr. Russell on Electrical Progress.*

Development in Many Fields.—The Mechanism of Thunderstorms.

We naturally take pride in our connection with this Institution and, through it, with the many electricians who have advanced our knowledge and applied electrical science so successfully to ameliorate the conditions of human life. The Institution unites the workers in all branches of the electrical industry for mutual help and encouragement, and besides interesting itself in research, engineering education, the library and the Benevolent Fund, keeps in close touch with sister Institutions through the recently formed Engineering Joint Council, and by means of joint meetings, the first of which was held as long ago as 1882.

During last year satisfactory progress was made in the development of transatlantic radio-telephony. The results published† show that there are large daily variations in the audibility and also large seasonal variations; and the latest results indicate that it will be necessary to use wave-lengths greater than 5 000 metres if the best voice transmission is to be obtained.

Electricity Supply Advancing.

Since the termination of the War in 1918 the section of the industry which deals with the supply of electrical energy has been very active and real progress has been made. In the boiler house radical developments are taking place. The possibilities of pulverised fuel are being thoroughly investigated both in this country and in America, and experiments are being made with boilers supplying steam at a pressure of 1 200 lb. per sq. in.

High Pressure Steam.

As the temperature in a boiler rises the density of the water in it diminishes and the density of the steam increases owing to the increased pressure. When the critical temperature of 700 deg. F. is attained the steam and water have the same density and are indistinguishable from one another. At this temperature the pressure is roughly 3 200 lb. per sq. in. The water also, having no latent heat, passes quietly into the gaseous state. The English Electric Co., in association with the Benson Engineering Co., are making experiments at the present time to generate steam at about 3 200 lb. pressure per sq. in. which, after being throttled to 1 500 lb. per sq. in. by means of a reducing valve and its temperature raised to about 700 deg. F., will be used to drive a specially constructed 350 kW turbine. After being expanded in this turbine the steam will be reheated and passed at a pressure of 250 lb. per sq. in. to an ordinary low-pressure turbine. That difficulties will be encountered in the manufacture of these very high-pressure turbines is certain; and that economies will result from their use is equally certain. Increasing the steam pressure will secure a higher thermodynamic efficiency, and will have the advantage of reducing the size of the steam pipes.

In the turbine room the size of generating plant continues to increase, and C. A. Parsons and Co. are now constructing a 40 000 kW set for the Commonwealth Co. of Chicago and a 60 000 set is being built in America. Since 1918 the thermal efficiency in large power stations has almost doubled. To-day there are power stations in different parts of the country with a thermal efficiency of 18 per cent., and an efficiency of 25 per cent. may be attained in the not very distant future

Improvements in Cable Design.

The use of pressures of 33 000 and 66 000 V for the transmission of electrical energy is becoming common, and the cable makers of this country are to be congratulated on their successful solution of the problem of making underground cables suitable for 66 000 V. For rural districts cheaper underground cables using 11 000 and 22 000 V will become common, and where single phase supply is used, cables will compare favourably in cost with overhead lines.

The use of polycore cables for a working pressure of 33 000 V is becoming general in large industrial areas and in cities. There is still unfortunately a difference of opinion as to whether it is more advantageous to use a polycore cable or single core cables, though the leading cable manufacturers are prepared to guarantee three-core cables up to 66 000 V, and the supply authorities favour them because they are easy to handle. In Paris a three-phase system of 60 000 V is in operation using single core cables. This has a very real advantage, that all faults are faults to earth. Hence by putting a suitable impedance coil in the earth connection it is possible to restrict the fault current to a definite value. In the United States and Canada there is a demand for cables which will withstand working pressures of at least 100 000 V. The manufacturers are seriously considering the construction of short feeders for this purpose as a commercial experiment. It is interesting to notice that in Holland in several cases both three-core and single core cables are used simultaneously. Data which will enable a practical comparison of their relative merits to be made will therefore soon be available.

Manufacturing Outlook Hopeful.

Judging from the steady improvement which has taken place during the past five years there is every reason to regard hopefully the future position of the electrical manufacturing industry, and in this connection reference is made to the British Empire Exhibition and to the World Power Conference.

The electrical installation industry to-day is prosperous and the quality of the materials used has never been better and the standard attained has never been higher. This is due to the good work done by the Institution in the production and continual revision of its Wiring Rules, and to the activities of the Electrical Contractors' Association. The British Engineering Standards Association by standardising materials has helped to stabilise the industry, and the National Industrial Councils have done excellent work in fostering the good feeling which exists between employers and employed at the present time.

Not many years ago the number of electric lamps used per head of the population of this country was the same as the corresponding number in the United States. Now the latter number is more than four times the former, and it therefore is well that the lamp industry is bringing the numerous advantages of a higher standard of illumination to the notice of the public.

Telephone Improvements.

There are seventeen automatic telephone exchanges in use in this country, and arrangements have been made for its introduction to London. Great progress has also been made in the use of light-gauge coil-loaded cables with thermionic repeaters for long-distance telephonic communication, and the rapid expansion of traffic between Great Britain and the Continent has rendered it necessary to consider the adoption of a type of submarine cable capable of carrying a larger number channels than those at present in use. The manufacture for the Anglo-Dutch telephone service has therefore been commenced of a paper-core, lead-covered and continuously loaded cable.

The main trend of recent progress in radio-telegraphy has been in the direction of improvements in methods of transmission by the elimination of harmonics and impurities, and development work in connection with high-power radio transmitters using silica valves and water-cooled metal valves. As the result of successful experiments on the use of a coupled circuit on an arc transmitter at Northolt, a similar circuit is now being installed at Leafield. These circuits have caused a very marked improvement in the suppression of harmonics and other undesirable emissions. As the result of experimental work, valve transmitters are to be used in the new high-power station now in course of erection at Rugby.

This station is rated at 1 000 kW and is designed to deliver 500 kW to the aerial circuit.

Railway Electrification.

The outlook at the present time as regards railway electrification is more promising than it has been. Large orders for the extension of railways in New Zealand, Australia, Brazil and Japan have been received in this country, and electric traction engineers and manufacturers are looking forward to a busy future. There is no technical reason why the whole of our railway systems should not be electrified. One benefit would be fuel economy, and Mr. Roger T. Smith has calculated that if the railways of this country were electrified there would be a saving effected of about 50 per cent. in the quantity of coal consumed.

Combined research has much to place to its credit, but pro-

* Abstract of Presidential Address delivered to the Institution of Electrical Engineers on Thursday, October 18th.

† See THE ELECTRICIAN, vol. xc, p. 58, Jan. 19th, 1923, and Messrs. Arnold and Espenschied's article in the last issue.

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gress depends very largely on the work of the rank and file in the industry. Duddell used to say that we could advantageously do much more to encourage those who have made small inventions or discoveries, and in particular he advocated that the Institution should publish accounts of any advances that had been made, no matter how short the paper was in which they were described. Some of the improvements suggested might cheapen cost of production and improve the quality and efficiency of our manufactures.

The Kelvin Centenary.

On June 26th next we shall be celebrating the centenary of the birth of the greatest of our Past Presidents, Lord Kelvin. The greatest of natural philosophers since Isaac Newton, he had the power, rare amongst scienists, of completely realising his conceptions in practice. We honour him specially for what he did to advance electrical knowledge. From the time when he was a student at Cambridge calculating the attractions between electrified spheres, down to the speculations he made about electrons in the latest years of his life, he was ever looking with eager eye to discover Nature's secrets.

Relativity.

The Michelson-Morley experiment appears to show that the velocity of light is independent of the velocity of the earth. We are therefore forced to conclude that the measuring rod has contracted by the two-hundred millionth part of its length in the direction in which the earth is travelling. A possible explanation of this is that the atoms forming the rod contain electrons, and that these electrons move with the rod and therefore act like electric currents. Theory shows that the mutual action of these currents would shorten the rod in exact accordance with the observed law.

Einstein's theory has nothing whatever to do with the mathematical suggestion of four dimensions in space, but he discovered that our conceptions of the framework of space and time were at fault as we had neglected the fact that we were on a moving globe. The four dimensions in his theory are the three in space and one in time, and his results show that these four dimensions are not independent.

The Electron Theory.

In 1891, in his Presidential Address to the Institution, Sir William Crookes showed electric discharges in tubes exhausted to a high vacuum by powerful air pumps, and pointed out that the discharges acted as if they consisted of streams of negatively charged particles. Sir Joseph Thomson a few years later proved that these negatively charged particles were exactly the same from whatever gas they were obtained, and were, in fact, the atoms of which a negative charge of electricity is made up. Sir Ernest Rutherford states that an atom consists of a nucleus surrounded by planetary electrons, and that this nucleus contains sufficient positive electricity to neutralise exactly the sum of the charges on the negative electrons. The assumption is made that all the different kinds of atoms are built up of protons and electrons, and if these electrical atoms had been known to scientists sixty years ago, electrical progress in several directions would have been much accelerated.

The Mechanism of Thunderstorms.

A remarkable thunderstorm visited London on July 9th-10th, 1923. The storm appeared on the south coast and progressed W.N.W. at a speed of about 25 miles per hour. The main rainfall, which was torrential in places, extended over a belt about 30 or 40 miles wide. The lightning flashes in some places occurred with only a few seconds' interval for hours at a time. The discharges were mainly from cloud to cloud or from a cloud to the upper air, and so the damage done was not serious.

From data published by the Meteorological Office, it appears that in the south-east of England if the temperature of the air at the earth level be 10 deg. C., then as we go vertically upwards it falls uniformly for a distance of six miles, where the temperature is only about −53 deg. C. After this altitude is attained the temperature remains almost practically constant up to the greatest height reached by pilot balloons, which is about twelve miles. The layer of the atmosphere up to six miles high is called the troposphere. Above this is the isothermal layer called the stratosphere. Clouds only appear in the troposphere and there is very little moisture in the stratosphere.

On a calm day as we go upwards the electric potential gradient diminishes. In midsummer a usual ground value is of the order of 100 V per ft. but in midwinter the average ground value is at least twice as much. In foggy weather it is sometimes greater than 500 V per ft. In fine weather the potential difference between the ground and the top of the troposphere is of the order of 1 000 000 V. Above this the potential gradient is practically zero, ans so the isothermal layer is also an equipotential layer. The voltage between the earth and the equipotential layer is, however, much too small to produce a lightning flash. That requires at least thousands of millions of volts.

The surface of the earth is generally at negative potential, but it sometimes has a small positive potential. Owing to the vertical potential gradient, the electrons from the earth are always moving skywards and act like a vertical earth air current.

Variation in Atmospheric Electrification.

Sir Francis Ronalds found that the intensity of the atmospheric electrification had a maximum value every morning and another maximum value in the afternoon. Chree has shown that these maxima values are usually greatest in cold weather. Possibly, therefore, they may be due to smoke or other impurities in the atmosphere.

At a height of three miles the temperature is below the freezing point, and the electric strength of the air is only about half what it is at the surface of the earth. At a height of 24 miles the electric strength would be of the order of some hundreds of volts per centimetre, and at 30 miles up would attain a minimum value. At greater heights it would begin to increase very rapidly and would soon become at least 30 times greater than the electric strength of air at ground level. When it is considered that two million volts will only bridge a few feet in air, the voltage of a lightning flash to earth must be exceedingly high.

Starting the Storms.

Owing to the small potential difference produced by the ordinary earth-air electric current, and consequently the minute amount of electrostatic energy stored in the field, it may be assumed that the most important function of this current is in assisting to start the storm. A thunderstorm usually travels over considerable distances and keeps on generating prodigious quantities of electrical energy. It functions like an electrostatic machine driven by a powerful motor.

The air in the centre of a thundercloud is practically always moving upwards with considerable velocity. In the upper layers of the troposphere, owing to ionization, there are sometimes many free electrons. If the humidity of the upward current of air be high enough the vapour condenses round the electrons and so the air is full of minute globules of water. Some of these coalesce, forming larger drops. If the vertical velocity of the air be more than 8 metres per sec. the large drops as they are blown upwards often break into smaller drops. The charge on the smaller drops is generally negative and on the larger drops positive. As the larger drops are often kept oscillating in the higher and very cold strata of the atmosphere owing to fluctuations in the velocity of the air currents, they keep melting and freezing again, producing ordinary hailstones, and as the gusts vary, the large drops and the positively charged hailstones descend. Electrical energy, due partly to the work done by gravity on the descending drops and by the air currents on the ascending drops, is thus stored in the atmosphere.

Cloud Charges.

On the upper part of cloud is a negatively charged layer and on the lower part a positively charged layer. The falling drops keep increasing the potential difference until it gets so high that a disruptive discharge ensues. There may be brush discharges between the upper layer of the cloud and the better conducting layers higher up. There may be a flash between the upper layer of one cloud and another cloud, and discharges between the lower layer and the earth or another cloud, or a flash-over between the two poles of the thunder cloud when they are not too far apart.

Thunder Operations.

Operations of this nature happen during a thunderstorm. The separation of the charged drops due to the difference in their velocities produces high potential differences, and there is plenty of energy available. The work done by an inch of rain falling a mile is 27 500 ft.-lb., or the one-hundredth part of a kW hour, per square foot of the earth's surface. It has recently been shown that in general the purer the raindrops the greater are the electric charges they assume on pulverisation, and in particular any contamination of a raindrop with sodium chloride diminishes the charges produced when it

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breaks in air. This possibly has the effect of diminishing the intensity of thunderstorms at seaside towns.

Lightning Conductor Problems.

But what we as engineers are specially interested in is how to protect buildings and apparatus and power and communication lines from damage due directly or indirectly to lightning flashes or to the gradual accumulation of electric charges. The principles laid down by Sir Oliver Lodge in 1889 still hold good, and they have been adopted by the Lightning Research Committee of the Royal Institute of British Architects. In practice they are found quite satisfactory.

It is desirable that records of curious lightning phenomena should be kept, though if the mechanism of thunderstorms were exactly known the need for recording unusual phenomena would not be so urgent.

Faraday and Humphreys have both expressed doubt regarding the existence of globular lightning, but personal experience leads to the conclusion that the evidence in favour of globular lightning is overwhelming.

Phenomena of Wireless Transmission.

Since light waves only differ from radio waves in wave length, it would be expected that when the atmosphere is exceptionally still and clear it would be possible to see round the curvature of the earth, it being well known that Hertzian waves travel round the earth. The case of two spectators who in May last saw over 400 miles from an altitude of 13 800 ft. on the Finsteraarhorn in the Bernese Oberland to the English Channel, is mentioned. As at the height they were the visible horizon was only 140 miles away, the light must have been bent round the curvature of the earth, and the mirage was probably caused by the refraction of the light rays by the strata of the atmosphere and these strata must have been very sharply defined. It can therefore be inferred with certainty that radio waves can be refracted in the troposphere so as to bend round the earth. So in addition to reflection and refraction the radio waves are scattered at the dividing surface between two strata, and this scattering must play an important part in radio transmission. The assumption that there is a definite stratum of the atmosphere that always reflects radio waves seems unnecessary.

In concluding his address, Dr. Russell drew attention to a few mathematical theorems which are of theoretical ineerest but may be of practical value. These are fully discussed in an appendix.

Largest Automatic Motor Generator Set.

The Union Electric Light and Power Co. of St. Louis has ordered from the Westinghouse Electric and Manufacturing Co. a three-unit 3 750 kW automatic motor generator set, which is the largest automatic motor generator set yet built.

The set consists of a synchronous motor and two 1 875 kW generators, one mounted on each side of the motor and all mounted on the same bed-plate. The a.c. supply is at 13 200 V, three phase, 60 cycles, and the motor is wound for this voltage. The generators are for two-wire operation at 250 V d.c. Excitation for the motor and the two generators will be supplied from a direct connected exciter. The two generators will be connected in parallel.

Included in the automatic switching equipment is a regulating panel comprising a constant voltage regulator, the elements of which will be connected to pressure wires extending from some point in the distribution system. The voltage will operate to maintain constant voltage at this point up to where the continuous rating of the generator is exceeded, when the regulation of the machine voltage is taken over by a constant current regulator which will maintain constant current by controlling the shunt field excitation.

The generators are of the shunt wound type fully compensated, no series field whatever being provided. As is the case with the smaller motor generators now in automatic operation, the set will be started by the closing of the contacts of a contact-making voltmeter when the voltage at the distribution centre falls to a predetermined value. Reduced voltage for starting the synchronous motor will be supplied from auto-transformers. The sequence for the various starting operations will be the same as that used in manual switching. A differential voltage regulator will operate to parallel the terminal voltage of the generator with that of the bus bars before the generator is connected to the load. The separate excitation of the generators will make it possible for the voltage to be reduced to zero if necessary to pick up a dead system. Since the two generators of the set will operate in parallel, provision is made for proper division of the load by means of a motor operated three point rheostat connected in series with the shunt field windings. This rheostat is controlled by a differential current regulator, one of its two operating elements being connected to a current shunt on each of the generators.

Research and Invention.

Sir John Dewrance on the Value of the Patent Law.

In the course of his presidential address to the Institution of Mechanical Engineers, which was delivered last Friday, Sir JOHN DEWRANCE said that if a patented article found a ready sale an infringer would often search the Patent Office records, and produce a "mosaic anticipation." One detail was shown in one patent, another in a second, and so on until it was contended that anyone skilled in the art could produce the subject of the patent.

It was unfair that documents should be evidence of anticipation. Evidence should be of prior use, and the extent of that use should be sufficient to prevent fraudulent anticipation being accepted. The object of a patent specification was that when the period of the patent monopoly had expired the industry might be informed by the specification exactly how to carry out the invention that had then become public property. If the industry carried out the invention as described by the specification of the patent, there was ample evidence of use, but in the large proportion of patents the public did not want to avail themselves of the privilege. The inventor used to be advised to make the wording of his specification wide enough to provide for possible improvements, and the document when read as an anticipation of a subsequent invention might be held to have a meaning that was never realised when the specification was prepared. Such specifications had been quoted forty years after being filed, during which period there had been no use in accordance with the specification. If the industry had not exercised their privilege of use, and the subsequent inventor had eliminated the defects that prevented the previous patent specified from coming into use, surely he had good ground for claiming that he had produced a new manner of manufacture.

Very Few Mechanical Engineering Inventions.

Very few mechanical engineering patents came before the Courts at the present time, and it seems probable that in the future they would be still more rare. The value of a patent was becoming appraised on other grounds than the support that could be obtained under the existing patent law, as interpreted by the Courts.

It was the fundamental idea of the patent laws that, unless a temporary monopoly was given to the inventor, the initial expense of exploiting the invention would not be incurred. Thousands of costly new designs were exploited without the assistance of the temporary monopoly. When it was realised that only one mechanical patent in 10 000 was worth exploiting, and the industry had to bear the cost in brain power, fees, etc., it seemed probable that it would be cheaper for the industry to associate to produce test designs such as was now being done for research, standardisation, and other associa tedactivities.

The chief difference between research and invention was that when conducted by an association of the industry the results belonged to the industry, but the rights of a patented invention belonged temporarily to the patentee. The mind of an inventor was liable to lose its freedom in designing. A preference was established for those designs that might become subject matter for a patent, rather than the standards suitable for adoption by the industry. The mind of the research worker should be quite free from any such restraint, the only object being the best possible result suitable for general adoption, and, in some cases, standardisation. It was remarkable that when fixing standards it was seldom, if ever, the British Engineering Standards Association had wished to adopt the subject of a patent. The activities of research associations, learned societies, technical colleges and the British Engineering Standards Association would increase and perform many of the duties now performed by patentees.

Reconstruction at 220 000 V.

How a Long Transmission Line was Converted when Alive.

The "Electrical World" gives an interesting account of the way in which the engineers of the Southern California Edison Co. adapted an existing transmission line to deal with 100 000 H.P. more power. The original operating voltage was 150 000 V. The height of the steel towers was increased 10 ft. and the line was re-insulated to make it suitable for 220 000 V. The extraordinary thing about the operation was that all the work was carried out while the line was alive. The towers were lifted bodily and an extension of the proper height erected underneath. The re-insulation consisted of increasing the number of insulators in each string from eleven to thirteen. The work of raising 1 400 towers took six months, and in the same time the insulators on 480 circuit routes were dealt with. This conversion has effected a great saving in cost over the erection of new lines to carry the additional power.

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The Institution of Electrical Engineers.

Proceedings at Opening Meeting of New Session.

There was a crowded attendance at the opening meeting of the INSTITUTION OF ELECTRICAL ENGINEERS on Thursday, October 18th, when the premiums were awarded and the new President delivered his Inaugural Address.

Mr. FRANK GILL, the retiring president, having taken the chair, announced the result of the ballot for the election of new members of Council, and presented the premiums to those few of the recipients who had taken the trouble to be present. In introducing Dr. Russell, he said that he had the fullest confidence that he (Dr. Russell) would well and worthily uphold the dignity of the Institution whilst he occupied the position of president.

DR. RUSSELL then took the chair, amid hearty applause, and immediately called upon Dr. Ferranti.

Thanks to the Retiring President.

DR. S. Z. de FERRANTI said he had the greatest possible pleasure in proposing that the best thanks of the Institution be accorded to Mr. FRANK GILL for his conduct in the presidential chair. When they considered the size to which the Institution had grown, the leading position that it occupied in the country, and the vast electrical interests which it represented, they could realise in some small degree the responsibility of the President. One of the best means of bringing about peace was the freest possible intercommunication. Mr. Gill had done a great deal to obtain more efficient international telephonic communication, and it was to be hoped that he would continue the good work he had begun. But there was something greater than knowledge, and that was character. Mr. Gill had shown that he had character to a great degree.

Mr. LL. B. ATKINSON, in seconding the vote of thanks, said every President of later years had been able to do one of two things—either to perform something that was badly wanted by the Institution, or to give some message and help to the public for the benefit of the industry and the Institution. In Mr. Gill they had a consulting engineer of world-wide acceptance as a great expert, who was able at the proper moment to make proposals as to European communication which could not have been made with greater force or greater ability by anybody else living, but which were made with greater force because he was their president.

The vote of thanks was carried with acclamation.

The Help of the Electrical Press.

Mr. GILL, acknowledging the vote of thanks, said if there had been any success it was due to the assistance of those men who were concerned in the running of the Institution—the Council and the staff. He wished also to say, in the name of the Institution, that a great deal was owing to the electrical Press for their attitude towards the Institution. Due to this help, the work of the Institution during the past year had been a continuous pleasure; hard work but very pleasant. It was stimulating to the man who occupied the chair to find the amount of help and sympathy he always got from the membership, and not only that, but he very quickly learned what perhaps he had not expected at first, that he could call for that help and get it every time.

DR. ALEXANDER RUSSELL then delivered his Presidential Address, an abstract of which will be found on p. 450 of this issue.

SIR RICHARD GLAZEBROOK, F.R.S., in proposing a vote of thanks to the President for his address, said he had been intimately connected with Dr. Russell in interesting and important problems, and had come to realise that his devotion to the science of electricity and the efforts he had made to promote it from every point of view were exceedingly keen. Electricity had progressed during the past 25 years at an enormous rate, and the difficulties that had accompanied that progress had become more and more obvious. In order to solve these difficulties, and to accelerate the rate of progress, it was necessary therefore that those in the position of leadership should have great powers of scientific and mathematical investigation and ample knowledge of the theory.

Mr. C. P. SPARKS, seconded the motion, which was carried with great heartiness, and briefly acknowledged by Dr. Russell.

A "Times" report from Geneva mentions that a Zurich engineering firm coupled with an announcement of the receipt of several IMPORTANT EXPORT ORDERS, a statement that it had been obliged to accept the business at prices which did not admit of the payment of current rates of wages.

Single Phase Motor Starters.

In a Paper on "The Analytical Determination of the Voltage-Steps in the Starter of a Single Phase Motor," presented to the Institution of Civil Engineers, Dr. S. P. Smith and Mr. M. G. Say point out that the starting of single phase traction motors is generally accomplished in the same way as the starting of direct current traction motors—namely, by permitting the current to vary between definite limits during what is known as the "notching up" period. The types of motors used for traction purposes have usually series characteristics, and the accurate determination of the resistance-steps for the direct current case has already been dealt with. In the case of the single phase motor, however, a complete and accurate method of determining the starting voltages has not been published, although the directions in which the problem can be approached have been indicated.

In the Paper a method for determining the starting conditions of a single phase neutralised series motor, which is now the standard type for traction work, has therefore been developed. The method is suitable for use in the office, and enables the voltages for the successive steps to be quickly determined for any specified conditions.

After evolving a general expression for the relation between successive voltages, it is shown how to find the number and value of the voltage-steps for given current-limits. The more difficult but more usual case of determining the starting-voltages for a given number of steps is then dealt with analytically. The equations thus obtained, though of a simple character, involve a trial-and-error solution, owing to the number of unknowns; but practically all difficulty is removed by adopting a short graphical process to obtain the solution.

Though it is seldom possible to make the actual steps accord with the ideal values thus obtained, owing to practical limitations in the equipment, a knowledge of the ideal values is of great service to the engineer, because it enables him to discover the conditions (current-limits, number of steps, etc.) under which smooth, uniform starting can be most nearly attained.

A Portable Oscillograph.

A portable oscillograph that is extremely compact, but yet will cover a broader field of work and is more easily operated than the earlier more bulky instruments, has been developed by the WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. Rapid strides in electrical measurement have been made possible with the help of the oscillograph, but with the development of electric railways, interconnected power systems, electrically-driven submarines and electrically-equipped aeroplanes there has been an increased need for an outfit which would be readily portable and would work just as well in the field as in the laboratory.

The new oscillograph is complete in one unit except for the motor and film holder. The main unit is 11 in. wide, 11½ in. high, and 25 in. long. It includes the entire optical system, special incandescent lamp illuminant, a highly sensitive three-element galvanometer, complete control equipment for vibrator elements (including 30 000 Ω of non-inductive resistors), and a transformer (for operating the lamp and motor) for 110 or 220 V supply at any frequency from 25 to 70 cycles.

A special lamp control switch and automatic lamp-extinguishing switch enable the operator to apply a greatly abnormal voltage to the incandescent lamp to obtain results equal to those formerly secured only with the intense light of an electric arc. With this automatic control the same lamp can be used for hundreds or even thousands of oscillograms, since the lamp is at greatly abnormal voltage only for a small fraction of a second during the exposure.

The galvanometer is of the latest type of construction and is equipped with super-magnets of a newly developed permanent type which make the vibrators more sensitive than with any previous electro-magnets. This new construction does away with the necessity for a field rheostat, ammeter, control switches, storage battery and rectifier. The outfit also includes a special film holder that can be loaded and unloaded without going into a dark room. It takes standard kodak films which can also be developed without a dark room, in a tank developing outfit. The main unit weighs but 80 lb. complete, and the whole outfit together weighs hardly more than 100 lb.

Excellent Results at St. Helens.

In our issue of September 14th we made a reference to the excellent technical results obtained by the St. Helens Electricity Department during 1922–23. We understand that 20 865 500 out of the 23 132 140, or 90·34 per cent. of the kilowatt hours generated during that period, were supplied from an Oerlikon 5 000 kW turbo-alternator, and that this set was on load for 7 627·25 hours during the year. The steam consumption obtained in practice was less than that guaranteed, though the latter figure was unusually low.

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Electrical Developments in Durban, Natal.

By E. POOLE, A.M.I.E.E., Assistant Borough Electrical Engineer.

The electrical undertaking of the Durban Municipality commenced operations in 1897, when there was little demand for electricity for other than lighting purposes. That it has kept pace with the requirements of the growing population, which now numbers about 95 000, more than half of whom are Europeans, there is little doubt, judging by the ever increasing sales of current for various purposes, of which the sale for private domestic supply stands out prominently, chiefly owing to the demands made for cooking requirements due to the introduction of a tariff which compares favourably with the price of coal and oil, the only other alternatives.

Overhead L.T. Distribution.

The low tension distribution and house services in the residential parts of the town are carried out by means of overhead wires. The system will, no doubt, be the envy of home electrical engineers when it is borne in mind that gas is unknown in Durban. The semi-tropical conditions make the introduction of electricity in the kitchen particularly desirable, as everyone is then more or less independent of the native who

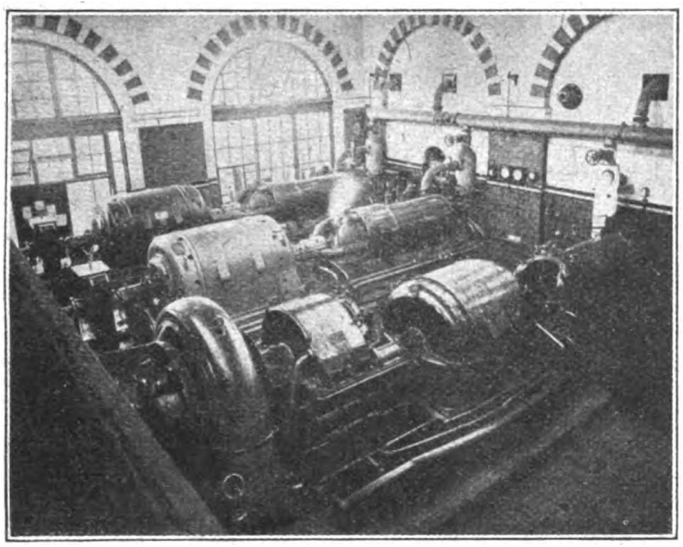

FIG. 1.—A VIEW IN THE PRESENT POWER STATION.

is generally employed as the servant; while, from the supply point of view, the objectionable peak load so often complained of in England, due to radiators, is as non-existent as are wintry conditions.

Generating Plant.

A brief description of the plant and distribution will probably be of interest, though the Durban power station can hardly boast of a "show" lay-out as it can of its load, for, like as may be found elsewhere, progress has advanced beyond all expectations. The first plant was installed at the sewerage works near the harbour in 1897, and soon became out of date. The present power station, which was erected in 1902, has undergone so many changes that very little is now left of the second original plant, and a third, and much larger station, is now in contemplation. The following is an estimate of the demand in kW which is expected within the next ten years:—

Present maximum demand	9 000 kW.
Increase for ordinary lighting and power purposes ..	6 000 kW.
Increase for domestic requirements	6 000 kW.
Increase for Government requirements	4 000 kW.
	25 000 kW.

The following table may be of interest in connection with the development of the undertaking, as showing the changes of plant, etc.:—

	No. 1 Power Station, 1897.	No. 2 Power Station, 1902.	No. 2 Power Station, 1923.
Boilers:	Cornish type, 100 lb. steam, hand fired.	Dry back marine type and B. and W. 1 000-8 000 lb. cap. Hand fired, 150 lb. steam. Green's economisers.	B. and W. land and marine type; chain grate stokers, superheaters and economisers. 150 lb. steam, mechanical handling coal and ashes.
Engines:	Peache, single acting compound vertical high speed non-condensing.	Horizontal slow speed cross compound and W. and R. high speed triple expansion vertical.	Turbo-alternators, 1 000 to 3 000 kVA, 6 600 V, 3-phase, 50 cycles.
Generators:	Alternators, 75 kW, 2 500 V, single phase, 62 cycles; also T.H. arc lighters, 1 500 V.	Direct current, 250 kW, 550 V, and 350 kW alternators, 2 750 V, single phase, 62 cycles.	Rotary converters and negative boosters for d.c. supply.

FIG. 2.—TRANSFORMER KIOSKS USED IN THE URBAN AREA.

Distribution:	H.T., 2 500 V, U.G.H. cables. L.T., 100 V, 2-wire O.H.M. and c/c cables; transformers, 6 to 20 kW, air cooled.	H.T., 2 750 V, U.G.M. cables. L.T. 200 V, 2-wire O.H.M., 100 and 200 V, c/c cables; transformers, 6 to 20 kW, air cooled, and 15 to 30 kW, oil cooled.	E.H.T., 6 600 V, 3-core cables. H.T. 2 750 V, c/c cables and O.H.M. L.T., 200-400 V, 3-wire O.H.M., 100 and 200, c/c cables; 200 V, 3-phase, 4-wire, O.H.M. (suburbs); transformers, 30 to 300 kW, oil cooled.
Street Lighting:	B.P. open type series arc lamp and 32 c.p. (incandescents (carbon).	Enclosed arc lamps (5 in series) and 32 c.p. incandescents (carbon).	300 W gasfilled and 40 W metal filament.
Tariff:	9d. per kWh.	Light, 8d. per kWh; power, 4d. per kWh.	Light, 5½d. Norwich system; power, 2d. to 0·6d. per kWh.
kWh Sold:	113 236.	1 107 265.	33 370 151.

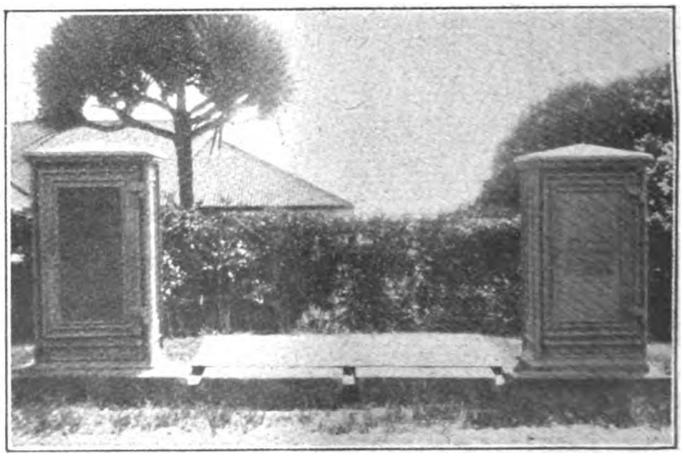

FIG. 3.—SWITCH PILLARS AND UNDERGROUND TRANSFORMER PITS IN OUTER AREAS.

The plant at the present power station has a total capacity of 16 450 kVA, current being generated at 6 600 V 3-phase 50 cycles; while d.c. current at 550 to 500 V is supplied for

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trams and motive power (chiefly by rotary converters), though a small amount is still generated direct by combined a.c. and d.c. turbine sets.

The boiler plant consists of the following :—

5 B. and W. Marine type, 28 000 lb. of steam at 160 lb. pressure.
3 B. and W. Land type, 14 000 lb. of steam at 160 lb. pressure.
3 B. and W. Land type, 20 000 lb. of steam at 160 lb. pressure.
2 B. and W. Land type, 12 000 lb. of steam at 160 lb. pressure.

There are also four sets of Green's economisers, and all boilers are fitted with chain grate stokers, and superheaters. The feed pumps are of the Sulzer and turbine types, with a capacity of from 8 000 to 10 000 galls. per hour, electrically and steam-driven respectively.

Coal Supply.

A coal conveyor of the B. and W. continuous bucket type conveys the coal from the storage bins, which are of 1 500 tons capacity, to the boiler hoppers, whilst the ashes are dealt with by means of a telpher which loads direct into railway trucks on an adjoining siding. Coal is brought from the Natal Coalfields, which are situated from 250 to 300 miles away, and is weighed in on an Avery weighbridge of 160 000 lb. capacity. The price delivered at the bunkers is from 14s. 3d. to 17s. 9d. per short ton (2 000 lb.), the class of coal used being " dross "

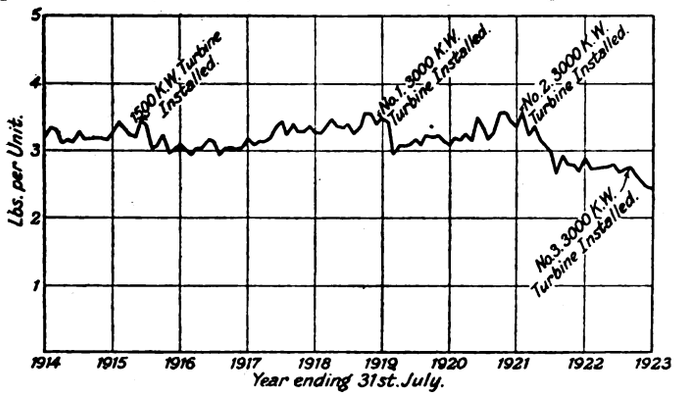

FIG 4.—COAL CONSUMED PER KWH DELIVERED TO MAINS, JULY 1914 TO 1923.

with an average calorific value of about 13 000 B.Th.U., and a volatile content of from 22 per cent. to 25 per cent., the consumption working out at about 2½ lb. per kWh.

The engine room plant (Fig. 1), beyond a few reciprocating sets originally installed and only used in case of emergency, consists of :—

3 3 000 kVA turbo-alternators. B.T.H.-Curtis impulse.
2 2 000 kVA turbo-alternators. Parsons reaction.
1 1 500 kVA combined a.c. and d.c. geared set. Parsons reaction.
1 1 000 kVA combined a.c. and d.c. geared set. Parsons reaction.
1 950 kVA combined a.c. and d.c. geared set. Parsons reaction.
2 1 000 kW rotary converters.
1 500 kW rotary converters.
2 track boosters.

The condensers are of various makes and are of the barometric and surface types, the condensing water being continuously circulated from natural draught cooling towers (four wood and one steel) of local design and make; the circulating pumps are of the Rees Roturbo, Worthington, and Sulzer types.

The switchgear is of modern design with E.H.T. cubicles for generators, groups and feeders, with the usual protective devices; there is also h.t. and d.c. switchgear of the usual recent type.

Flexible Distribution System.

The distribution system of the undertaking is of special interest, on account of its flexibility, enabling the heavy loads consequent on the demands to be easily dealt with. The original lay-out was by means of single-phase concentric mains carrying current at 2 500 V and feeding into transformers spaced about half a mile or so apart whence the low tension supply was distributed at 200 V by means of 2-wire bare overhead mains; the services to the houses being pulled on direct to the roofs by means of specially semi-insulated weatherproof wires. The low tension distribution arrangement not only lent itself to being easily converted into a 3-wire arrangement with 19/16 mains as a standard, as it is to-day, with 400 V across the outers and 200 V to middle wire, but the pressure drop on the distribution mains was easily kept up by cutting in on the h.t. main passing by with an extra transformer between existing ones, such transforming points being capable of dealing with loads up to 100 kW.

The transformers are generally placed in pits with a pillar on either side containing the h.t. and l.t. switchgear, the pillars acting as vents, air being admitted at the bottom of the pit through a pipe which also acts as a drain for any water which may find its way in. FIG. 3.

Residential Area.

The residential area, being of a hilly nature, is particularly suitable for transformer pits, and little difficulty is found in selecting positions suitable for drainage as well as being central for distribution. On level areas, however, as in the town proper, transformer kiosks (Fig. 2) are erected above ground, or where this would be an objectionable obstruction watertight tanks are now being constructed for underground use in which to house the transformer, with special ventilating pipes connected thereto (Fig. 3).

The h.t. side of the distribution, however, has gradually undergone a great change, and what were the original 2 750 V direct current feeders and transforming points some years ago have now been superseded by E.H.T. 3-core feeders at 6 600 V 3-phase, the principal transforming points becoming 3/2-phase from 6 600 V 3-phase through Scott connected tranformers to 2 750 V 2-phase, with the original direct current feeders balanced up on either phase feeding the smaller transforming points as originally. This system was decided on as the distribution had grown so far that direct current cables and single-phase transformers had become too firmly established, and it has its advantage that the simplicity of single-phase switchgear for the larger number of transformer points is an off-set to the double transformation at a few principal 3/2-phase sub-stations.

In the power station there are also installed banks of 3/2 phase transformers for dealing with the transforming points in that vicinity.

All new suburban extensions are, however, being carried out entirely by 3-phase 6 600 V transformation to 3-phase 4-wire distribution at 200 V to neutral, the E.H.T. supply being by both overhead and underground mains.

Tariffs.

With low generating costs, and so flexible a distribution system, there only remained the question of tariffs to attract the consumer, and with the advent of low tariffs for domestic purposes there was a ready response and an increased demand

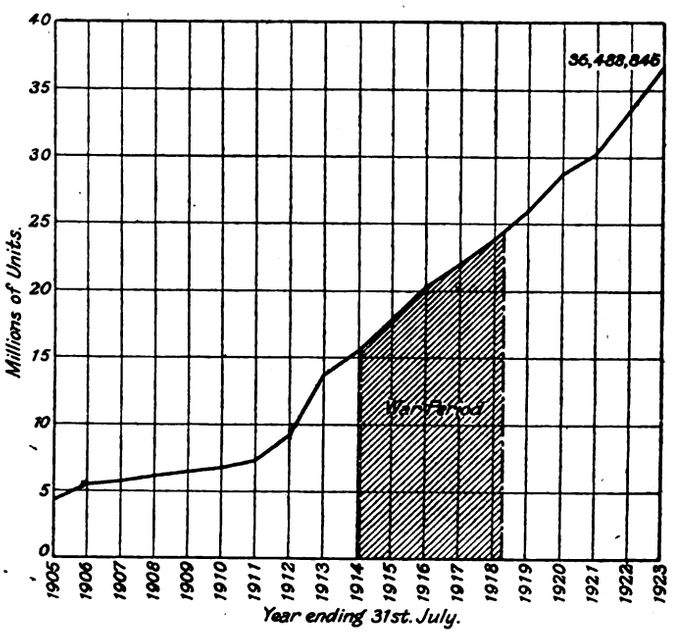

FIG 5.—INCREASE IN KWH SOLD 1905 TO 1923.

which is daily mounting up. The domestic tariff is on the principle of the well-known " Norwich " system; the minimum sum being based on the rateable value of the house, carrying with it a certain number of units at the fixed lighting rate of 5d. per kWh plus 10 per cent.; all consumption above the minimum being charged at ½d. Outside the borough area there are various rates, but the one generally adopted is to charge

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a minimum of 24 kWh per month at 7½d. per kWh and all in excess at 1d. per kWh, so a cheap domestic supply is available in the suburbs also. There is, as a result, an immense number of small domestic appliances in use, and many families have adopted electricity entirely by installing complete stoves and water heaters; especially is this the case in residential flats which are now being built in large numbers.

With over 10 000 consumers it is interesting to note that the average annual consumption works out at about 800 kWh per consumer, whilst many are using from 5 000 to 6 000 kWh per annum, where domestic electricity is used in the fullest sense.

The following table shows how householders have availed themselves of the ½d. rate for domestic requirements chiefly for cooking purposes, and while sales of current at the ordinary rates has increased about 100 per cent., current at the cheap rate has increased about 500 per cent. in the past seven years.

Year ending July 31st	kWh sold at 5d.	kWh sold at ½d.
1915	1,958,958	689,644
1917	2,475,527	1,252,607
1919	3,034,078	2,002,718
1921	3,632,350	3,362,746
1922	3,864,689	4,059,793

The combined curve of output and consumers (Fig. 6) shows at a glance the growth of the demand during the past 10 years, the units curve being subdivided into classes of supply.

Of domestic apparatus there are many makes in use, and while English manufacture is generally more solid and reliable, the price is rather a set-back, resulting in the lighter and cheaper American article having a large hold on the market, though the sale of locally made apparatus is very encouraging.

A Useful Water Heater.

A useful type of water heater has lately been designed by the Borough Electrical Engineer, Mr. John Roberts, and to encourage local industry tenders were called for its manufacture esulting in a materially cheaper heater being available for the public on advantageous terms offered by the Town Council, either by hire or payment in monthly instalments or purchase outright. The heaters hold about 13 gallons and are designed to consume about 300 W only, the idea being to switch on the current on retiring for the night and to have hot water available for the morning for two or three baths, depending on the requirements. The cold water enters at the bottom of the tank and is spread by means of a baffle plate, and the operation of turning on the cold water forces out the hot. The department has thus created a night load to the improvement of the power factor and the consumer has a cheap heater low in running costs.

No Hiring or Propaganda.

The hiring out of apparatus generally has not yet been introduced, neither are repairs undertaken as local contractors are antagonistic to municipal trading, though it would probably be to the advantage of contractors in increased sales.

Little has been done in propaganda work, in the way of advertising, neither has a show room yet been established, for while the department has as much as it can do to just keep pace with the demand, there seems little need to handicap itself by any such campaign.

Some Notes on Domestic Apparatus.

In regard to apparatus, there is still room for a deal of improvement, not only for a cheaper article, but for one that is cheap in regard to the replacement of elements which should be possible for the average consumer to do himself. There is much in favour of the open type element, being a standard for both hot plates and ovens, as with the former almost any ordinary utensil may be used, there not being the necessity to have perfectly flat bottoms as in the case of the enclosed hot plate. Oven troubles are few, and these could be easily reduced by eliminating terminals inside and bringing the heater wires through the walls of the oven to the terminals at the back. Mention has been made from time to time of applying thermal storage to apparatus and there would appear to be room for further research in this direction.

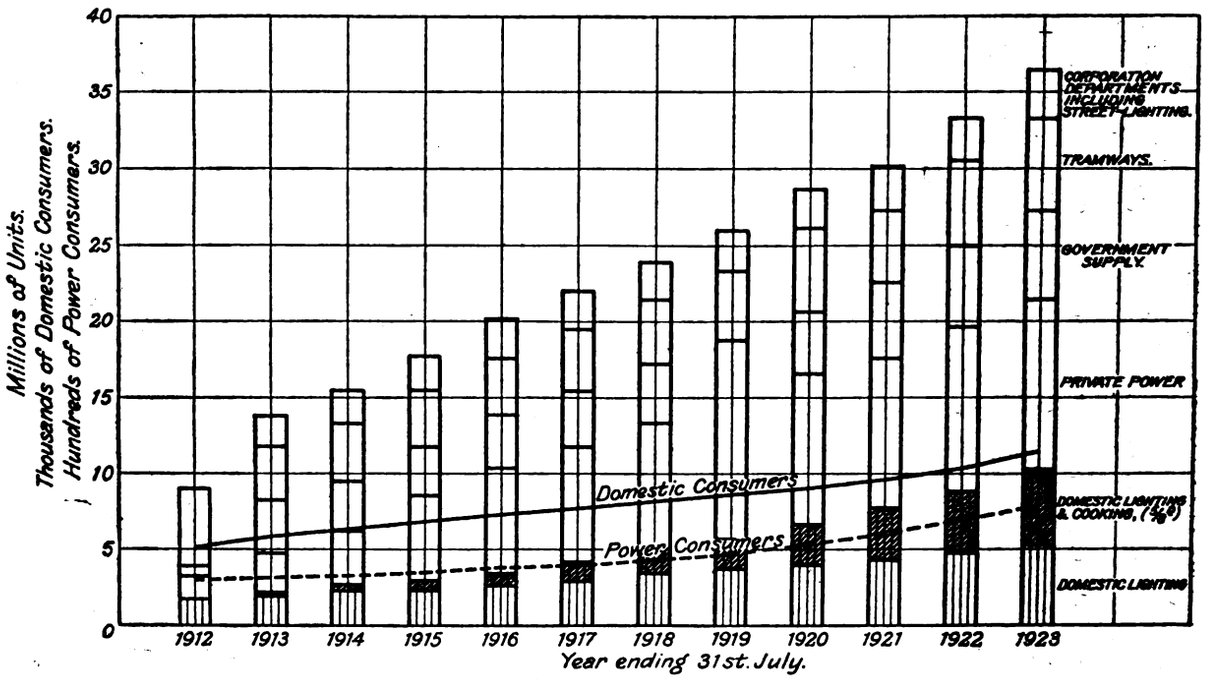

FIG. 6.—COMBINED CURVE OF OUTPUT AND COMSUMERS TO SHOW GROWTH OF SUPPLY.

The Power Load.

Equally with the domestic load development, so has the power load increased, practically two thirds of the total output being for power purposes and mains have been extended far afield for various industries. In one direction current is supplied to a sugar mill 14 miles distant; in other directions to oil mills 4 miles and 6 miles distant; also to a stone quarry 10 miles distant. Then again the South African railways and harbours take a bulk supply at several points, and their latest demand is for 3 000 kW at a large graving dock now in hand, as well as 2 000 kW for a grain elevator.

The charge for bulk supply of current to the Government is on a basic price of 0·5d. per kWh subject to variation with the rise and fall in price of coal, while the charges to private consumers of power are on a sliding scale of from 2d. to 0·6d. per kWh, the latter figure applying on all consumption over 15 000 kWh per month.

The power supply is distributed by both underground and overhead mains at 500 V d.c. for small powers in a limited central area of the town, and at 6 600 V 3-phase transformed down to 500 V in the outer area and suburbs. There are at present two rotary converter sub-stations on the system for supplying d.c. current for trams and motors, and it will be of special interest to know that contracts have been made in England for the supply and equipment of two automatic rotary converter plants of 500 kW each for other sub-stations.

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The Tramways System.

The Durban tramways system has a route mileage of 20 miles and there are 16 eight-wheeled cars with a capacity for 94 passengers per car, also 90 four-wheeled cars with a capacity for 54 passengers per car.

The consumption last year was 5 667 370 kWh, the number of passengers carried 26 307 148, and the number of car miles 2 313 097.

Street Lighting Improvements.

Street lighting improvements have been carried out in sympathy with other improvements, the old centre pole arc lamps in the business area having been replaced by gas filled lamps, and to meet the growing demands of traffic the centre poles have now been changed for span lighting over the centre of the roads and Holophane refractors are being adopted with still further improvement. In the residential area both side and span lighting has been adopted, the latter method being very effective where trees are planted along the pavement as is the case in many of the thoroughfares.

An example of flood lighting has lately been installed for lighting the open area on the beach, clusters of six 2 000 c.p. lamps being erected on 75 ft. lattice masts. A proposition is now under consideration to have two masts 100 ft. high to carry further lamps as well as to carry aerials in connection with a wireless broadcasting station which it is the intention of the municipality to establish shortly.

	£	s.	d.
Government Contract Supply	22,017	11	11
Tramway Supply	23,613	11	5
Public and Departmental Lighting, etc.	19,466	7	4
Sundry Revenue	744	10	7
	£216,193	12	10

ELECTRIC SUPPLY FUND—NET REVENUE ACCOUNT FOR YEAR ENDED JULY 31ST, 1922.

	£	s.	d.
Interest	28,211	3	10
Renewals	25,000	0	0
Sinking Fund	4,471	0	0
Sundry Expenses	737	13	3
Amount transferred to Borough Fund	26,000	0	0
Special Contribution to Renewals Fund	1,591	17	8
	£86,011	14	9

	£	s.	d.
Balance from Account	86,011	14	9
	£86,011	14	9

The gross capital expenditure amounts to £850 574, and out of the profits £74 491 has been paid into a Sinking Fund as well as £151 564 to a Renewals Fund, while each year a special contribution up to 4 per cent. is made towards the relief of the rates, the total amount so paid amounting to no less than £213 075 and there still remains a sum of £20 000 in reserve.

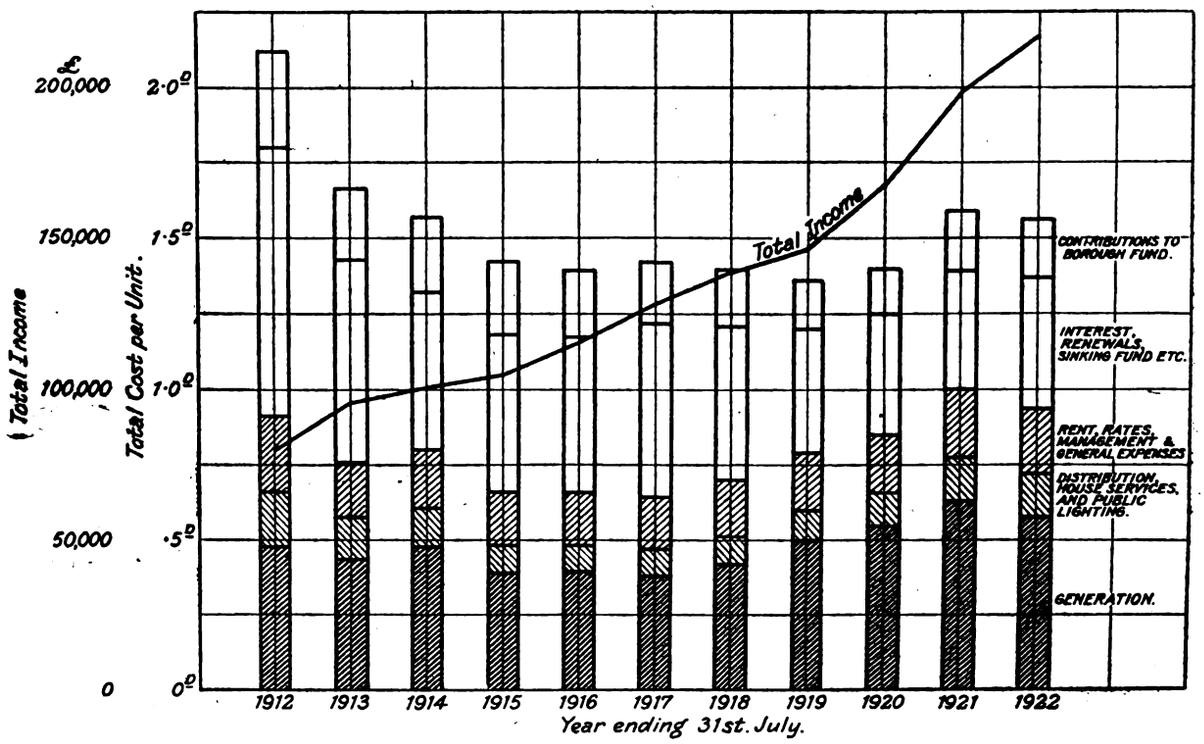

FIG. 7.—GROWTH OF INCOME AND VARIATION IN TOTAL COSTS, 1912 TO 1922.

Financial Position.

From a financial point of view the Durban undertaking holds a record to be proud of, and the following table gives the financial statement for the municipal year ending July, 1922 :—

ELECTRIC SUPPLY FUND—REVENUE ACCOUNT FOR YEAR ENDED JULY 31ST, 1922.

Expenditure.	£	s.	d.
Generation	80,213	2	10
Distribution	10,170	10	3
House Services	8,109	10	0
Public Lighting	2,62–	0	3
Rents, Rates and Departmental Charges	11,980	13	7
Management and General Expenses	17,079	1	2
Total amount of Working Expenses	130,181	18	1
Balance carried to Net Revenue Account	86,011	14	9
	£216,193	12	10

Income.	£	s.	d.	£	s.	d.
Private Consumers—						
Lighting and Heating	105,877	8	9			
Power	38,210	6	1			
Bulk Supply	6,263	16	9			
				150,351	11	7

Further Developments.

The electrical position in Durban is thus a most important one and in view of the railway electrification now in hand the possibilities ahead loom very largely.

An Electricity Act has lately been introduced in the Union of South Africa providing for the supply and control of electricity, and one of the first matters that a Board constituted under that Act has to deal with is Durban's demand for a new power station of large dimensions.

The Electricity Commission, under that Act, has also the power to put down a power station, and it has yet to be decided whether it will be left for the Durban municipality to do so, or the Commission. But it has been generally agreed that one large power station should be built for all Government, municipal and suburban demands.

In common with other towns in South Africa, an Ordinance has recently been promulgated whereby all wiremen have now to be licensed and contracting electrical engineers registered, and wiring regulations common to practically all municipalities have lately been introduced.

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The Cambridge Remote Power Indicator.

An Essential Instrument for Large Power Schemes.

The growth of power schemes and the development of "linking up" have brought with them the necessity for knowing at some central strategic point exactly what is happening at various places of tactical importance on the system. This knowledge enables the load superintendent to tell the various generating and sub-stations what proportion of the load they shall bear, but to do this satisfactorily it is obvious he must know exactly what each station is doing. A knowledge of the position at the various sub-stations is also useful at the power station, especially when there is an interchange of power between two or more supply authorities.

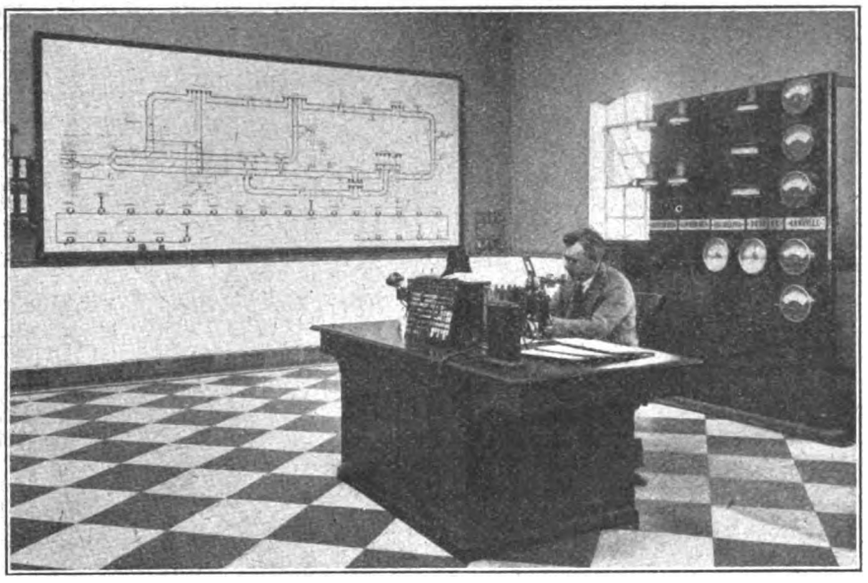

FIG. 1.—THE CAMBRIDGE REMOTE INDICATOR FOR POWER SUPPLY SYSTEMS, INSTALLED AT THE CARVILLE POWER STATION OF THE NEWCASTLE-ON-TYNE ELECTRIC SUPPLY CO

In many cases this information is given by telephone, but at best this requires two operators and at worst it may involve delay at a time when rapidity of communication is essential. It is possible to transmit the actual current used with fair accuracy over short distances, but power indications which are the most useful cannot be transmitted on the alternating system owing to distortion on the pilot wires and the necessity of using four conductors for one measurement. An ammeter to indicate the smallest practicable alternating current would absorb about 3 VA, while under the best conditions operation over a long pilot wire would mean an energy consumption of at least 10 000 microwatts. All these disadvantages can be overcome by the use of direct current; and as a direct current moving coil instrument is much more sensitive than the most sensitive alternating current instrument, taking only about 0·4 microwatt, the energy required is therefore decreased.

Mr. Fawsett's Design.

All these considerations led to the design by Mr. E. Fawsett of the Newcastle-on-Tyne Electric Supply Co., of an indicator based on the use of thermo-piles. This indicator has been successfully employed on the system of that company for the past five years. Its capabilities are evident when it is stated that the indicators in question are now dealing with power up to 80 000 kW and currents up to 10 000 A over distances of eight miles. The arrangements used can be modified to indicate or record voltage, current, power or power-factor at a distance. The apparatus is compact, cheap, absorbs a negligible amount of energy and requires little attention.

Principles of the System.

The principle upon which the apparatus, which is made by the CAMBRIDGE AND PAUL INSTRUMENT CO., operates is that a thermo-pile is warmed by a heater which carries a sub-multiple of the alternating current it is desired to measure. The direct current generated by the thermo-pile is proportional to the square of the alternating current flowing in the heater. At full load on the heater the electromotive force given by the thermo-pile may be as great as 40 mV. This is sufficient to operate a high resistance indicator through a pilot wire of 1 000 O resistance, so that if the resistance of the wire is 24 O per mile an indication can be given at any distance up to 20 miles.

The thermo-pile, which is illustrated in Fig 2, consists of a number of thermo-junctions mounted in series; it is fixed above a resistance (the heater). The millivolts generated by the thermo-pile are measured either by a unipivot microammeter or by a recording instrument. The sensitivity of either instrument is such that it is possible to have a considerable resistance in series with the thermo-pile to permit of a readable deflection. Fig. 1 shows the installation at the Carville Power Station of the Newcastle-on-Tyne Electric Supply Co. The instruments are indicating power, etc., at distances not less than eight miles from the station.

Indication of Voltage at a Distance.

Referring to Fig. 3, if P and Q represent the power lines between which it is desired to indicate the voltage, a potential transformer PT is placed across the lines, and its secondary is connected through a resistance R to the heater H of the thermo-pile E, and the millivolts generated are indicated on the unipivot instrument G. As an example, on an 11 000 V power circuit an 11 000/110 V potential transformer provides 0·1 A at 110 V for the heater circuit, the resistance of the latter consisting of 20 O in the heater itself and a resistance making up the balance of 1 100 O. The thermo-junctions energised from this give 40 millivolts d.c., which is amply sufficient for a line 10 miles long at 50 O per mile run, a unipivot switchboard instrument and some swamping resistance.

Indication of Current at a Distance.

In Fig. 4, CT is a current transformer of any convenient type of which the primary is inserted in the power circuit, the secondary being connected to the thermo-pile heater. A simple current transformer 5 to 0·2 ratio is employed. This is energised from the secondary of the high voltage current transformer used for general indications at the sending end. The 0·2 A winding is connected to a 3 O heater, and, in addition, to a simple protective relay such as is described below. The total power required from the current transformer will not exceed 5 VA. The heater is made of lower resistance for current measurements on account of the necessity of withstanding reasonable overloads; heavy overloads and short circuits are taken care of by the protective relay.

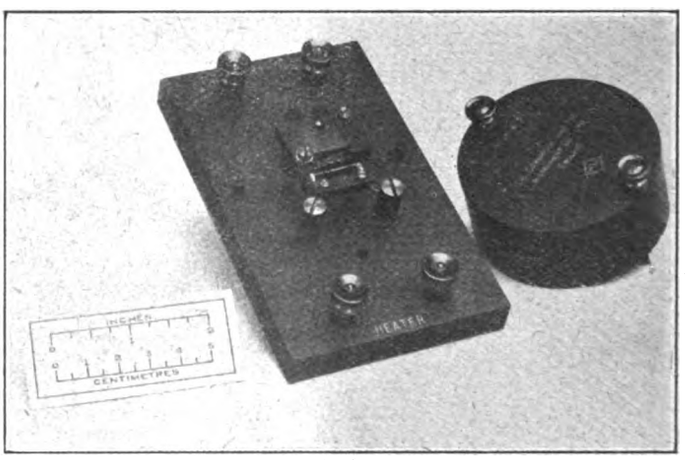

FIG. 2.—VIEW OF THE THERMO-PILE USED.

Indication of Power at a Distance.

If a current corresponding to the voltage and also one which is a sub-multiple of the power current be applied to a heater, then the e.m.f. generated in the thermo-pile is proportional

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to the square of the vector sum of the two currents, that is $(V+A\cos\theta)^2$, θ being the angle between the two. If a second heater be energised by the same two quantities but with the sign of the A term reversed, the e.m.f. generated in the corresponding thermo-pile will be proportional to $(V - A\cos\theta)^2$. If then the two thermo-piles are connected so that the e.m.f.'s are in opposition, the resultant e.m.f. shown by the indicating instrument will be proportional to $(V+A\cos\theta)^2 - (V - A\cos\theta)^2$ which is proportional to V A cosθ, the power of the circuit, and the indicator scale will follow a straight line law.

Indicating Power.

Fig. 5 illustrates this method of indicating power. The two current transformers T_1 T_2 have exactly similar secondary windings, the primary being common to both. They are each connected to a heater, but in opposite senses, and in such a way that they operate independently. The heaters are also connected in series to the secondary of the potential transformer T_3 so that they are traversed by a current which is proportional to the voltage of

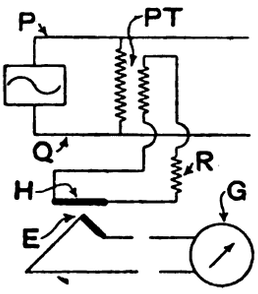

FIG. 3.

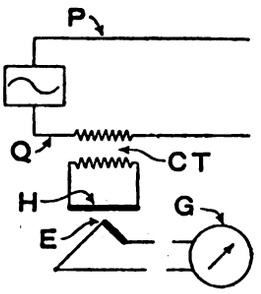

FIG. 4.

the circuit to be measured, the total current in each heater being usually not greater than 0·2 A. It is evident that if the load current is in phase with the pressure, the instantaneous superimposed currents are additive in one heater and in opposition in the other, so that one will be at a higher temperature than the other, hence the e.m.f. generated in one thermo-pile will be larger than that generated in the other.

If, therefore, the piles are connected in series with a millivoltmeter but with their e.m.f.'s in opposition the deflection on the instrument will be proportional to the difference between them, viz., to the power of the circuit. If the two heaters are energised by equal currents from the current transformers only, or by the same current from the potential transformer only, there will be no deflection on the millivoltmeter. When they are energised from the two sources simultaneously there will be a deflection proportional to the power, which deflection is accurate at all power factors. If the millivoltmeter is fitted with a centre-zero scale, it is possible to measure the transference of power in either direction. This may be a considerable advantage where power stations are interlinked. In practice the current transformers employed are either two simple rings with exactly similar windings, the common primary being the actual high tension circuit, or a single special transformer having two equal secondary windings and with its primary connected to the 5 A secondary of the live current transformer.

Fig. 6 illustrates a modification of the wiring in Fig. 5. This is used for the indication at a remote point of wattless power. The modification consists of the employment of a condenser L in the voltage circuit instead of a regulating resistance as shown at R in Fig. 5.

In the case of three-phase circuits it is usual under balanced conditions to refer to the current in one phase and the pressure between that phase and the neutral or to the power as obtained by the two wattmeter method.* With a 20 000 V three-phase balanced load and 30 000 kVA to be indicated, a 1 000 A main current transformer in, say, the red phase feeds a three-ring special split secondary transformer with common 5 A primary, two of the secondaries giving 0·1 A, and the third giving 0·2 A. The potential is obtained from the usual 100 V potential circuit so arranged as to give voltage from red phase to neutral either direct from a three-phase potential transformer or else, if separate single phase potential transformers are used, by means of a star resistance. The current required will be 0.1 A which is passed through both 10 O heaters in series, which heaters are also independently fed from the two 0·1 current transformer rings above described. The third ring operates the protective relay and permits of a further 3 O heater being used to give remote indication of current, and so an approximate indication of power factor, at the distant end.

It is further possible by the addition of a sufficient number of heaters and transformers to obtain a true indication of the algebraic sum of the loads in any number of lines.

By suitably combining the circuit arrangements shown in Figs. 5 and 6 the apparatus can be made to give indications at the central station of power-factor at any remote point.

Synchronism.

While a synchroscope can be operated through a moderate resistance, a limit is quickly reached. It is also frequently inadvisable to have alternating current at a potential of 100 V on the pilot wire, and in any event this arrangement only provides for indicating whether the distant point and the reading point are in synchronism. When a supply at a point of interchange may be cut off by the switch tripping it is useful to know at the control point or power station whether the interchange supplies are in synchronism or not. This indication can be given by feeding one heater in opposite senses from two potential transformers, one on each supply. So long as these are in synchronism no e.m.f. is generated by the thermo-pile, but should the machines get out of step an oscillating e.m.f. is transmitted to the millivoltmeter and should one machine shut down a steady deflection is produced.

Quick-acting Protective Relay.

As the measuring arrangements for this form of transmission necessarily includes one or more heaters, and the factor of safety on them is unavoidably low, it is advisable to include a protective relay in the current circuit. This is fitted with a specially small time lag to short circuit the heaters if the current exceeds a pre-determined amount. A simple electro-magnetic alternating current relay, with poles shaped so as to give the release mechanism considerable travel for a small change in current, operates a spring controlled cut-out switch in one half cycle on the current rising above the safe value, and restores the circuit on the current falling

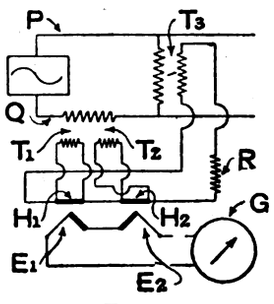

FIG. 5.

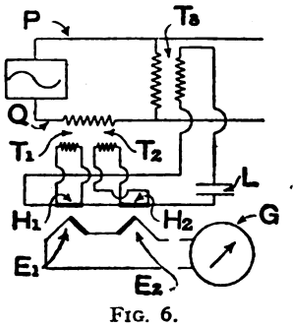

FIG. 6.

below that safe value. The relay may be operated by the same current transformer as supplies the remote ammeter. In one large installation this arrangement has dealt safely with large numbers of overloads and short circuits.

Advantages of the Method.

The advantages of this method of remote indication may be thus summarised :—

1. In a large alternating current distribution system, the controlling engineer at the central station can learn without difficulty the load on any given cable many miles away.
2. Only two pilot wires are required to indicate the power taken at a distant station.
3. A negligible amount of energy is required to operate the indicating instruments.
4. If desired a continuous record of the voltage, current power, or power factor at any point in a distribution system can be obtained at any other point of the system.
5. The initial expense of the instruments is small.
6. The method can be developed to meet special requirements.

According to a cablegram from the TOKYO ELECTRIC LIGHT COMPANY, the hydraulic power stations and transmission lines, including the underground cables, are all safe. Out of seventy transforming and sub-stations in Tokyo and Yokohama, twelve small stations were destroyed. Out of 100 000 poles for distribution in Tokyo and Yokohama, 35 000 were destroyed.

* In the latter case the indication on the unipivot gives the true power.

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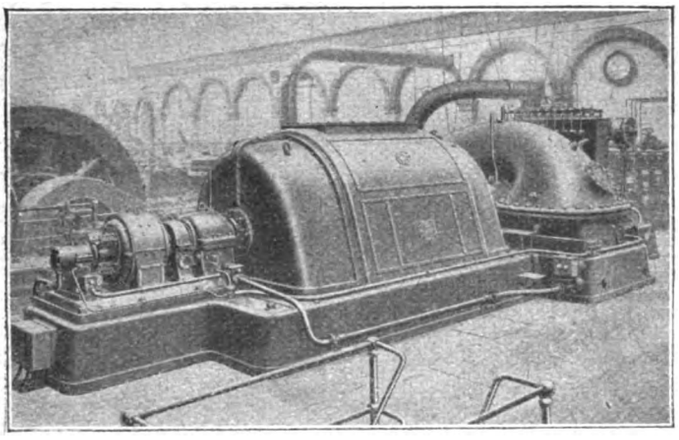
Electricity Supply at Halifax.

Some Changes in Twenty Years.

On February 15th, 1904, Alderman Thomas Hey, chairman of the Tramways and Electricity Committee at Halifax, started up a 750 kW dynamo driven by a slow speed cross compound horizontal engine. On October 18th, 1923, Alderman Thomas Hey started up a 10 000 kW turbo-alternator, and this new set occupies the same space as the old. In that simple statement lies much of the history of electrical engineering in general during the intervening twenty years and of the history of the Halifax electricity undertaking in particular. Another point of historical interest is that 200 kW Parsons turbines were in use as long ago as 1898 and that Halifax was the first place in Yorkshire to use a three-phase supply.

In 1904, however, Halifax had already been enjoying the benefits of electricity supply for some ten years, and though during the first part of that time its financial condition may have given some uneasiness, that was soon a thing of the past. During the last twenty years, it is hardly necessary to say, its history has been one of uniform prosperity, though we may add as an additional argument that the output has risen from just under 5 000 000 kWh in 1905 to nearly 22 000 000 kWh in 1923. The latter figure just exceeds that of 1918, the previous record year, and altogether outclasses 1922, when the output was some 17 000 000 kWh.

To cope with this development the Council decided in 1920 to install a 10 000 kW turbo-alternator and condensing plant.



THE 10 000 KW TURBO-ALTERNATOR AT HALIFAX.

While as the existing switchgear was only suitable for hand operation, it was also decided to erect a new switch house and to install modern e.h.t. motor operated switchgear.

Details of the Latest Extensions.

The new generating unit, which was designed and manufactured by the BRITISH THOMSON-HOUSTON CO., is rated at 10 000 kW and runs at a speed of 3 000 revs. per min. It has the distinction of being the first set built for so large a capacity at this high speed. It generates three-phase current at 6 600 V and 50 cycles and has an overload capacity of 25 per cent. The turbine is of the Curtis compound impulse type with nine stages. The first stage has two rows of blades and the remaining stages one row of blades each. The steam pressure is 160 lb. per sq. in. with a total temperature of 550 deg. F. and the vacuum is 28 in. The alternator is of the totally enclosed air cooled type and is provided with a direct coupled exciter. In order to facilitate the machine running through the critical speed, the alternator outboard bearing is of a specially flexible type. The bearing is designed to permit of a small radial play between friction collars and the radial movement thus allowed, with the resulting work done on the friction collars, completely destroys any tendency of shaft to whip. The alternator is self-ventilating.

The condenser, which was supplied by WORTHINGTON-SIMPSON is of the surface type with a cooling surface of 23 000 sq. ft. It is directly connected to the exhaust chamber of the turbine by means of a copper bellows expansion joint. The circulating pump is driven by a 300 H.P. motor and delivers at the rate of 17 500 gall. per min. A hydraulic vacuum pump and, as a stand-by, an ejection steam air pump are installed.

Steam Raising Plant.

These extensions have necessitated the addition of four B. and W. cross type marine boilers and superheaters to the steam raising plant. These are arranged in pairs with a separate Green's economiser. The evaporative capacity of each boiler is 37 000 lb. of steam per hour, and they can be used with either induced, forced or balanced draught.

Two further cooling towers each capable of cooling 220 000 gallons per hour from 105 deg. to 80 deg. F. with air temperature at 60 deg. F. and a humidity of 80 per cent., have been installed by the PREMIER COOLER AND ENGINEERING CO.

New Showrooms.

We are glad to learn that the Halifax Electricity Committee and the chief electrical engineer are fully alive to the advantages of encouraging the use of electricity for domestic and other purposes, and that a new suite of showrooms, together with a sales bureau, are rapidly nearing completion in Town Hall Street, East.

The sales bureau will be on the ground floor with an imposing central entrance, and from this an easy and artistic staircase leads to the first floor where the showrooms and demonstration rooms are located. These will include a lounge dining room, bedroom, bathroom, and kitchen, all fully equipped with the most modern appliances for electric lighting, heating, cooking ventilating and washing; they are tastefully decorated and furnished, and made to look as homely as possible.

On the recommendation of the chief electrical engineer, the Corporation have decided to put into operation a simple hire scheme for electric cookers complete with kettle, wiring and fixing, the rental being 7s. 6d and 8s. 6d. per quarter A hire purchase scheme is also in operation, with payments spread over 3 years.

Tariffs.

The domestic tariff in use is based upon 18 per cent. of the rateable value of the house up to £30, 22 per cent. between £30 and £50, and 26 per cent. over £50; all plus 1¼d. per kWh. This covers a supply for lighting, cooking and heating. An alternative tariff is 7d. per kWh for lighting and 1½d. per kWh for heating. For business premises the lighting charge is 7d. per kWh up to 1 200 units per quarter, and 3¾d. per kWh in excess of this figure; or alternatively, on the maximum demand system, 7d. per kWh for the first 365 hours' use of the maximum demand in kilo-watts per half year and 2d. per kWh in excess. The charge for heating is 1½d. per kWh.

A new tariff is under consideration for late hour window lighting, signs and heaters, all current being registered through one meter. It is hoped to have this tariff in operation at an early date.

We have to thank Mr. W. M. Rogerson, chief electrical engineer of Halifax, for the information on which this article is based.

Electrical Workers' Wages.

New Minimum Rates for East Midlands.

At a meeting of the Anomalies Committee of the No. 7 District Council of the East Midlands Area, in connection with the electricity industry held in Nottingham last week, the new minimum rates to be paid to employees in Grade 2 undertakings, which include Kettering, Loughborough, Long Eaton, Mansfield, Grantham, Melton Mowbray, Stamford and Sleaford, were considered, and the following rates recommended :—

First-class engine driver, 1s. 4d. per hour; ditto, second-class, 1s. 2d.; first-class stokers, 1s. 3d.; ditto, second-class, 1s. 2d.; coal trimmers, 1s. 0½d.; boiler cleaners, 1s. 0½d.; ash trimmers, 1s. 1½d.; fitters, mechanical, 1s. 4d.; ditto, Leicester, 1s. 4½d.; ditto, electrical, 1s. 4½d.; fitters' labourers, semi-skilled, 1s. 2½d.; ditto, unskilled, 1s. 1½d.; first-class jointer (plumber jointer), 1s. 7½d.; ditto, non-plumber jointer, 1s. 4½d.; second-class jointers (plumber jointer), 1s. 5½d.; ditto, seniors, 1s. 4½d.; ditto, juniors, 1s. 2½d.; main layers, 1s. 2½d.; jointers' mates, 1s. 1d.; jointers' labourers, 1s. 0½d.; meter readers, 1s. 1d.; ditto, fixers, 1s. 1½d.; battery attendants, 1s. 2½d.; carpenters, 1s. 5½d.; bricklayers, 1s. 5½d.; bricklayers' labourers, 1s. 0½d.; electrical wiremen, 1s. 5d.; assistant wiremen, 1s. 3d.; wagon drivers (electric and petrol), 1s. 1¾d.; wagon loaders, 1s. 0½d.; meter repairers, 1s. 5d.; general labourers, 1s. 0½d.; street lamp men, 1s. 0½d.

These rates, which all show a slight increase, varying from ¾d. to 1½d., will not come into operation until they have received the confirmation of the full Council.

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Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument

NOTES ON WIRELESS MATTERS.

To the Editor of THE ELECTRICIAN.

SIR,—It appears Mr. Henry M. Sayers, in your issue of September 21st last, raises a question in electronic theory that might well engage the attention of the radio engineer group. Heaviside (see "Electromagnetic Theory," Vol. III., p. 50) is decidedly against the "continuous flow theory of electrons in solid conductors." He prefers to believe it to be a local phenomenon in the main. This is my own view. On the other hand, the article by the writer in "Revue General de L'Electricité," September 1st, 1923, explains away some of Mr. Sayers' ether difficulties. Yet why and how an electron can radiate energy is still a little difficult to see. The recent paper by Sir Oliver Lodge on the inter-relationship of ether and matter is decidedly refreshing to read in these days of Lorentzian dematerialised electrons.

To bring about the in-phase relationship referred to by Mr. Sayers, I find it necessary to modify the views hitherto held regarding capacity and self-induction coefficients due to hyper-velocities along surfaces of wires, of voltage waves. In this way transverse electromagnetic waves in space at normal light speed can be explained. The mathematics of this, ignoring the Lorentzian electronic theory, will probably appear in the French press.

Incidentally, I should like to correct a view that seemingly follows, from Prof. Howe's rejoinder. I have maintained that there are three types of waves possible according to Maxwell's theory, viz., hypervelocity surface waves of potential giving rise to radial electromagnetic waves at normal light speeds and longitudinal waves at infinite velocity.—I am, etc.,

Chevy Chase. A. PRESS.

October 10th.

ELECTRONS AND THE ETHER.

To the Editor of THE ELECTRICIAN.

SIR,—I am sorry if I have not made myself clear, but I must admit my inability to agree with Mr. Sayers, even now, that there is any contradiction between the electronic and electro-magnetic theories. His own illustration will suit me admirably. He says that to attribute the magnetic field in a beam of light to the motion of the electrons in the light source is like attributing the sound of a bell to the motion of the bell material. I agree. But that is no reason for being puzzled at the arrival of the sound, in the absence of bell material in the intervening space. There is air present to carry the sound, and similarly in the electrical case there is no need to look for electrons in the ether, which is present to carry the waves set up by the electrons.

What that ether is composed of certainly transcends my knowledge, but I am perfectly willing to think of it as a fluid with waves in it, or as a lot of Faraday tubes stretching in all directions. Either analogy can be used, according to the problem in hand, but I prefer to retain the idea that it is an analogy, in order to avoid consideration of how the planets are not resisted, or of how it is that there is always a Faraday tube between the two electrons I happen to be considering.

On this understanding, the electricity and the field are two distinct entities, and not different aspects of the same, just as the bell and the air waves are not the same thing.

Admittedly there remains something to explain, viz., what the ether is, but that there is any contradiction I fail to see.—I am, etc., JAMES H. AWBERY.

Teddington, Middlesex.

October 22nd.

To the Editor of THE ELECTRICIAN.

SIR,—I notice in my article appearing in the correspondence columns on page 429 of THE ELECTRICIAN for October 19th, that the word "on" appears instead of "or" in line 45. The sentence should read, "When our globe and Jupiter are in opposition or superior conjunction."

I do not know whether the slip was mine or the printer's, but the use of the word "on" was unfortunate, seeing that two different planetary configurations were referred to.—I am, etc., ARTHUR E. COTTERELL.

Beckenham.

October 22nd.

To the Editor of THE ELECTRICIAN.

SIR,—To get over the ether difficulties mentioned by Mr. Sayers, I take it for granted that the ether consists of layers of electric polarised and magnetic polarised particles. The electric poles being at right angles to the magnetic poles. I call these particles electro-magnetons. An electric force or a magnetic force will set up a twist of the electro-magnetons. This postulate is only a development of Faraday's lines of force theory. It is contrary to Ampere's theory of magnetism, but Dr. Campbell, in his "Structure of the Atom," says:—"If we are hidebound, by tradition, let us by all means stick to Amperean and Maxwellian theories, reject as a pernicious heresy, unsanctioned by the Fathers of the Church, all modern theory of radiation, all modern theory of spectra; let us retire as hermits to the desert of ignorance and refuse to have any dealings with the wicked, bustling world of modern science."—I am, etc., CHARLES E. HUME.

Ramsgate.

October 22nd.

ELECTRICITY SUPPLY AT AYLESBURY.

To the Editor of THE ELECTRICIAN.

SIR,—I find myself in agreement with Mr. Jefferson's calculations. The test, as is frequently specified in such cases, was run at unity power factor. Under these circumstances I find nothing abnormal in the losses quoted.—I am, etc., W. M. SELVEY.

London.

October 22nd.

A BULK SUPPLY PROBLEM.

To the Editor of THE ELECTRICIAN.

SIR,—I notice in THE ELECTRICIAN of October 19th, 1923, that you are advocating a bulk supply to a London undertaking. Apparently the so-called economy is the only matter that troubles you. Do you ever give a moment's thought to the men who will be adversely affected by the change over? Of course, a claim for compensation can be made, but recent awards are totally inadequate, and do not cope with the situation at all. A man's career may be permanently affected, if not finished, for a paltry hundred pounds or so. The station I am in will change over to a full bulk supply in the immediate future, and finding another job seems nearly impossible. This is, of course, a mere detail to those in authority, and very little sleep will be lost by them on this account.—I am, etc.,

"BULK SUPPLY."

[Our correspondent accuses us of inhumanity. But we are afraid that in this case, as in many others, the greatest good of the greatest number must be the rule. While, on the one hand, stations will be shut down and so release personnel, others will be started up or extended, and so more than absorb the surplus.—ED. E.]

Electrical Firms and Foreign Tenders.

Action of Unsuccessful Canadian Tenderers.

Some weeks ago the city of Winnipeg called for tenders for three new units, each consisting of a turbine and a generator, for its hydro-electric power plant. Half a dozen firms tendered. For the three 6 500 kVA generators the tender of the Swedish General Electric Co. of £45 800 and for the three turbines the tender of Canadian Vickers, Ltd., of £25 548 were recommended for acceptance. The tactics now being adopted by some of the unsuccessful competitors, states the Winnipeg correspondent of the "Manchester Guardian Commercial," are arousing some comment. One of these is the Canadian General Electric Co., whose bid was £7 806 higher than that of the Swedish General Electric Co. The former firm, the writer states, immediately set out to try to get the city to ignore the recommendation of its hydro-electric engineers and award the contract to itself. The district manager of the company addressed a letter to the manager of the city's power plant, pointing out that the company is owned and directed by Canadians, and suggesting that if a price difference exists in favour of a manufacturer other than Canadian, particularly one outside the British Empire, the Canadian firm might have an opportunity of studying the tenders with the object of enabling the Corporation to purchase Canadian manufactured equipment.

Among the unsuccessful tenderers for the turbines was the Boving Hydraulic and Engineering Co., of Lindsay, Ont. A representative of this firm asked for acceptance, or further consideration, of its tender, notwithstanding the fact that it was not even the next lowest tender.

The original recommendations were accepted.

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Promoting Retail Sales.

The Second E.D.A. Conference.

Mr. S. T. ALLEN, chief electrical engineer to the Wolverhampton Corporation, presided at the second E.D.A. Salesmanship Conference, which was held on Friday, October 19th, the subject being "How to Organise and Promote Retail Showroom Sales."

The discussion was opened by Mr. H. W. ROBERTS, of the General Electric Co., whose main argument was that the public must be brought round to regard the purchase of electrical apparatus as equally essential as many other articles. Before this could be done it was necessary to kill the prevalent idea that electricity was expensive; to make the electrical showroom as commonplace as the draper's, grocer's or chemist's; and to introduce more specialisation into the installation branch.

Educating the Public.

Discussing the establishment of retail showrooms, the great desideratum, said Mr. Roberts, was to have them in the market places of the town, if possible next to a grocer's or draper's, or some shop which was necessarily visited daily by the ladies. In that way, through constantly seeing the shop, electrical apparatus would become as common as the things displayed in the other shops. As regarded lay-out, Mr. Roberts favoured the long and narrow shop rather than the square one, the window not being of the enclosed type but consisting of a platform with a rail at the back over which the remainder of the shop could be seen. The space nearest to the wondow should be devoted to demonstrations of the larger appliances, on the middle of one side should be the retail counter, and on the other side there should be a display of appliances. Every effort should be made to avoid a congestion of fittings.

As regards assistants, women were favoured, as they were better able to speak on domestic matters; there should be a commission system of payment on apparatus sold, and assistants should be encouraged to specialise in one branch of the business.

Sales Methods.

Dealing with sales methods, various suggestions were made as to what should be done in the shop itself, but stress was laid upon persistent canvassing of the district and the great importance, when work was being done, of inducing the customer to put in extra points so that apparatus could be used in addition to lighting. The displays in the showroom windows should be changed frequently and some attraction provided in the way of moving apparatus.

"Sale or Return" Condemmed.

Finally, Mr. Roberts strongly condemned the system of filling showrooms with apparatus on sale or return. This was the worst form of business and did not lead to stability. He deprecated giving long credit, and impressed upon all concerned in the installation business the necessity for giving customers introductions to the wholesale houses so that they could go and choose their fittings. This should be done immediately a wiring order had been obtained in order to prevent the customer going to the large retail stores.

DISCUSSION.

Mr. P. M. SHEARS (sales manager, Hackney) deprecated the use of technical terms when selling electricity, and said that in Hackney they invariably adopted the principle of selling on the wattage basis and talking in £ s. d. He agreed with hire purchase; this had been extremely successful in Hackney.

Women a Necessary Element.

Alderman Mrs. HAMMER (Hackney) enlivened the proceedings with a number of amusing anecdotes showing how she had persuaded people to use electricity. She championed the cause of women in the sale rooms, on the committees and councils; their services must be obtained as well as those of men. It was necessary to make electricity the fashion, and only women could make fashion. She suggested that an electrical showroom should be situated next to a milliner's shop, not necessarily a grocer's.

Co-operative Advertising.

Mr. R. ROBSON (Newcastle) did not consider that the electrical industry understood the field it had in front of it. Local co-operative advertising should be adopted all over the country. There should be a section of E.D.A. in every large town. As to national advertising, he emphasised the importance of manufacturers advertising under a trade name; if they did that their goods would be pushed to a greater extent. Rather than have separate counters in a showroom, he suggested separate shops. A counter usually resulted in the sale of flash lamps, wireless parts, etc., and people wanting heating apparatus should not go to the same counter. He suggested that a chief salesman in a showroom should be an electrical engineer and his assistant a woman. Commission should not be paid on single articles, but on the whole profit of the shop over a certain period.

Mr. VARCOE (Birmingham) urged that the industry should concentrate on the electric iron, his experience being that, once this was introduced into the home, other apparatus followed easily.

More Showrooms Required.

Mr. E. A. JOYCE, emphasising the need for more showrooms, suggested that perhaps contractors felt it beneath their dignity to become shopkeepers. With regard to goods on sale or return, he defied anybody in the room to contradict his statement that if any contractor was going to open a showroom he would try to get his goods on sale or return.

Mr. H. T. YOUNG (Troughton and Young) urged that electrical manufacturers should advertise widely in the daily press so that consumers would go to the contractors for their particular goods, in the same way that people went to chemists for various remedies which were advertised by the manufacturers of them. The man who advertised his particular brand of goods nationally was out to make millions. He also emphasised the importance of putting a fitting into the room in which it was to be used; it could be fixed free, and the consumer could see the effect of it. His experience was that in 99 cases out of 100 the consumer kept it, and paid for it. As to salespeople, his experience was that men were better than women, except, perhaps, in regard to cooking. As to goods on sale or return, if a man could furnish his showroom with such goods and keep his capital in the bank, he did not blame him.

A Word for Women Salesmen.

Mrs. WALKER (North Met. Co.) defended the cause of women sellers, because they could talk to other women better about cookers. Showrooms were more attractive since women came in, because of their artistic taste. Her experience with regard to goods on sale or return was that they hung about the showroom for years and were never sold.

Mr. H. MANN agreed that goods on sale or return were not disposed of so quickly as others. He emphasised the importance of wholesalers and manufacturers demonstrating their apparatus to salesmen, and urged contractors to see that wiring in houses was of good quality.

Reductions in Price Not Sufficient.

Mr. W. A. GILLOTT said that mere reduction of the price of electricity was not sufficient inducement to the public to use it; they must be shown by demonstration what electricity would do.

Mr. F. H. HOWELL said his observations of some of the windows of electrical contractors led him to emphasise the need for cleanliness, and for changing the windows frequently.

Helping the Contractor.

The CHAIRMAN, reviewing the position as he saw it, said he was pleased to notice the greater enthusiasm which was instilled into the industry at the present time. He was also glad to see the spirit of co-operation which existed. As a supply engineer he did his best to help contractors.

Large-Scale Electric Cooking.

Four Tons of Beef Roasted in Improvised Electric Oven.

An unusual application of electric heating was made recently, states the "Electrical World," when beef for 5 000 people was roasted out of doors in an improvised electric oven at Ephrata, Wash. Four beasts, each weighing about a ton, were used, and a poster was displayed bearing the legend, "You Tellem We Cookem Cow."

The oven, which took the form of a pit, was 32 ft. long, 4 ft. wide, and 6 ft. deep. Twelve heating elements, each of 3 kW capacity, and consisting of about 150 ft. of No. 14 iron wire, were placed about 12 in. above the bottom of the pit. Sheet iron heat deflectors were placed 12 in. above the heating elements, and 18 in. above the deflectors were placed iron bars to hold the beef. Thermostatic control was provided to maintain an even heat in the pit.

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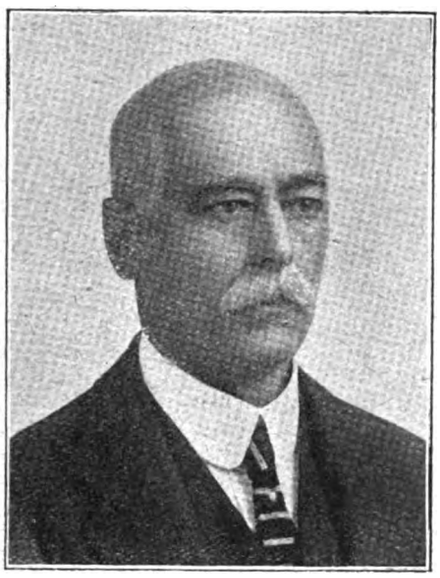
Death of Mr. A. L. Dearlove.

A Prominent Submarine Cable Engineer.

We regret to record the death, which took place on Friday last at 41, Hill Street, Berkeley Square, London, of Mr. Arthur Lovel Dearlove, aged 64 years, senior partner of Clark, Forde and Taylor, consulting electrical engineers. A funeral service was held at Golders Green Crematorium on Tuesday.

Educated privately at King's College, Mr. Dearlove spent three years with Latimer Clark, Muirhead and Co., where he had charge of the manufacture of the condensers and duplex apparatus supplied by the firm to the submarine telegraph companies. In 1878 he was engaged in the establishment of duplex working between London and Emden (Germany) as well as upon the cables of the Eastern Telegraph Co. After completing this work he joined, as assistant, the firm of Clark, Forde and Taylor, with whom he has since remained. During the last 41 years he has had a wide experience of all branches of cable work, the manufacture, laying and testing of over 100 000 miles of cable having been carried out under his supervision.

In 1888 he was engaged by Henley and Co. to assist in the laying of the cable between Venezuela, Curaçao, San Domingo, Haiti, and Cuba, and in 1891 he established the duplex system on the cables of the Brazilian Submarine Telegraph Co. at the company's stations



[*Photo: Langfier.*

THE LATE MR. A. L. DEARLOVE.

at Lisbon, St. Vincent and Pernambuco. In 1897 he was engaged by the Cie Française des Cables Télégraphiques to conduct repairing and laying operations on the company's Atlantic and West Indian cables.

For some years, in conjunction with the late Mr. Herbert Taylor, he was engaged in research on the working of long submarine cables. Joining Mr. Alfred Graham as partner in Alfred Graham and Co., in 1898, Mr. Dearlove assisted in the development of that business for many years, relinquishing his connection at the end of 1915. Associated with the late Mr. Herbert Taylor and Mr. S. G. Brown he assisted in developing the Taylor-Brown-Dearlove system of automatic translation on submarine cables.

Mr. Dearlove became a partner in Clark, Forde and Taylor in 1898, and to his initiation was due the early employment of the electric welding method for the sheathing wires of submarine cables. He also investigated and published his experiments on "The Temperature Coefficient of Clark's Standard Bell" and "The E.M.F. and Temperature Coefficient of Weston's Cadmium-Mercury Cell." He was a contributor to the electrical journals, principally on subjects intimately associated with cable engineering, including "The Determination of the Inductive Capacity of Long Submarine Cables" and "Notes on the Anglo-American Co.'s 1894 Atlantic Cable." He was also the author of a useful book of tables giving the "Working Speed of Submarine Telegraph Cables of Various Cores, with other Data." In 1908 he patented an improved type of artificial line for the duplexing of cables.

Mr. Dearlove had been a member of the Institution of Electrical Engineers since 1898.

Among those present at the funeral service were Major C. Turner-Jones, Mr. Adrian Newell, Mr. Eric Newell, Mr. Alan Fyffe, Sir Charles Bright, Sir George Buchanan, Capt. V. Campos, Comdr. Robinson, and Messrs. F. J. Adye, H. S. Ball, A. Baxendale, C. Brodribb, S. G. Brown, Kenneth Buchanan, T. Clack, W. H. Coade, W. J. Cole, A. P. Crouch, A. Davidson, J. J. Delahanty, A. E. Foster, S. J. Goddard, E. S. Heurtley, H. F. Hesse, L. M. Higham, R. J. Hughes, F. Jacob, H. Kingsbury, G. C. Lovibond, D. Lucas, R. W. Paull, R. H. Peet, E. Stallibrass, W. Steventon, T. H. Tebbett, S. Wood, and F. Woollan.

Empire Cable and Wireless Services.

Views of the Dominion Premiers.

Following the statement on the Empire's cable and wireless services made by Sir LAMING WORTHINGTON-EVANS to the Imperial Economic Conference last week (reported in our previous issue), Mr. G. P. Graham, Minister of Railways and Canals, Canada; Mr. S. M. Bruce, Prime Minister, Australia; Mr. W. F. Massey, Prime Minister, New Zealand; Mr. C. A. Innes, member of the Governor-General's Council for Commerce and Railways, India; and Mr. W. Ormsby-Gore, Under-Secretary for the Colonies gave their views on the situation. An official report of the proceedings published last Friday shows that in regard to wireless communication Canada and India favoured the creation of an Empire chain, preferably under private enterprise, while Australia desired a definite assurance that reciprocal stations will be erected in this country, as the erection of the new Australian high-power station is now to be proceeded with.

Canadian Wireless Policy.

Mr. G. P. GRAHAM said there were about 280 wireless stations in Canada, some owned by the Government and some under private management. The wireless system, excluding that portion of it managed by the Department of Defence, was under the Marine Department, which granted licences. Licences had been granted to the Marconi Co. for stations at Montreal and Vancouver. The Canadian policy in regard to the Empire chain was in favour of private ownership. He had wondered whether a wireless system could not well be established between Canada and the West Indies.

Having received from Sir L. WORTHINGTON-EVANS an explanation of the position in the negotiations between the Government and the Marconi Co., Mr. S. M. BRUCE said he thought it would be better not to discuss the question of private or Government enterprise at this stage. They were building their high-power wireless station but they must have reciprocal stations and arrangements in England. He would discuss this matter privately with the Postmaster-General.

Competition in the Pacific.

Regarding the question of wireless in the Pacific we should undoubtedly have foreign competition, but Australia might be able more or less to secure the predominance of the Empire in this area. In reply to questions raised by Mr. Bruce, Mr. AMERY said the whole question of the Amalgamated Wireless Co. erecting a chain of stations in the Pacific had been before the Imperial Communications Committee, and, as far as they were concerned, approved. There remained an outstanding question as to how far Fiji could come within the scheme.

Mr. W. F. MASSEY was optimistic as to the future of wireless, but explained that little had as yet been done in New Zealand in the way of establishing stations, as they had been watching the course of events. They had not yet decided on the best course to adopt or on the route over which the wireless should go. He did not think there would be much difficulty in arranging for a wireless station in New Zealand.

Wireless Progress in India.

In India, said Mr. C. A. INNES, they had always been in favour of entrusting wireless, under careful safeguards, to private enterprise, and they were now working on those lines. The Government of India was now considering the question of placing a contract with an Indian company to start a large wireless station.

*** A wireless telegraph company formed for the purpose of erecting a high power station in India has (Reuter states) been registered under the title of the Indian Radio Telegraph Co., with a capital of three crores of rupees (approximately £2 000 000).

Referring to Mr. Graham's remarks on wireless communication with the West Indies, Mr. ORMSBY-GORE said our present experience of it had not been altogether happy, and he was quite sure that cable communication must come first.

Imperial Cable Difficulties.

Dealing with cable services, Mr. Graham said that being Minister of Railways with a telegraph system under control of the national railway system, he appreciated the Postmaster-General's difficulty and the disability under which they found themselves as owners of this telegraph system in connection with the Imperial cable. If they could not get messages for the Canadian National lines over the Imperial cable, they could not be expected to hand in messages to the Imperial cable if they could send them otherwise. Mr. Bruce said Australia attached great importance to having a reliable cable service and took the view that the establishment of an all-British cable service was an admirable thing. Mr. Massey said he had been hoping for a long time past to see a reduction in cable rates. The week-end cable had been a very great convenience to business people. Mr. Innes did not think India had at present much to complain of in regard to its cable service.

The New West Indian Cable.

Mr. Ormsby-Gore hoped that before the Conference terminated it would be possible to get the assent of the Governments of Canada, Australia and New Zealand to the proposal to allow the Pacific Cable Board to work the new West Indian cable. The Board would have to be reconstructed and given powers to do so by an Act of Parliament. The Bill would be ready in a few days, and he would circulate it to the Governments concerned.

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Merchandise to Sell and Profit By.

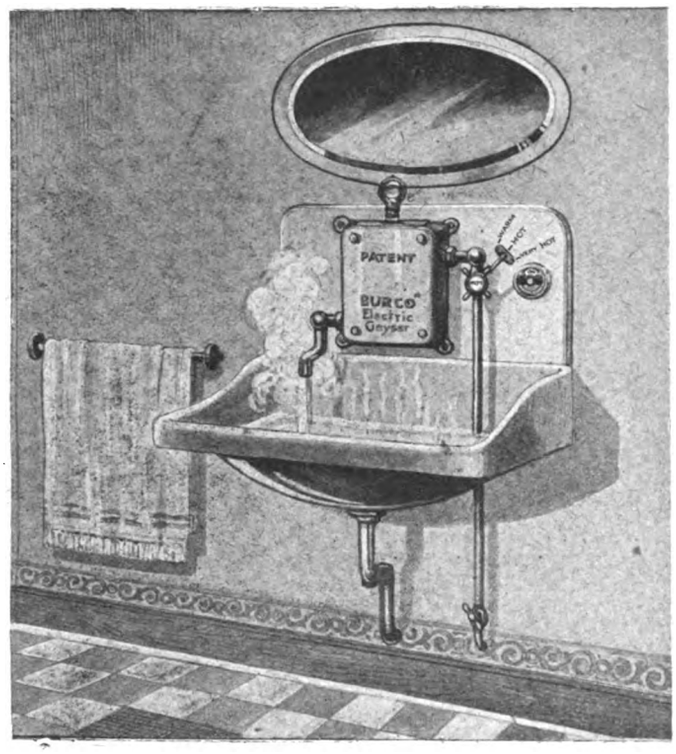
***In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of* THE ELECTRICIAN.**

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

A Providential Blessing.

Very few electrical men will admit that Providence has showered many blessings on the industry, but, be that as it may, it is providential that these chilly autumn mornings do agitate the minds of "domesticians" on the problem of the hot water supply. That is to say, hot water "on tap" for shaving and the morning wash



BURNLEY COMPONENTS WASHING BOILER.

or bath. It is for this reason that electric geysers, both small and large, according to the requirements of the household, will make particular appeal just now, and will prove as easy to sell as hot chestnuts to small boys on a cold winter's day. Now is the time to solicit business, and there are several good geysers offered by manufacturers. We illustrate the "Burco" geyser marketed by BURNLEY COMPONENTS, LTD.

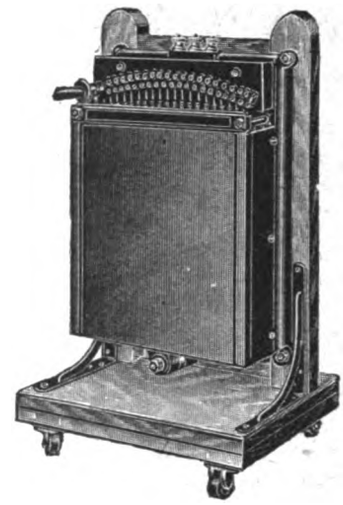
A B.T-H. Hand Lamp.

We illustrate a workshop hand lamp manufactured by the BRITISH THOMSON-HOUSTON CO. The device is not new, but undoubtedly it is good "merchandise to sell and profit by." Hand lamps are troublesome devices to the buyer; there is a natural temptation to buy on price and price alone, but many have found that, unless great care is exercised, whatever profits are made when the hand lamps were installed have been absorbed by service charges owing to the fact that they have proved faulty in service or have failed to comply with Home Office regulations. The hand lamp which we illustrate is one which can be accepted as being thoroughly well made to withstand the rough usage to which these appliances are peculiarly liable. The lampholder is worthy of particular mention. It is one of the standard bayonet all-porcelain type with a porcelain skirt, being designed of such a depth so as to cover the lamp cap as required by the Home Office. The price of the hand lamp is competitive, and can therefore be specified on jobs where it is anticipated that the competition will be keen.

A GOOD HAND LAMP.

A Test-Room Rheostat.

The test-room rheostat which we illustrate is manufactured by DONOVAN AND CO., and, while such apparatus is not of a kind which falls correctly under the heading of these columns, it is a piece of apparatus with unique features, and a brief description will be of interest to many readers of THE ELECTRICIAN. The rheostat is made in two standard sizes: (*a*) 8 A capacity with 33 O resistance; (*b*) 4 A capacity with 100 O resistance. The frame is made in cast-

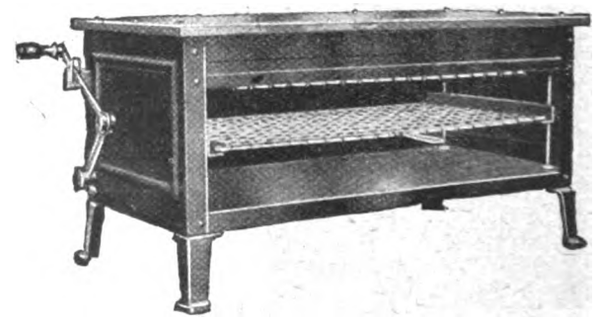


TEST-ROOM RHEOSTAT.

iron finished black with a cover of sheet steel. The resistance wire is mounted on oiled slate and the wire, according to the manufacturers' specification, is of the best non-corrodible copper nickel alloy. Donovan and Co. will be pleased to send a descriptive list of the rheostat to all interested engineers.

A Toaster for Restaurants.

Apropos of our comments under another heading of the business which can be obtained from restaurants with heating and cooking apparatus, we illustrate a toaster with a rise and fall grid, which has been specially designed and manufactured by the ARORA CO., for



A USEFUL TOASTER.

this work. This particular toaster is specially constructed for rapid work. It has a loading of 4kW, and the rise and fall grid facilitates its operation very considerably. This is a unique piece of apparatus and proves that we are far from the stage when ideas for new equipment to meet particular conditions are exhausted.

"Double Double Six Six."

If a name or a title alone would sell a cooker then most certainly the BRITISH ELECTRIC TRANSFORMER CO. have hit upon a happy title for the cooker which we illustrate. That title is "double double six six," and it must bewitch a prospective buyer. The expression is almost as fascinating as the word "Tricity." This new cooker is intended for small schools or restaurants and is capable of cooking for the requirements of approximately sixty persons. It is, of course, a twin edition of the No. 666 cooker, which we referred to in THE ELECTRICIAN of May 18th, 1923. As we mentioned then, this cooker, together with the Tricity No. 639A, are the two cookers which the Grimsby Corporation have decided to standardise for their hiring-out scheme. In addition to this development, the company have also placed on the market a small cooker which will be known as the No. 670. There is a gap in the programme of

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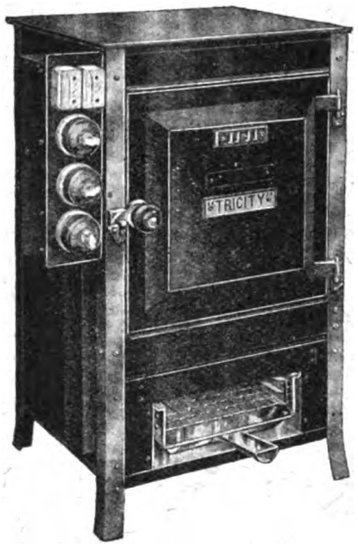
cookers so far as small loadings are concerned and the development of the No. 670 cooker is an attempt to fill it. As is well known, it is widespread criticism that for many districts the loading of a cooker is too heavy, but that there would be a good market for a cooker with a smaller loading, say between 2 and 3 kW. Many

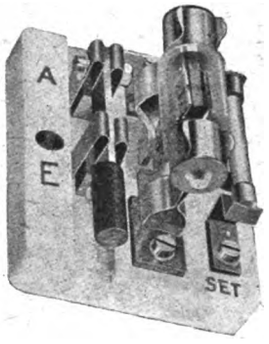


THE "6666" TRICITY COOKER.

manufacturers advise the trade to cater for this business with a small grill or breakfast cooker, but these two devices do not appeal to housewives as do ovens or cookers, and it is for this reason that this line of development in these districts has not been successful. There is much to appeal to a housewife in a device which is built on the lines of an oven, no matter how small (within reason) the dimensions may be. We illustrate the "Tricity" No. 670, and at a list price of fourteen guineas it should prove a good selling proposition.

Siemens Aerial Protector.

We illustrate a very useful wireless accessory which is manufactured by SIEMENS BROS. AND CO. It is a small device for aerial protection, complete with an earthing switch, and should sell readily at the list price of 12s. We had occasion to refer to the possibilities of the market for a device of this kind some few weeks ago and there is no doubt that the idea is finding much favour



SIEMENS BROS. AND CO. AERIAL PROTECTOR.

with the public. There is undoubtedly great force in the argument that it is absolutely necessary that some protection should be provided against the risk of fire or damage caused through the aerial being struck by lightning. Siemens claim that the vacuum protector possesses a number of advantages, one, in particular, being that it will operate many times before renewal is necessary. The illustration will reveal the fact that the accessory is a very compact one, and, as we have said, will undoubtedly sell well at the list price of 12s.

PHILLIPS AND TURNER ask us to announce in this column that they are in a position to quote the trade competitive prices for galleries, switchplates and other small fittings parts.

From the SIMPLEX CONDUITS, LTD., we have received a copy of their conduit price schedule No. 995. The schedule cancels all previous issues; the revised prices are scheduled to come into force on October 8th.

Readers of THE ELECTRICIAN will note with interest the following particulars of catalogues just published by METROPOLITAN-VICKERS ELECTRICAL CO. (a) leaflet 39/1-1, describing type CCB a.c. squirrel cage induction motors, (b) 59/4-1, describing auto transformer and star delta starters, and (c) circular No. 1059/1, being a technical description of type OL 650 V automatic oil-break ironclad switchgear.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

From the ASTRO ELECTRIC LTD., we have received folder describing the many types of Astro intensifiers.

DONOVAN AND CO. have published a new price list on their whole range of electrical supplies, including lamps.

CRYSELCO, Ltd., ask us to advise readers that they have just published a new price list of Cryselco lamps.

From C. H. PARSONS we have received a price list on the whole range of "Britmac" switches and lampholders.

BRITISH INSULATED AND HELSBY CABLES have issued a new list, No. P 181, describing the "Prescott" wiring system.

"Zenith Resistances and Rheostats" is the title of a new catalogue just published by the Zenith Manufacturing Co.

"Laminated Gears in Textile Mills" is the title of a descriptive volume which LAMINATED GEARS, LTD., announce the issue of.

AUTOVEYORS, LTD., invite trade inquiries for their S-electrode variable condenser, which is described in a booklet just published.

CROMPTON AND CO. have published a technical brochure on auto-synchronous motors. It is a publication which will appeal to all engineers.

BURLECTAS, LTD., have published a list, printed in colour, showing a range of table standards made up with Staines Art Ware and silk shades.

"Prescott mistake proof switch cut-out," is the title of a descriptive pamphlet, No.183, recently published by the BRITISH INSULATED AND HELSBY CABLES.

The TELEGRAPH CONDENSER CO. have kindly sent us a copy of their revised brochure No. 31, describing the T.C.C. static condensers for the improvement of powder factor.

WATSON AND SONS (ELECTRO-MEDICAL) ask us to announce the publication of bulletin 56S. describing the Sunic X-ray combination horizontal couch and high tension transformer.

From the M. K. ELECTRIC we have received their latest catalogue, dated September, describing, with prices, their whole range of "Multi-Kontact" wall plugs and sockets, etc.

The Duplex Mono Automatic Gas Analysing Recorder, manufactured by JAMES GORDON AND CO., is fully described in a technical publication just issued by the manufacturers.

The "Benjamin Bulletin" is one of those regular publications which the trade look forward to. The BENJAMIN ELECTRIC CO. has sent us a copy of the latest issue.

The ECLIPSE CABINET WORKS CO. ask us to announce that they are manufacturers of floor and table standards in wood, and that they will be pleased to receive enquiries for prices from buyers.

Buyers of powder jointing and iron cement should make a note on their purchasing cards of the MORTIMER JAMES POWDER JOINTING CO. They have recently published a folder describing their products.

From the WESTERN ELECTRIC CO. we have received two catalogues which merit the attention of all wireless retailers. The first is entitled "A Line of Loud Speakers" and the other describes "Weconomy Wireless Sets."

Colliery engineers and others will note with interest that Alklum Electrics, Ltd., have just published a new catalogue describing the "Worsnop" miners' electric safety lamp. The list also contains technical data on and prices of Alklum storage batteries.

Railway engineers, particularly, will learn with interest that the GENERAL ELECTRIC CO. have published a leaflet, R.S.3 016, describing the "Valley" type K rectifier for use on a.c. floating battery systems. We hope to refer in more detail to this rectifier at an early date.

"We will print your name and address here, free of charge." This is the service which Siemens offer the trade in connection with the folder publicity on their whole range of lamps. The folder dealing with vacuum and gasfilled lamps includes, of course, the new and reduced price list announced by all ELMA makers of gasfilled lamps.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI announce the issue of No. 99 of their quarterly bulletin which contains interesting technical articles on series three-phase motors, an electric pumping installation at the Antwerp Dry Docks, steel works, electric cranes, tests on paper for use in the manufacture of high tension cables, and electric mine signalling lamps.

Any announcement made by the INDIA RUBBER AND GUTTA PERCHA AND TELEGRAPH WORKS CO. (better known as the Silvertown Co.) commands the attention of all buyers. Particularly is this so with regard to the new list entitled "Self-contained Electrical Measuring Sets." The same comments apply to the list describing the range of "Silvertown" wireless accessories. This list should be in the hands of every wireless retailer.

Two new attractive coloured showcards have recently been produced by the GENERAL ELECTRIC CO. and are now available for distribution to the trade. The first of these advertises "Gecophone" headgear telephone receivers of both the headband and lorgnette types. The other showcard, featuring Marconi valves, embodies the "Wireless Wonder" figure so familiar in the G.E.C. valve advertisements. We understand that copies of these showcards will be sent gratis to all applicants.

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E.P.E.A. (Southern Division) Dinner.

Satisfactory Progress of the Association.

The fifth Annual Dinner of the Southern Division of the Electrical Power Engineers' Association to members of the National Executive Council was held at the Hotel Cecil on Saturday last.

Capt. J. M. DONALDSON, M.C., in proposing the toast of the Association, said it was based on two reciprocal axioms—" Hear the other side " and " Put yourself in the other man's place." Before the formation of the Association, relations between employers and employees in the supply industry had been very one-sided. But men who had had an expensive education, and who were engaged in carrying out wearing and responsible duties thought it only right that they should receive an adequate reward. He reminded them, however, that employers were human, too, and would probably do and think what everyone else would do and think under the same circumstances.

Status of the Power Engineer.

In reply, Mr. W. J. OSWALD said that the Association was justly proud of the work it had done so far, and of the objects it had attained. Its principal object was to raise the status of the power engineer, and if conditions a few years ago and to-day were compared it would be seen that a great deal had been done in that direction. The Association stood by Whitleyism because it believed that the most vital industry in the country should be free from drastic action and strikes. He thought that both employers and the members of the E.P.E.A. hoped that the salaries would not interfere with the greater work for which the National Joint Board was designed.

Mr. J. H. PARKER, in proposing " The Guests," said it was extraordinary how the E.P.E.A. had come out of its troubles on the right side, considering how difficult and complex had been the matters with which it had to deal. He ascribed a good deal of this success to the ladies, who, by their intuition, had guided the members of the Executive Council along the right path. The Association owed a great debt to the members of the National Joint Board, and to no one more than Alderman Walker. The Association also owed a debt of gratitude to the electrical Press.

In reply, Alderman W. WALKER gave a brief history of the formation of the National Joint Board for staffs working in electricity undertakings. Though the first schedule was not perfect, it had helped to standardise conditions. Referring to the rift last year, he said that both sides thought they were doing what was best, but it was impossible to go on indefinitely; and it was much better to get the differences settled by arbitration. In settling these differences the E.P.E.A. had set a good example. Those undertakings who had not carried out the conditions were more of a menace to the employers than to the E.P.E.A.

Mr. A. H. ALLEN, who also replied to this toast, said that one of the most important functions of the E.P.E.A. was to act as a lightning conductor, whose function, he reminded them, was not to be struck, but to dissipate the atmospheric strain by silent discharge.

In the course of the evening a presentation was made to the immediate past president—Mr. Jeffrey—as an appreciation of the splendid service he had rendered them during his year of office.

Faraday House Old Students' Dinner.

Presentation to Dr. Russell.

The fifteenth Annual Dinner of the Faraday House Old Students' Association was held at the Hotel Cecil on Friday last, Mr. H. W. MILLER, the president, being in the chair. About 250 old students and guests were present.

In proposing the toast of " Faraday House and its Old Students," Mr. W. W. LACKIE said it was a great tribute to the worth of Faraday House as a training institution that it could inspire in its students such a belief in its merits. Faraday House students held important positions all over the world, and he thought it would not be too much to say that the secret of its success lay in Dr. Russell, who was, in fact, Faraday House.

Dr. ALEXANDER RUSSELL, who was received with great enthusiasm, in replying to the toast said that the Governors were re-equipping the workshops, laboratory and test-rooms, and had given the staff a free hand to acquire any instruments they desired. In 1919 Faraday House was affiliated with 71 factories, power stations and railways. To-day it was affiliated with 139, of which 81 were factories. Its continued prosperity was due to the kindness of the firms with which it was connected. During the past year seven students had passed the B.Sc. examination in engineering, two with honours.

In the course of the evening a presentation from Faradians and Faraday House was made to Dr. Russell by the President to mark their pleasure at his election to the Presidency of the Institution of Electrical Engineers. In making the presentation—a handsome cabinet of silver, and a gold cigarette case—Mr. MILLER said that letters had been received from all parts of the world expressing anxiety to support this testimonial.

In the course of his reply, Dr. RUSSELL mentioned that it was 34 years since he came to " Faradia," and he was pleased that some of the members of his first class were present that night. Old Faradians seemed to make a point of sending their sons to the institution, and some of the sons of earliest members had gained scholarships quite recently.

Newport Electrical Exhibition.

Applications Signed for 227 Cooking Installations.

The Newport Electrical Exhibition, referred to in our previous issue, was an outstanding success, and the Electricity Committee's optimism in taking the Stow Hill Pavilion, which has a floor area of 20 000 super. feet, has been justified. Approximately 24 000 people visited the Exhibition, and notwithstanding the fact that the Corporation issued complimentary tickets equivalent to the free admission of 21 000 people, over 8 000 paid for admission.

The exhibitors have expressed their unbounded satisfaction at the general administration and organisation of the Exhibition and at the business results accruing from it, and the general public and exhibitors alike express the view that the Exhibition has been a splendid educational effort. We understand from Mr. A. Nichols Moore, the borough electrical engineer, that definite applications were signed for no fewer than 227 additional cooking installations. This is a remarkably high figure, and there seems to be no question that the rate for cooking and heating—1d. per kWh—and the reasonable hire charges, which range from 4s. to 7s. per quarter in the case of the larger cookers, have been the principal factors contributing to this success. Based on previous experience the Electricity Department is satisfied that the additional load secured will represent a consumption of 350 000 kWh per annum. In addition to cooking apparatus, large orders for heating apparatus were secured, and considerable orders for washing and ironing apparatus, vaccuum cleaners, electric machine tools, etc., were reported from all the stands.

A pleasing little incident in connection with the Exhibition was a private supper party given by Alderman Fred Phillips to the Corporation staff and the exhibitors last Saturday night at the close of the Exhibition. Councillor W. T. Griffiths, a member of the Electricity and Tramways Committee and of the Electrical Exhibition Sub-committee, thanked the Alderman on behalf of the Sub-committee; Mr. Nichols Moore responded for the Corporation staff, and Mr. T. E. Alger, of R. Alger and Sons, the oldest electrical contracting firm in Newport, responded for the exhibitors. Mr. Alger presented Mr. Nichols Moore with a handsome cigarette case and card case as a token of the exhibitors' regard, with an expression of their appreciation at the manner in which he had organised and conducted the Exhibition.

Institution Notes.

The new session of the ROYAL SOCIETY OF ARTS will open on November 17th with an address on " Exhibitions " by Lord Askwith.

Mr. Henry Joseph is to read a paper on " Electric Motors in Service " before the BIRMINGHAM AND DISTRICT ELECTRIC CLUB to-day (Friday).

The Vice-Chancellor of Cambridge University announces that the General Electric Co. of New York has given $5 000 to the Cavendish Laboratory TO PROMOTE INVESTIGATIONS, and the British Thomson-Houston Co. £250 for a similar purpose.

Lecturing on " Illumination by Electricity," at the opening meeting of the PAISLEY ASSOCIATION OF ELECTRICAL ENGINEERS, Mr. F. B. Humphriss pointed out that by keeping their shop windows illuminated after business hours retailers could secure much additional revenue.

The INSTITUTION OF ELECTRICAL ENGINEERS announces the award of the following scholarships for 1923–24:—A Salomons Scholarship (value £50), to Mr. James Linton (Heriot Watt College, Edinburgh); David Hughes Scholarships (value £50 each), to Mr. R. MacWhirter (Royal Technical College, Glasgow) and to Mr. R. E. Banks (The University, Birmingham).

November 6th is the date of the opening meeting of the North Western Centre of the INSTITUTION OF ELECTRICAL ENGINEERS, and the Chairman's address will be followed by a smoking concert at the Midland Hotel. On November 20th a paper on " The Drive of Power Station Auxiliaries," by L. Breach and H. Midgley, will be read. There will be an informal meeting on December 4th, and on December 18th Mr. David Brownlie will read a paper on " Pulverised Fuel and Economical Steam Generation." Meetings in the New Year will be held on January 8th and 22nd, February 5th and 19th, March 4th and 18th, and on April 1st.

Fires of Alleged Electric Origin.

Misleading Accounts in the Daily Press.

Our daily contemporaries simply cannot get it out of their heads that the majority of fires are due to electrical causes. In the report of the chief officer of the London Fire Brigade for the year 1922 appears the following sentence: " Of the false alarms . . . 1 148 were due to defective electric circuits," i.e., to defects in the fire alarm circuits. This is ingeniously paraphrased by the " Pall Mall Gazette " to read, " Of the total, 1 148 were due to fires caused by defective electric circuits." Is this due to ignorance, innocence, or to more complicated causes? In any event it will probably come out sooner or later in a gas propaganda leaflet. There is only one way to scotch this idea; electrical engineers must rub into the thick heads of reporters and editors of daily papers the fact that electricity does not cause fires nearly so often as coal, gas, lighted matches and other inflammable agents.

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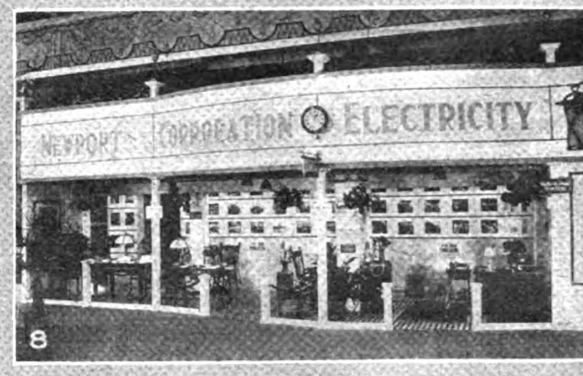

ELECTRICAL NEWS IN PICTURES.

Fig. 1 and 2.—The joint efforts of the Corporation and the Metropolitan-Vickers Co. have produced these interesting window displays at Bradford.

3.—Mr. P. J. Baker, recently appointed general manager of the Southampton Tramways, has designed a new top-covered car for negotiating low archways.

4.—Hackney's "all-electric" homes for disabled soldiers (p. 470).

5, 8, 9 and 10.—Splendid results have been obtained from the Newport Electrical Exhibition, at which these photographs were taken (p. 466).

6.—Mr. Arthur Hewitt, the first chairman of the North Wales and South Cheshire Joint Electricity Authority.

7.—A corner of the Kitchen in Waring and Gillow's "All-Electric" Home (p. 470).

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Tenders Invited and Accepted.

BATTERSEA (LONDON) BOROUGH COUNCIL, November 1st.—Six e.h.t. feeder cubicles. Particulars from the Engineer, Electricity Works, Lombard Road, S.W.11.

LAMBETH (London) BOROUGH COUNCIL, November 1st.—Electric wiring and fitting of Coroner's Court and mortuary. Specification from the Borough Engineer, Town Hall, Brixton Hill, S.W.2.

DINGWALL CORPORATION, October 31st.—Electric wiring and fitting at the Slaughter House. Particulars from the Town Clerk.

TAUNTON CORPORATION, November 16th.—1 000 kW steam turbine, with condensing plant and accessories. Particulars from the Borough Electrical Engineer.

IRELAND.

DUBLIN CORPORATION, November 1st.—Repair of batteries or, alternatively, supply of a new battery at Pigeon House works. Particulars from the City Electrical Engineer, Fleet Street, Dublin.

RATHMINES AND RATHGAR URBAN COUNCIL, November 1st.—Fuel economiser for the Electricity Works. Specification from the Electricity Works.

AUSTRALIA.

COMMONWEALTH OF AUSTRALIA, October 30th (in London).—Switchboard cable. October 31st (in London), Telegraph printing apparatus. December 12th (in London), or December 15th (in Australia), cable terminal boxes (S.A. 676). Particulars from the Supply Officer, Australia House, Strand, London, W.C.2.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS, December 5th.*—Transformers for White Bay power house. December 19th.*—Transformers for Meek's Road sub-station.'

VICTORIAN ELECTRICITY COMMISSION, December 15th.*—Transformers and spares.

VICTORIAN ELECTRICITY COMMISSION, December 15th.—Four 1 000 kVA single phase transformers and spares. Specification (No. 23/145) from the Agent-General for Victoria, Melbourne Place Strand, London, W.C.2.

VICTORIAN ELECTRICITY COMMISSION, January 3rd.*—Aluminium steel cored cable and accessories.

VICTORIAN ELECTRICITY COMMISSION, January 19th.—Transformers, switchgear and accessories for sub-station B. Specification (No. 24/2) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2, upon deposit of £2 2s.

NEW ZEALAND.

AUCKLAND ELECTRIC POWER BOARD, November 24th.*—Transformers and accessories.

SOUTH AFRICA.

JOHANNESBURG CORPORATION, November 15th.*—Test transformer and other transformers.

JOHANNESBURG MUNICIPALITY, November 19th.*—Cables.

CAPE TOWN MUNICIPALITY, November 29th.*—Transformers.

The tender of Baxter and Caunter has been accepted by MAIDENHEAD CORPORATION for a balancer, £325.

For switchgear, A. Reyrolle and Co.'s tender, £19 300, is recommended for acceptance by LEEDS CORPORATION.

For a 150 kW transformer, GILLINGHAM (KENT) CORPORATION has accepted the tender of the Hackbridge Transformer Co., £144.

For a conveyor for the electricity works, CHELTENHAM CORPORATION has accepted the tender of the New Conveyor Co., £591 2s. 6d.

LAUNCESTON BOARD OF GUARDIANS has accepted the tender of F. Jackman for electric light wiring and fitting at the Institution, at £95 12s. 6d.

DONCASTER CORPORATION has accepted the tender of A. Reyrolle and Co. for high-pressure switchgear for controlling new rotary converter, £280.

The tender of the Britannia Lathe and Oil Engine Co. for supply of a 1 200 B.H.P. engine to the Electricity Department at £750 has been accepted by SOUTHEND CORPORATION.

PONTYPRIDD URBAN DISTRICT COUNCIL has accepted the tender of W. T. Henley's Telegraph Works Co. for 2 700 yards three-core l.t. cable and about 2 000 yards run l.t. electric lighting overhead lines on wood poles.

The Leeds Forge Co. has received orders for 50 steel railway coaches required in connection with the scheme for the electrification of the SYDNEY (N.S.W.) SUBURBAN RAILWAYS, and 250 bogie wagons for the SOUTH AFRICAN RAILWAYS.

Dewrance and Co., London, have contracts for valves for the high pressure steam and feed-water pipe ranges, and for boiler mountings for the VITRY POWER STATION, PARIS; and also an order for valves for the extension at GENNEVILLIERS POWER STATION, PARIS.

When tenders were invited in America for the supply of 1 806 miles of cable for the U.S. WAR DEPARTMENT's new Alaska cable, no bids were forthcoming. The contract has, we understand, been placed with Siemens Brothers and Co., the price being equivalent to about £276 445.

GLASGOW CORPORATION has placed a repeat order with the Mirrlees Watson Co. for two surface condensing plants of 26 000 ft. cooling surface, to work in connection with two 15 000 kW turbo-alternators, to be supplied by Messrs. C. A. Parsons and Co., for the Dalmarnock station.

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* Particulars from the Department of Overseas Trade.

THE TATA POWER COMPANY, which will shortly make an issue of capital, equal to £1 000 000, has placed orders amounting to £750 000 with Callenders Cable and Construction Co., the English Electric Co., the British Thomson-Houston Co., and the Mannesmann Tube Co. It is stated that the Tata Co. will also place other contracts with British manufacturers.

WINNIPEG (MANITOBA) MUNICIPALITY has placed with Vickers Limited (Hydro-Electric Department), an order for three 7 300 H.P. water turbines, required in connection with the power station at Point du Bois on the Winnipeg River. We are informed that Vickers' water turbines, of an aggregate weight of over 750 tons, have been shipped to India and New Zealand since June last.

The following tenders have been accepted by BRADFORD CORPORATION: British Mannesmann Tube Co., 200 steel tramway poles, £1 741; Hadfields, Ltd., six sets of points and crossings, £531; Alfred Wiseman, Ltd., 48 sets of gearwheels and pinions, £535; A. Ridgway and Co., wiring school clinic, Great Horton Road; Harry Moss, wiring at Hepworth Wesleyan Chapel and schools, and Mount Stead, Ben Rhydding.

The SHROPSHIRE, WORCESTERSHIRE AND STAFFORDSHIRE ELECTRIC POWER Co. has placed contracts with the British Thomson-Houston Co. for a turbo-alternator; Cole Marchent and Morley for condensers; British Insulated and Helsby Cables, Ltd., for 16 miles of 33 000 V h.t. cable; and Stewart and Co. for cooling water intake and outlet culverts, pile driving and ferro-concrete work, in connection with the new power station at Stourport, on the river Severn.

The Cambridge and Paul Scientific Instrument Co. has just received an order for the supply to BELFAST CORPORATION ELECTRICITY DEPARTMENT of temperature measuring equipment for eight boilers, including eight 6-point thermo-electric indicating outfits for measuring temperatures of steam, of the inlet economiser gases and of the stack, an 18-point electrical distance thermometer outfit for water temperatures, and a totally-enclosed indicating outfit for turbine steam temperatures.

GLENFIELD AND KENNEDY (Kilmarnock), have secured a contract for 50 steel sluice gates from the irrigation department of the Government of India. 30 of these gates are 50 feet wide by 11 feet deep, 4 are 50 feet wide by 13 feet deep, and 16 are 20 feet wide by 6 feet 4 inches deep. The contract includes mechanism for raising and lowering the gates, i.e., wire ropes, counterweights, gearings, steel rollers, etc. The total weight of steel involved in the order is over 2 000 tons and the value of the contract is nearly £80 000. The firm has just booked a repeat order from the Royal Irrigation Department of the Siamese Government for two similar gates, each 41 ft. ⅛ in. wide by 19 ft. 8¼ in. deep, with the usual auxiliaries.

Legal Intelligence.

Electric Night Signs.

Proprietors Fined for Highway Obstruction.

A case of interest to manufacturers and users of illuminated electric signs was heard at Bow Street on Tuesday, when an employee of a sign contractor and two employees of a newspaper using the apparatus were fined 40s. each with 3 guineas costs.—For the Commissioner of Police, it was stated that the proceedings were brought without the slightest intention of interfering with commercial enterprise, but owing to the enormous crowds attracted to Trafalgar Square, the site of the sign, to see the result of a prize fight, all ordinary traffic had to be dislocated in spite of the efforts of an additional force of 60 police.

Recovering the Price of Goods Sold.

An Undefended Action.

In the King's Bench Division on October 18th, before Mr. Justice Bailhache, the case of the Industry and Commerce Alliance, Ltd., Vernon Place, London, *v.* Willesden Electric Co., Ltd., was in the list for hearing, it being an action by the plaintiffs to recover £706 19s. 6d., the price of goods sold and delivered.—Mr. Cecil Douglas Falcke, general manager of the plaintiff company, gave evidence to the effect that the goods had been delivered and not paid for. The full price was £1 011 9s. 6d. but certain credits reduced the claim to £706 19s. 6d.—There was no appearance for the defendants, and judgment was given for the plaintiffs for the amount claimed, with costs.

Anglesey Electricity Supply Co.'s Debt.

Plaintiffs Obtain Writ of *Elegit*.

In an action under a writ of *elegit* at Holyhead Sheriff's Court on October 19th, judgment was given for Mr. E. S. Lance, electrical engineer, and Mrs. E. Parry, against the Gwalchmai Electricity Supply Co., who owed the plaintiffs £257. An order was made investing the company's property in the plaintiffs until such time as the amount due was paid.—In evidence it was stated that judgment had been entered at Bangor for the plaintiffs, but the defendant company had not been able to meet its obligations. It was a public undertaking, and the plaintiffs asked for possession of the land, machinery and plant until the debt was paid. The public would not thus be deprived of their light. Mr. Lance said he was one of the promoters of the company, which was formed in 1917. He disposed of his interest in the company, and there was a balance due to him of £248 and interest. The value of the property was estimated at £300, with an annual value of £30.—Judgment was entered for the plaintiffs as stated above.

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Electricity Supply.

Extensions and Developments.

PLYMOUTH Corporation Electricity Committee has approved of cable extensions to cost £4 500.

BURNLEY Electricity Committee has authorised the laying of 1 350 yds. of cable in the Marsden Road district.

The Electricity Commissioners have sanctioned the borrowing of £25 000 by WILLESDEN Council for mains and services.

WEST HAM Education Committee proposes to have electric lighting installed in twelve schools at an estimated cost of £7 200.

BEDFORD Electricity Committee is authorised to carry out certain cable extensions and to purchase additional transformer and switchgear.

In connection with the BURNLEY municipal election Alderman J. H. Grey is advocating the erection of a £300 000 power station to supply the whole of North-East Lancashire.

WORCESTER Electricity Committee's recommendation to construct an overhead transmission line to Malvern electricity works has been approved. The scheme, which involves the use of steel lattice towers, will cost over £4 000.

TAUNTON Town Council has applied to the Electricity Commissioners for a loan of £20 000 for the installation of a 1 000 kW turbine plant, doubling the size of accumulator battery, two boilers, and new circulating water main, with sumps, screens and accessories.

ACCRINGTON borough engineer has been instructed to draw up schemes for electric main extensions covering Rishton Road, Clayton-le-Moors, 250 yds.; Union Road, Oswaldtwistle, 270 yds. Rhyddings Park, Oswaldtwistle, 180 yds.; and Monk Street, Accrington, 86 yds.

Alterations in Charges.

ORDERS have been made fixing the charge for electricity supplied by the ISLE OF WIGHT Electric Light and Power Co. at 10d. per kWh in Sandown, Shanklin, Newport, East Cowes, Cowes, and Carisbrooke. The charge in the Ventnor area remains at 1s. per kWh.

HEBDEN BRIDGE Urban Council has reduced the charges for electricity as under with effect from October 1st:—Lighting from 7d. to 6½d. per kWh; for motors, from 3½d. to 3d.; heating, from 2½d. to 2d.; domestic, from 2d. to 1¾d.; street lighting, from 4d. to 3½d.

ABERTILLERY Urban Council has revised the charges for electricity for ordinary power, and, from October 1st, the prices will be: first 100 kWh per quarter, 5d.; next 100, 4½d.; next 100, 4d.; next 100, 3½d.; beyond, 3d. For cinemas and theatres, the charges are to be: first 2 500 kWh per quarter, 4½d., and afterwards, 3d., with a discount of 5 per cent. on payment of accounts within 10 days of demand.

Tapping New Areas.

The CLOWNE Electricity scheme is to be proceeded with as soon as possible.

MIDDLESBROUGH Council is negotiating with a view to supplying electricity to Nunthorpe.

WORTHING Corporation has decided to extend its electricity supply mains in the parish of Durrington along the Arundel Road to John Selden Lane.

As the result of a conference in Sheffield last week there is understood to be every prospect of a supply of electricity being available in THORPE by next autumn.

Colonel Woodall has applied to the Electricity Commissioners for a Special Order to enable him to supply electricity in the boroughs of DEAL and SANDWICH, the urban districts of WALMER, the rural districts of EASTRY and the ISLE OF THANET, and in the parish of RINGWOULD, in the rural district of Dover.

BIRKENHEAD Parliamentary Committee has decided to recommend that the Town Clerk be authorised to take steps towards proceeding with the application to the Electricity Commissioners for a Special Order, extending the Corporation's area for electricity supply so as to include the urban district of Bebington and Bromborough.

The Electricity Commissioners have granted an Order to a company to supply electricity within the area of the CRANBROOK Rural Council. The same company has applied for powers to supply electricity to the borough of TENTERDEN, and in the area of the Tenterden Rural Council. The generating station is to be erected at Hartley, Cranbrook.

Inquiries and Orders.

SOUTHMOLTON Ratepayers' Association is opposing the application of the Town Council for an Order authorising the Corporation to supply electricity to the town.

REDCAR Corporation is applying for a Special Order in respect of the Borough of Redcar. Objections to the Secretary, Electricity Commission, Whitehall, London, by November 12th.

The Electricity Commissioners have informed the SHOREHAM Urban Council that the electric lighting powers obtained in 1922 by Mr. F. Gibbs have been transferred to the Shoreham and District Electric Light and Power Co.

The Minister of Transport proposes to confirm the SEATON AND DISTRICT Electricity Special Order and the WAKEFIELD Corporation and SOUTHAMPTON Electricity (Extension) Special Orders. Objections to the Secretary, Ministry of Transport, Whitehall, London, by November 3rd.

An arrangement has been made by which the BRIGHTON Electricity undertaking will take over the supply of current to the Southwick Urban Council's district. The immediate cost will be £14 450, and the consumers are to pay at the rate of 7d. per kWh for lighting and 2d. for power.

Personal Items.

MR. H. TOMLINSON LEE is seeking election to the Wimbledon Council at the forthcoming elections.

MR. ADAM GOWANS WHYTE has now resumed his duties as Editor-in-Chief of the Electrical Press.

The Sidmouth Urban Council has appointed Mr. H. BURGESS as joint manager of the Gas and Electricity works, at a minimum salary of £400 per annum.

Hackney Borough Council proposes to allow Mr. L. L. ROBINSON, the borough electrical engineer, a sum of £150 per annum towards the maintenance of a motor-car.

In recognition of the late Mr. GORDON BRYANT'S services as electrical engineer to the Yarmouth municipal tramways undertaking, the Town Council has decided to grant his widow £578.

Accrington Electricity Committee reports that terms have been arranged with Mr. BLACKMORE for acting as consulting engineer for a period of three years. The arrangement has been confirmed by the Town Council.

We understand that Mr. H. O. BISHOP, late of the Edison Swan Electric Co. and British Insulated and Helsby Cables, Ltd., will shortly join the staff of Mr. J. E. White, 49, Bridge Street, Deansgate, Manchester, as sales manager.

Manchester Tramways Committee on Tuesday accepted the resignation, to take effect in December, of Mr. JAMES WOOD, the assistant manager and financial superintendent of the department, and placed on record its high appreciation of Mr. Wood's services.

Mr. RICHARD HAZLETON, the new secretary of the Society of Technical Engineers, was a Member of Parliament from 1906 till the end of 1918, and was for a number of years on the Public Accounts Committee of the House. He served as a member of Lord Balfour of Burleigh's Committee on Commercial and Industrial Policy.

At a meeting of the Chester Electricity Committee, the chairman reported that he and other members of the Finance Sub-committee were favourable to an honorarium being made to Mr. S. E. BRITTON, the electrical engineer, on account of the large amount of work, involving heavy financial commitments, which he had successfully carried out during recent years. It was resolved to recommend to the Council that an honorarium of £500 should be granted without prejudice to the consideration of his salary in January. The Finance Committee have passed a resolution that they "do not approve of the recommendation of the Electricity Committee."

OBITUARY.—Mr. MILLER TIFFIN, who was for a considerable period employed by Mr. William Parkin Moore, electrical contractor, Whitehall, Mealsgate, near Carlisle, has died, aged 82 years. The death is announced of Mr. THOMAS HUNT, who had for upwards of 50 years been employed by J. Downham, Ltd., electrical engineers, Fleet Street, Bury (Lancs).

WILL.—Mrs. HERTHA AYRTON, the widow of Professor W. E. Ayrton, and the first woman member of the Institution of Electrical Engineers, left £8 160.

Business Items.

Mr. M. F. RIDGWAY has commenced business as an electrical engineer at 2, Strickland Gate, Kendal.

Mr. H. G. WESTLAKE, electrical engineer, Fountain Street, Halifax, has opened new showroom premises.

Mr. H. POWELL, who has for eight years been under the Admiralty, has commenced business as an electrical engineer at 27, Lymington Avenue, Leigh-on-Sea, Essex.

The ST. HELENS CABLE AND RUBBER CO. has opened a branch office at 30, Wood Street, Manchester. This branch is for the convenience of Lancashire and Cheshire customers who have been used to prompt service direct from the old Warrington works.

A. C. ALEXANDRA AND CO., electrical and mechanical engineers, 10, Iddesleigh House, Caxton Street, Westminster, announce that they intend to increase their capital from £20 000 to £50 000 to enable them to acquire additional factory premises, which will enable them to cope with the increased demand for their specialities.

Mr. F. CHARLES RAPHAEL, consulting electrical engineer, informs us that, owing to a printer's error in the new telephone directory, his address is given as No. 9, Ludgate Hill, instead of No. 19, Ludgate Hill. He asks us to state that his address is St. Paul's Chambers, 19, Ludgate Hill, London, E.C.4 (Telephone: Central 3387.)

HIGGS BROTHERS, Birmingham, have purchased 14 acres of land at Witton and have started the erection of a new works. The first building will be approximately equal in area to the present works, and has been designed for the economical manufacture of electric motors up to 50 H.P. It is anticipated that the first portion will be completed in about 12 months' time, when the whole works will be transferred to Witton.

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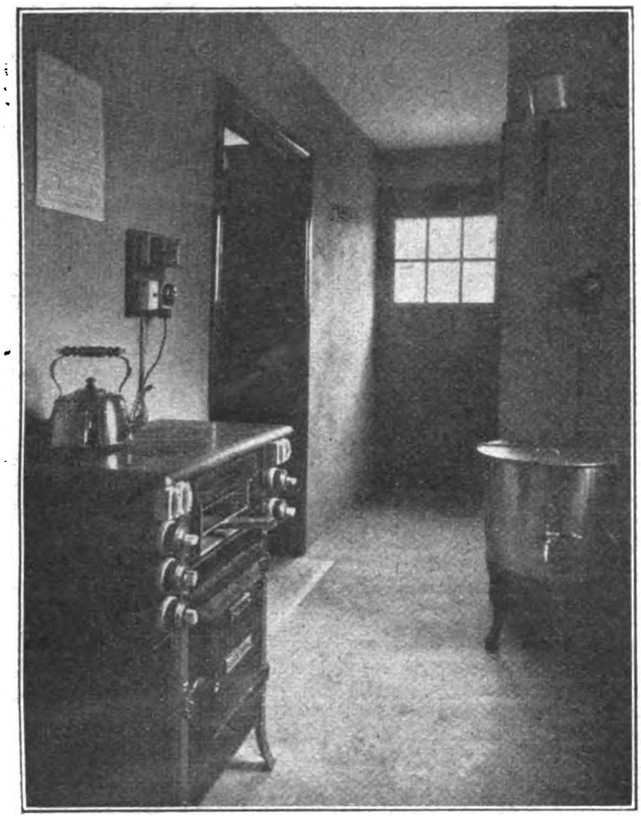
Hackney's Homes for Heroes.

Further Details of the Electrical Equipment.

As briefly noted in our issue last week, H.R.H. the Duke of Connaught on Saturday last opened a number of all-electric houses at Wattisfield Road, Clapton, built by the Council of the Disabled Soldiers and Sailors (Hackney) Foundation, to accommodate ten men, who suffered limb disablement during the Great War, and their families.

Owing to the enterprise of Mr. L. L. Robinson, the borough electrical engineer, the houses have been carried out in accordance with the "all-electric" idea. The electrical equipment consists of a light in every room, in the kitchen a Tricity cooker which is



A Corner of one of the Kitchens.

provided with an oven, a grill and a closed-in hot plate, and in the scullery, a Nobbs' copper provided with a 2 kW heating element. The latter firm has also been responsible for the water heating arrangements, a 2 kW Nobbs' heater being provided, while a boiler has been installed in the kitchen.

Combined Plug Arrangements.

It is generally accepted that besides the ordinary lighting of an "all-electric" house, sufficient plugs must be provided for the supply of heaters and smaller electrical apparatus. A convenient way of doing this is to mount a power plug and a lighting plug on the same board, but this arrangement has usually meant that the lighting plug is not sufficiently fused. This difficulty has been overcome in these particular dwellings by providing on the same board a Santon combined switch and plug for the power circuit, and looping out from this into a combined switch and light plug through a 5 A fuse. The arrangement is neat and compact, and seems provided for all electrical requirements. In addition to the coal fire in the principal living room a 2 kW Sullivan fire is provided in each house, with a good long flex so that the benefits of electric heat can be obtained just where they are needed in any room.

Free Maintenance.

The connected load in each flat and house amounts to about 10 kW. Wiring has been carried out by means of cab-tyre cable buried in the plaster, and seeing that the work was carried out by the Hackney Electricity Department, it is hardly necessary to say that the workmanship and materials are of the best. As regards the supply, the lighting circuits are fed through a Ferranti pre-payment meter, and are charged at the rate of 8d. per kWh, while the cooking and water heating circuits, as well as the wall plugs are supplied through another similar meter, and are charged for at the rate of 1½d. per kWh. These charges include the rent of the installation, and provide free maintenance by the Electricity Department. The distribution boards, which are of exceedingly solid construction, are by White and Co. The whole of the work was carried out by the Electricity Department, and the capital cost which amounted to £650, is being borne by them and repaid, as stated, by means of the price charged for the electricity consumed.

Northern Electrical Engineers.

Mr. T. Carter's Inaugural Address.

A meeting of the North Eastern Centre of the Institution of Electrical Engineers was held on Monday at Armstrong College, Newcastle, when Mr. Thomas Carter, the new chairman, delivered his inaugural address, in the course of which he remarked that the award to Mr. Rosen, of the John Hopkinson Premium, for his paper on "Some Problems in High Speed Alternators and their Solution" was of special interest to the Centre; still more important was the award of the Faraday medal to Sir C. A. Parsons

Adequate training for engineers was very necessary, but, important as was the provision of the right sort of education for those who offered themselves to be educated, it was even more vital to select for that education only those who could use it properly

Theory and Practice.

Purely intellectual training ought to be shunned. The pure theorist could not go out into the world of commerce and meet his fellows, mostly not pure theorists, with any chance of success. For that reason, the purely technically trained engineer was unfitted, in most instances, to sell the machines he designed or built. To his theory must be added knowledge of men and their ways if he were not to be beaten every time by the keen man trained to deal with human beings in the very practical school of contact with them.

Forty Years Ago.

"The Electrician," October 27th, 1883.

Utilising Water-Power.—It is stated that M. Tommasi intends carrying out some experiments in this direction near Verviers in Belgium. He will utilise water-power for the generation of electricity, to be used in turn for driving machines and producing light.

* * *

Amalgamation.—Something has driven the Gas Light and Coke Company and the South London Gas Company to amalgamate. The Edison and Swan Companies have united, and the Hammond Company is gathering under its wings such of its chickens as still retain a spark of vitality.

* * *

A Large Rheostat.—The rheostat used by the committee of the Munich Electrical Exhibition in testing machines, etc., mentioned in our issue of the 6th instant, p. 497, consisted of wires supported on porcelain insulators fixed to a large frame erected in one of the galleries of the exhibition building. The frame was 60 metres long (192 ft.), and consisted of several rows of vertical posts, fitting into crossbeams overhead. This explanation may serve to elucidate the remarks in our article which might otherwise require some thought.

An "All Electric" Home.

Interesting Display at a London Store.

To show the public the varied uses to which electricity can be put in the home, Waring and Gillow, Ltd., have erected and furnished an "all electric" home in their London establishment. This home, which was opened last Friday, consists of a flat of six rooms containing all the latest electrically-operated labour-saving devices. The dining room is equipped with an electric toaster, cigar lighter, kettle, fire, coffee urn, and hot plate, while the adjacent drawing-room is fitted with an electric fan, kettle, hot plate, fire, reading lights, radiator, and an electrically-driven gramophone. In the best bedroom are a bedside cooker, curling tongs, and a vacuum cleaner, while the equipment of the bathroom includes an electric water boiler, fire, towel rail and airer, geyser, hair dryer and vibro-massage equipment. There are two other smaller bedrooms, also electrically equipped, and last, but not least, the electric kitchen, which contains a very effective clothes washer in addition to an electric iron, stove, polishing motor, kitchen kettle, and boiling plate.

Insurance of X-Ray Tubes.

Scheme for Guarding Against Loss or Breakage.

Although it is now possible to insure against practically every kind of risk, it will probably be news to some of our readers that Coolidge and X-ray tubes can be insured against breakage, fire, theft, and perforation.

There is, as every radiographer knows, an ever present risk of puncture from various causes, most of which are beyond the control of the user, and further, there is the risk of accidental breakage in handling and working, either by the radiographer or his assistants. Less frequent perhaps, but still reasonably possible, there is the risk of loss or damage by theft. Obviously it is wise to insure against these risks if a satisfactory means of insurance is available. The insurers, Watson and Sons (Electro-Medical), Ltd., Sunic House, 43, Parker Street, Kingsway, London, W.C.2., have issued a pamphlet giving particulars of a scheme which affords protection against all the risks we have mentioned. One policy covers breakage in working, accidental breakage, burglary, housebreaking or theft, damage caused by burglars, fire, lightning or gas explosion; while the second policy covers the foregoing, plus punctures or perforations. The premium is very low, considering the nature of the risks covered and the completeness of the protection afforded.

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Electric Traction.

Tramway Extensions and Developments.

SHEFFIELD Tramways Committee proposes to seek powers authorising certain tramway extensions.

GLASGOW Dean of Guild Court has sanctioned the erection of a tramway sub-station in Abercorn Street.

CARDIFF Tramways Committee has decided to purchase a second machine for grinding out the corrugation on tram rails, at a cost of £569.

The provision of an additional junction at Tower Bridge has made possible the extension of the LONDON County Council's tramway service between Waterloo and Tower Bridge, to Rotherhithe, Deptford, and Greenwich.

Unrelenting opposition to any extensions of the LONDON County Council tramway system in the borough of Holborn was expressed at a meeting of ratepayers last week. The meeting protested against any modification of the present absolute veto of the borough councils with regard to tramway proposals in their area.

Fares, Receipts and Passengers.

Traffic receipts on LONDON tramways controlled by the Underground group totalled £38 902 for the week ended October 13th, a decrease of £6 148 on the corresponding period last year.

With traffic receipts of rs.53 447 for the fortnight ended October 15th, the MADRAS electric tramways have increased their revenue by nearly 13 per cent. over the corresponding period last year.

From 144 461 972 passengers, LIVERPOOL Corporation Tramways received £1 085 589 during the first nine months of the year. Compared with the corresponding period last year 18 406 671 more passengers were carried, but receipts were £63 165 less.

Traffic receipts on CARDIFF tramways from April 1st to October 6th amounted to £149 344, an increase of £1 052 on the corresponding period last year. A sub-committee has recommended the institution for a trial period of three months of penny fares for certain short distance stages.

On attention being drawn to a decrease in tramway traffic receipts at last week's meeting of the LONDON County Council, the Chairman of the Highways Committee said that, although competition had something to do with the position, the other transport undertakings were also suffering.

Official returns of 34 of the principal tramway undertakings in the United Kingdom, as published by "The Tramway and Railway World" for the week ended October 6th, give total receipts of £352 085, or £16 528 less than in the corresponding week of last year. The total length of track included in the return was 1 948 miles.

Electric Railway Items.

A NEVER-STOP RAILWAY is to be installed at the British Empire Exhibition.

YIEWSLEY Urban Council is asking the Great Western Railway to electrify its line between Paddington and Uxbridge.

For the week ended October 13th traffic receipts on the MERSEY RAILWAY totalled £4 496, bringing the aggregate total up to £185 316.

The erection of a new station at Watford, in connection with the extension of the L. and N. W. and Metropolitan Railway's joint line from Rickmansworth to Watford, is to be commenced shortly.

Silver challenge shields for the smartest station on the line have been awarded to the following UNDERGROUND stations: Mansion House (District Railway), Waterloo (Bakerloo line), Caledonian Road (Piccadilly line), Charing Cross (Hampstead line), Bank (Central London Railway), Bank (City and South London line).

Miscellaneous Traction News.

LIVERPOOL'S fleet of trams now totals 635.

CARDIFF Tramways Committee has decided to recommend its non-union employees to join the Tramwaymen's Union.

EDINBURGH Tramways Committee is recommended to build eight new tramway cars in the Corporation's tramway shops, in preference to placing the work with a Bristol firm as previously arranged.

Stinking Fish.

Some Thoughts on Gas Propaganda.

We always thought it was bad salesmanship to decry one's competitors and their goods. Yet that is what the gas industry is always doing, and the only conclusion we can draw is that it is getting rather frightened. In an article on "Metallurgy and the Gas Furnace," in the Gas Industries Number of the "Manchester Guardian Commercial," Mr. R. J. Sargant says that "for the heating of small forgings and the heat treating of small parts it cannot be said that the town's gas furnace should have any competitors; but it has such in the furnaces heated by oil, coke, coal and—who knows how soon?—electricity." In fact, of course, the electric furnace is increasingly being used because it offers every advantage that the gas furnace possesses, and many others besides; not the least among them is exact temperature control. We note with interest that this article contains an illustration of a battery of gas boilers for supplying water in a London municipal bath. The author will be astonished to learn that this installation has been replaced by electrical equipment, and has therefore become a sort of gas "Puffing Billy." Mr. J. H. Bowden, of Poplar, will tell him all about it.

Wireless News.

Marconi Company's Reply to the P.M.-G.

With reference to the Postmaster-General's statement on Imperial wireless communications at the Imperial Economic Conference last week (see THE ELECTRICIAN, October 19th, p. 434), Mr. GODFREY C. ISAACS, managing director of Marconi's Wireless Telegraph Co., states that from the official report of the speeches it would appear that the Postmaster-General is under a misapprehension as to what the company has proposed. Both verbally and in writing, he states, we have endeavoured to make it clear that we were, and are, prepared to enter into a pooling arrangement with the Post Office provided we can secure the commercial management of our services, or, if that is not agreeable to the Post Office, we are prepared to accept a general non-exclusive licence under which facilities would be afforded to the Post Office station for communication with the stations to be erected in the Dominions.

The difficulty which the Postmaster-General has been under the impression was standing in the way of an agreement between the Post Office and the company, he adds, does not in fact exist. There would appear now to be no reason why agreement should not be reached immediately, the licence issued, and a commencement made with the provision of the stations necessary to furnish the Empire with a modern wireless telegraph service.

In another statement issued to the Press, Mr. Isaacs said, in regard to the Postmaster-General's references to wireless telegraphy, that the commercial wireless services were more accurate, swifter, and fully as reliable as cable services. The Postmaster-General did not seem to have heard of the development which gave wireless telegraphy the additional advantage of secrecy. The company held that the future function of the cable service was to supplement the wireless service. The pioneer work in wireless telegraphy had been conducted by the companies without Government subsidies such as were enjoyed in the pioneering days by the cable companies.

Objects of the Wireless Retailers' Association.

We have received the following statement from the Wireless Retailers' Association: "As its title indicates, the Association consists of accredited wireless retailers, many of whom are the proprietors of important businesses, and its objects are briefly the promotion and safeguarding of the interests of retailers.

"With regard to protection, the position of retailers is perfectly clear and logical. No one is more desirous of supporting home industries than the retail trader; but so long as many British manufacturers reduce trade discounts to a level at which it is impossible for retailers to obtain a reasonable return for their outlay and enterprise, so long will they feel justified in demanding that wireless apparatus shall not be singled out for treatment as a monopoly."

Reduction of B.B.C. Tariff.

Members of the National Association of Radio Manufacturers are prepared to credit their trade customers with the difference between the old B.B.C. tariff and the scale now in force in respect of sets in stock on October 1st, 1923, to which the B.B.C. tariff applies. Trade buyers desiring to claim such credit must lodge the claim with the respective suppliers of the sets on or before November 10th, after which date no further claims will be entertained; each claim must be accompanied by a certificate that the sets were actually in stock on October 1st, 1923. Trade buyers should apply to their suppliers for the necessary forms of claim.

Wireless Insurance for Landlords.

It has been found that a very real demand exists for some form of protection for landlords who wish to be compensated for damage done to their property by the fixing and using of a wireless set and aerials. In many cases landlords are withholding their consent to these erections without some legal form of indemnity or obligation being given by the wireless owner, and to meet this difficulty the Liverpool Marine and General Insurance Co. has now prepared a special landlord's wireless protection policy. The advantages of the scheme from the tenant's point of view are that it relieves him entirely of all legal obligations to his landlord in respect of his set and yet enables him to indulge in his hobby without interference.

Extension of Wave Bands.

The British Broadcasting Co. states that it is in negotiation with the Post Office with regard to the extension of the wave bands recommended by the Broadcasting Committee. The following lengths have been provisionally allotted, but the arrangement is only temporary:—Aberdeen, 495 metres; Bournemouth, 385 metres; London, 363 metres; Manchester, 370 metres. The rest are unchanged.

Wireless News in Brief.

During the last few days 227 000 INTERIM AND CONSTRUCTORS' LICENCES have been applied for, and another 7 000 broadcast licences have been taken out.

A citizen at Ringfield, New Jersey, has sued another because the latter's LOUD-SPEAKER KEEPS HIM AWAKE. The case is not yet decided, but the neighbourhood is said to be bitterly divided on the point. Evidence has been called to show that loud-speakers were soothing and conducive to sleep.

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Company Meetings.

Satisfactory Progress of Ferranti, Ltd.

Presiding at the eighteenth annual meeting in London on October 18th, Mr. A. W. Tait (the chairman) said the net profit for the year under review was £36 362, compared with £24 371 in the previous year, and was approximately the same as that for the year to June 30th, 1921. The output showed some increase as compared with the previous year, although it was considerably below that for the year 1921 in both volume and value. The trading profit was £107 958, an increase of approximately £17 600.

Increased Sales of Meters.

With regard to meters—the chief department of the company's business—they had had an increased turnover during the year in quantity and value, notwithstanding that prices had been reduced in certain cases in sympathy with lower costs and to meet foreign competition. Their sales, both at home and abroad, had been satisfactory, and the business in d.c. as well as in a.c. meters had continued good.

Better Prospects for Transformers.

The transformer department had suffered during the year under review in consequence of the want of orders, and the output was below that of the previous year. The prospects for the current year were, however, better, and they expected a considerable increase in business in that department when the railway electrification and other power development schemes were actively proceeded with.

The financial position of the company had shown further substantial improvement during the year. The company was now in a thoroughly sound financial position. The reduction of indebtedness over the last few years had been substantial, and the only mortgage indebtedness now outstanding amounted to £54 020. That was being reduced gradually, and before long that item should disappear altogether. The cash resources of the company were now ample for its requirements.

With regard to the current financial year, the orders received up to date and the output of the works were encouraging, and, although there was considerable trade depression and business in the export markets was extremely difficult, the directors were hopeful that they might be able to present an equally satisfactory account next year.

They had increased their holding in the Ferranti Meter and Transformer Manufacturing Co. of Canada, which company now seemed to be well established, and recent figures received from Canada showed encouraging progress.

Victoria Falls and Transvaal Power.

Continued Prosperity: Erection of New Power Station.

Delay in the erection of the Victoria Falls and Transvaal Power Co.'s new power station was due, said the chairman (the Marquess of Winchester) at the annual meeting last Thursday, to the necessity of obtaining a licence from the Electricity Control Board. The official inquiry regarding their application for a licence to erect at Witbank had not yet been completed, but it was anticipated that they would be able to erect the plant and to transmit power to the Rand.

Relations with Electricity Supply Commission.

Alluding to the South African Electricity Commission, the powers and objects of which have already been published in THE ELECTRICIAN (August 10th, 1923, p. 156), the chairman said he did not think the Commission would desire to enter into competition for supply in the company's area provided they continued efficiently to discharge the duties of a public electricity undertaking. The trend of the discussions which had taken place up to the present had shown that the Commission had not the intention of hampering the enterprise of those who had already invested their capital in order to make available a cheap supply of electricity. When the railways were electrified the Commission would buy the station from the company and sell them a bulk supply. The arrangement would also probably define that an equitable proportion of any saving resulting from a cheaper coal cost be passed on to the power consumer, a principle which the company had always embodied in its power contracts.

Companies' Reports, Dividends, etc.

BABCOCK AND WILCOX.—An interim dividend of 5 per cent., tax free, is announced.

ARON ELECTRICITY METER, LTD.—Tenders for the debenture sinking fund to the extent of £5 300, at an average price of 71⅜, have been accepted.

ASSOCIATED FIRE ALARMS, LTD.—Presiding at the annual meeting last week, Mr. A. D. Fairbairn estimated the value of the property protected by the company's alarms at £120 000 000. The loss ratio of property protected by the alarm from 1911 to 1920 was less than 3 per cent., compared with a loss ratio of about 50 per cent. in respect of unprotected risks.

WHITEHALL ELECTRIC INVESTMENTS.—Approximate net operating returns for August of the concerns in which the company is interested are given below: Cia. Chilena de Electricidad Limitada, £41 000; Cia. Electrica de Tampico, S.A., £15 600; Puebla Tramway Light and Power Co., £9 300; Vera Cruz Electric Light, Power and Traction, Ltd., loss, £1 750, due to a strike which extended from August 8th to 29th; Cia. de Luz Electrica y Fuerza Motriz de Orizaba, S.A., £1 750; Cia. Electrica de Cordoba, S.A., £370.

HERBERT MORRIS.—After allowing for income and corporation profits taxes, the profit for the year ended July 31st was £75 313, plus £5 169 dividends from investments, and £16 823 brought in. After providing for directors' fees, preference dividend, ordinary dividend for the first half-year, and depreciation, there remains a disposable balance of £57 705. The directors recommend the payment of a further dividend on the ordinary shares, making 10 per cent., free of tax, placing £10 000 to reserve, leaving £29 736 to be carried forward.

KAYSER, ELLISON AND CO.—The net profit for the year to June 30th last was £5 853, which reduces the debit balance brought in to £33 787. The directors propose to transfer £33 787 from reserve to wipe out this loss; also to transfer £3 000 from reserve, and to pay on December 1st the six months' preference share dividend to June 30th, 1922. The reserve fund will then stand at £4 791. As anticipated last year, trade has shown some improvement, and, although the company's plant is still far from fully employed, the directors consider they have every reason to be satisfied with the result of the year's working.

Cable, Telegraph and Telephone Companies.

INDO-EUROPEAN TELEGRAPH CO.—Payable on November 1st an interim dividend has been declared at the rate of 5 per cent. per annum.

MONTEVIDEO TELEPHONE CO.—The profit for the year ended July 31st, 1923, after providing for all charges, income tax and corporation tax, was £17 182, plus £13 782 brought forward. After transferring £10 000 to reserve, the directors recommend a final dividend of 3 per cent., making 5 per cent., less tax, leaving £10 107 to be carried forward. At the last meeting of the shareholders the ad-referendum agreement, entered into with the Postmaster-General on June 30th, 1922, for the sale of the company's undertaking in Uruguay, was ratified, and the company was advised that the matter was thereby legally concluded. The Postmaster-General, however, refused to sign a definite contract on the grounds that the available profits of the company had been materially reduced by granting the increases in wages demanded by the strikers, payment of which had been unnecessarily forced upon the company by a Government decree. The annual meeting will be held at Winchester House, London, E.C., on November 6th, at 11 a.m.

Supply and Lighting.

MONTREAL LIGHT, HEAT AND POWER CONSOLIDATED CO.—Cabled advices state that the company has declared the usual quarterly dividend of 6 per cent. per annum, and that the Montreal Light, Heat and Power Co. has declared the usual quarterly dividend of 8 per cent. per annum, both being payable on November 15th to holders registered on October 31st.

Traction Companies' Results.

CALCUTTA TRAMWAYS CO.—Shareholders registered on October 23rd will receive on November 14th an interim dividend of 2½ per cent., free of tax.

BRAZILIAN TRACTION, LIGHT AND POWER CO.—A quarterly dividend of 1 per cent. declared on the ordinary stock is payable on December 1st to holders registered on October 31st. A similar distribution was made a year ago.

BARCELONA TRACTION, LIGHT AND POWER CO.—As the half-yearly revenue justifies an increase of ½ per cent. in the half-yearly interest payment due on December 1st next on the first mortgage bonds, the committee for the bondholders has approved the payment of 1½ per cent. for the half-year.

UNITED ELECTRIC TRAMWAYS OF CARACAS.—For the year ended June 30th last the net revenue was £22 792, plus £8 503 brought in. The directors recommend the payment of a dividend of 10 per cent., less tax, for the year, leaving to be carried forward, subject to corporation profits tax, £14 294. The annual meeting was held at Dashwood House, London, E.C., on Monday.

New Companies.

SCOTTISH LAMPS, LTD.—Private. Cap., £100. Electricians, etc. Reg. office: 4, Jane Street, Glasgow.

ROANOID (BIRMINGHAM), LTD.—Private. Cap., £5 000. Dealers in electrical fittings, etc. Reg. office: 54, Tenby Street North, Birmingham.

SHARLAND AND WADDINGTON, LTD.—Private. Cap., £3 000. Electricians, manufacturers of and dealers in electrical fittings, etc. Reg. office: 21, Constitution Hill, Birmingham.

RADIO ACOUSTICS, LTD.—Private. Cap., £10 000. Electrical engineers, manufacturers of and dealers in wireless apparatus, etc. Reg. office: 175A, Peckham Park Road, London, S.E.

VIENNESE ELECTRIC LAMP WORKS, LTD.—Private. Cap., £1 000. Business indicated by title, and electrical engineers, etc. Reg. office: 87 and 88, Charter House Chambers, Charterhouse Square, London, E.C.

E. GOLDSTON, LTD.—Private. Cap., £2 500. Electrical engineers, manufacturers of electrical apparatus, wireless fittings, etc. Solicitor: J. Prag, Gray's Inn Chambers, 20, High Holborn, London, W.C.1.

PETER CURTIS, LTD.—Private. Cap., £100. To establish, manage, and regulate wireless telephone and telegraph exchanges and works for the supply of electric light, etc. Reg. office: 34, Whitfield Street, London, W.1.

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Telegraph and Telephone Notes.

TELEPHONE KIOSKS are to be erected in Paddington streets,

A large AUXILIARY SWITCHBOARD has been installed in the Central Telephone Exchange, Dublin, at a cost of about £8 000.

There are approximately 14 100 000 TELEPHONES IN USE in the United States of America. The average daily number of conversations is about 39 000 000.

Protests were made at a recent meeting of the Sheffield Chamber of Commerce against delays in the completion of the AUTOMATIC TELEPHONE EXCHANGE, promised over four years ago.

A firm of advertising agents has applied to Blackpool Corporation for SANCTION TO ERECT TELEPHONE KIOSKS in different parts of the borough. Consideration of the matter has been deferred.

At the opening of the NEW AUTOMATIC TELEPHONE EXCHANGE at Hull, the Lord Mayor of Hull said the municipal telephone service saved the subscribers £15 000 a year compared with the Government system.

In his annual report the County Surveyor of Herefordshire complains that the scenery is disfigured by " gaunt and ugly telegraph, telephone, and cable poles, the wires of which ought to be put underground."

The erection of an AUTOMATIC TELEPHONE EXCHANGE in Ship Street Barracks, Dublin, is to be commenced shortly. The new exchange, which will accommodate about 1 000 subscribers, is expected to be ready for service in a year's time.

According to a Central News message THE TELEGRAPHIC RATE from France to Ireland is now cheaper than that from France to England. The new Irish rate, which became operative on October 1st, is 29 fr. per word. The rate to England is 75 fr.

It is stated that, in consequence of trade depression, firms and persons who wished in the early part of last year to become subscribers for the BENGAL TELEPHONE CORPORATION'S SERVICE no longer desire to do so. The company has applied to the Government for permission to introduce a message rate to meet the needs of small users.

Service Notes.

The fifth annual dinner of the ROYAL NAVAL DIVISION SIGNAL COMPANY will take place at the Engineers' Club, Coventry Street, London, on Saturday, November 3rd, at 6.30 for 7 p.m. Tickets, price 7s. 6d., may be obtained from the hon. secretary, Mr. J. N. Robertson, 14, Wood Grange Avenue, Ealing, London, W.5.

Arrangements have been made for the annual reunion dinner for past and present officers of the WIRELESS TELEGRAPH SCHOOL AND SQUADRON, Royal Air Force, to take place in London, on December 5th. It is to be regretted that it will not be possible to issue direct invitations this year to all ex-officers interested, owing to the fact that certain records, containing lists of addresses, have been mislaid. The Secretary will therefore be glad if those concerned will regard this announcement as a personal invitation. Applications for tickets (which will be ten shillings, inclusive) should be made to the Secretary, Reunion Dinner, Wireless School, R.A.F., Winchester.

Lieut.-Commander J. S. Morrell has been appointed to the charge of the wireless station at the new naval base of Singapore, and Lieut. M. J. W. Ellingworth to the charge of the wireless station at Seletar, which will be worked in connection with the first-named station. The spending of nearly £10 000 000 at Singapore will include a good deal of electrical business. Warrant Telegraphist W. Watson has been posted to the cruiser "Maidstone" for wireless duties from October 7th. Warrant Telegraphist J. F. Shooter joins the "Iron Duke," the flagship of the Mediterranean Station, and Warrant Telegraphist J. H. Garner the light cruiser "Birmingham," which is going to the Africa Station as flagship—both for wireless duties. Warrant Electrician C. R. Fursden has joined the battleship "Ajax" in the Mediterranean. Warrant Telegraphist G. Durban joined the Horsea Wireless Station on October 15th.

Training of Engineers.

Need for Developing the Commercial Side.

The 56th ordinary general meeting of the Western Centre of the Institution of Electrical Engineers was held at Cardiff last week. Mr. F. Tremain presided, and introduced the new chairman, Mr. C. T. Allen.

Delivering his address, Mr. Allen referred to the training of young engineers, remarking that he thought the fetish of manual training was often overdone, because the present-day machine and mass production methods might often leave the apprentice with little knowledge beyond that of operating one or two machines.

If the commercial side were added to the training of an engineer, then they might see engineers at the head of more of our industries.

In the discussion which followed, Mr. Hubert Spence-Thomas referred to the system of engineering training employed in America, where the students, to a great extent, paid for their own education. This was made possible by enabling them to work for six months in the year and to study during the remaining period. It was a system which had met with marked success, and the student was thus able to obtain a commercial knowledge in conjunction with his engineering training. Prof. Bacon, Prof. Knox, and Messrs. D. Cleaver, David, Burr, and others also took part in the discussion.

Miscellaneous.

A new X-RAY AND ELECTRICAL TREATMENT department has been opened at the Manchester Royal Infirmary.

A somewhat novel and generally unsuspected cause of petrol fires, mentioned in " Nature," is the power which the mobile spirit has of GENERATING STATIC ELECTRICITY

Firms wishing to have their TRADE LITERATURE displayed and distributed in Egypt should forward supplies to H.M. Commercial Agent, The Residency, Ramleh, Egypt.

The Wimbledon Corporation's Electrical Exhibition held in March last has so encouraged the USE OF ELECTRIC COOKERS that the 200th electric cooker was connected on Monday.

A chlorinating plant is to be installed at the MAIDSTONE electricity works with a view to preventing the river water from causing algæ growth in the condenser tubes.

During August, Canada imported ELECTRICAL APPARATUS to the value of 1 151 695 dollars, of which 995 905 dollars' worth came from the United States and 60 841 dollars from the United Kingdom.

The Westinghouse Electric International Co. has received orders for electrical apparatus to be used in RECONSTRUCTION WORK IN JAPAN totalling well over $1 000 000. It is understood that the power plants in the earthquake zone were not seriously damaged but that the distribution systems were practically destroyed.

After Business Hours.

Birmingham Electric Club's Snooker Handicap

A snooker handicap has been arranged amongst members of the Birmingham and District Electric Club, and a sub-committee has been formed to decide the handicap figures. A nominal entrance fee of two shillings and sixpence will be charged. Further details, as to when the various rounds will be played, will be available at a later date; the games will be played at the Grand Hotel, Colmore Row. Four prizes have been offered by members of the club—first, second, highest break, and highest score made in any one game, excluding handicap points.

Women Engineers' Ball.

Arranged by the Women's Engineering Society, under the patronage of the Duke and Duchess of York, a ball will be held at the Hotel Cecil, London, on Thursday, November 1st. The President (Lady Parsons) will receive the guests. Tickets at 1½ guineas, or 8 guineas for a block of 6—both including supper—are obtainable from the Women's Engineering Society, 26, George Street, Hanover Square, London, W.1.

"Journal of Scientific Instruments."

A New Monthly Review.

The first number of a new monthly review, the " Journal of Scientific Instruments," has just been issued by the Institute of Physics in co-operation with the National Physical Laboratory. The purpose of the journal, which is edited by Dr. John S. Anderson, is to describe methods of measurement and the construction and use of instruments employed in all branches of scientific and technical work. The journal will be issued on the 15th of each month, the price of a single issue being 2s. 6d. It may be obtained from the Institute of Physics, 10, Essex Street, London, W.C.2, or through any bookseller.

Prices of Metals, Chemicals, etc.

TUESDAY, October 23rd.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£63 5 0	—	5s
Electro Wirebars ..	„	£64 15 0	—	5s.
H.C. Wire, basis ..	per lb.	9¼d.	—	1/16d.
Sheet	„	9⅞d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 1⅛d.	1/16d.	—
Brass 60/40—				
Rod, basis	„	7½d.	—	—
Sheet, basis	„	10d.	—	—
Wire, basis	„	10d.	—	¼d.
Pig Iron—				
Cleveland Warrants	per ton	£5 2 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
Lead Pig—				
English	„	£29 10 0	£1	—
Foreign or Colonial	„	£28 0 0	£1	—
Tin—				
Ingot	„	£201 17 6	—	12s. 6d.
Wire, basis	per lb.	2s. 8d.	—	—
Aluminium Ingots ..	per ton	£120 0 0	—	—
Spelter	„	£33 7 6	£1	—
Mercury	per bottle	£9 15 0	10s.	—

Sulphur (Flowers)—Ton £8 10s. *Sodium Chlorate*—Per lb. 2½d.
„ (Roll-Brimstone)—„ £8 10s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. „ £25 10s. per ton, £7 10s.
Boric Acid (Crystals). „ £48 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 1⅜d. to 1s. 1⅝d; plantation 1st latex, 1s. 1⅝d. to 1s. 1⅞d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

ALCO FITTINGS CO., 14, Ellison Street, Aldgate, E., electrical engineers. £23 10s. 9d. September 17th.

BRITISH RADIO SALES CO., LTD., 8–9, Stephen Buildings, Gresse Street, W., manufacturers. £42 4s. 10d. September 5th.

CENTRAL ELECTRIC CO., 159, Pentonville Road, electrical engineers. £14 12s. 8d. August 21st.

CHARTERS ELECTRIC SUPPLY CO., Lyme Street, Warrington, electricians. £15 3s. 9d. September 11th.

POWELL, E., AND CO., 20, Sycamore Road, Aston, Birmingham, electricians. £18 13s. 3d. September 18th.

SMITH AND BIRKETT, Radio House, 22 and 24, Wheeler Gate, Nottingham, electrical engineers. £13 18s. 3d. September 19th.

SOUTHPORT ELECTRICAL SUPPLY CO., LTD., 99, Eastbank Street, Southport, electrical engineers. £11 1s. September 20th.

WARD AND CO., 216, Edgware Road, W., electric sign agents. £11 19s. 4d. September 17th.

Receivership.

SANDERS, KENNEDY AND CO., LTD. F. J. Sully, of Bank Chambers, Bridgwater, was appointed receiver and manager on October 13th, under powers contained in first mortgage debenture dated September 17th, 1923.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

KEENE (WILLIAM J. A.), LTD., electrical engineers, 10, North End Road, Golders Green, London, N.W. This company is in voluntary liquidation, the statement of affairs presented at the statutory meeting of creditors on Monday, showing liabilities of £2 183, all due to unsecured creditors, and net assets estimated to realise £213, or a deficiency of £1 969, so far as the creditors are concerned. The liquidator reported that a petition for the compulsory liquidation of the company had been filed by Cakebread Robey and Co. and had been adjourned. After some discussion the petitioning creditors intimated that they proposed to proceed, and the liquidator stated that the petition would not be opposed. The meeting broke up without any resolution being passed.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Companies Winding-up.

MITCHELL'S ELECTRICAL AND WIRELESS, LTD., 188, Rye Lane, Peckham, London, S.E.15. Winding-up order, October 16th.

WIRELESS INSTALLATIONS, LTD., 81, Turnmill Street, London. Winding-up order, October 16th.

Companies Winding-Up Voluntarily.

BENNETT AND RUTHERFORD, LTD. J. A. Marr, Chartered Accountant, Glasgow, appointed liquidator. (Edinburgh Gazette.)

MORGAN and TAYLORS RADIO ELECTRIC, LTD. S. E. Clutterbuck, of 31, Queen Street, Cardiff, accountant, appointed liquidator.

Bankruptcy Information.

MATSON, Frederick John, lately carrying on business at Asquith Street, Woodhouse, Leeds, under the style of the SUNNYVALE ENGINEERING CO., but now at 24, Rider Road, Woodhouse, Leeds, under the style of the MAGANDYNAMO CO. First meeting, October 29th, 11 a.m., Official Receiver's Office, 24, Bond Street, Leeds. Public examination, November 6th, 11 a.m., County Court House, Albion Place, Leeds.

Notices of Intended Dividends.

SLATER, Thomas Gascoigne, carrying on business as SLATER BROTHERS, 25, Dickinson Street, Mount Street, Manchester, electrical engineer. Last day for receiving proofs, November 3rd. Trustee, J. G. Gibson, Byrom Street, Manchester, Official Receiver.

WEST, Harry Bernard, of 3, Clyde Street, Canterbury, electrician. Last day for receiving proofs, November 3rd. Trustee, A. H. Ward, the Official Receiver's Office, 10, Burgate Street, Canterbury.

Patent Record.

APPLICATIONS FOR PATENTS.

October 8th.

24 942 P. AND H. ASHTON. Electrical apparatus.
24 943 C. E. HOLDEN. Railway, tramway and road vehicles.
24 970 H. E. HERRINGTON and W. T. SLEATH. Wireless detector.
24 991 T. W. CASE. Apparatus for converting sound waves into variations of electric current.
24 995 WESTERN ELECTRIC CO. Inductance devices.
24 996 WESTERN ELECTRIC CO. Speech frequency translating systems.
24 997 WESTERN ELECTRIC CO. (CAPEK and BROECK). Telephone exchange systems.
24 998 WESTERN ELECTRIC CO. Electric signalling systems.
25 014 METROPOLITAN-VICKERS ELECTRICAL CO. Electric systems for automatic sub-stations (6/10/22, U.S.).
25 016 E. MOREHEN. Wireless and telephone transmitting and receiving apparatus.
25 029 METROPOLITAN-VICKERS ELECTRICAL CO. and J. W. YOUNG. Ventilation of electrical apparatus, etc.
25 030 METROPOLITAN-VICKERS ELECTRICAL CO. and W. J. BROWN and E. Y. ROBINSON. Vacuum electric tube devices.
25 032 R. D. BANGAY. Incandescent lamps.
25 036 N. EASTERBROOK. Telephones.
25 049 A. E. WATKINS. Electric resistances.
25 060 T. UNDERDOWN. Interchangeable h.t. battery and adaptor.

October 9th.

5 066 F. TIDY. Rubber cap for telephone receivers.
25 009 N. BENDIXEN. Electric heat alarms.
25 084 MIDLAND ELECTRIC MANUFACTURING CO. and W. L. BARBER. Switches and switch-fuses.
25 089 STEVENS AND CO. (1914) and H. STEVENS and H. TAYLOR. Wireless telephony, etc.
25 097 G. V. DOWDING and K. D. ROGERS. Wireless aerials.
25 101 C. A. VANDERVELL AND CO. and W. H. GLASER. Automatic electric switches for motor vehicles, etc.
25 110 E. G. THOMSON. Electric heating of incubators.
25 121 F. KRUPP AKT. GES. Lifting magnets (24/10/22, Germany).
25 122 A. T. SCOTT. Variable inductances for radio frequency circuits.
25 128 P. C. RUSKEN (KRUPP AKT. GES. GRUSONWERK). Wet magnetic separation of material on roller separators.
25 135 and 25 136 BRITISH THOMSON-HOUSTON CO. and A. S. FITZGERALD. Protective apparatus for A.C. systems.
25 137 BRITISH THOMSON-HOUSTON CO., J. H. BUTCHER and A. P. YOUNG. Telephone receivers, etc.
25 138 BRITISH THOMSON-HOUSTON CO., L. GRIFFITHS and A. P. YOUNG. Electric tachometers.
25 142 METROPOLITAN-VICKERS ELECTRICAL CO. (WESTINGHOUSE ELECTRIC AND MANUFACTURING CO.). Electric sub-stations.
25 143 METROPOLITAN-VICKERS ELECTRICAL CO. Electric sub-stations (19/5/23. U.S.).
25 148 A. D. OLIVER and E. S. M. PRICHARD. Delay mechanism for overload circuit breakers, etc.
25 158 W. T. HENLEY'S TELEGRAPH WORKS CO. and P. DUNSHEATH. Multi-core electric cables.
25 164 R. J. M. LOWNE. Terminals.
25 179 C. E. PRINCE. Electrically driven indicators, etc.

Arrangements for the Week.

FRIDAY, OCTOBER 26th.

PHYSICAL SOCIETY OF LONDON.
5 *p.m.* At the Imperial College of Science, South Kensington, S.W. Paper by Dr. E. A. Owen and Mr. G. D. Preston on "X-ray Analysis of Solid Solutions."

THE NEWCOMEN SOCIETY.
5.30 *p.m.* In Prince Henry's Room, 17, Fleet Street, London, E.C. Presidential address by Mr. Lough St. L. Pendred on "The Value of the History of Technology."

BIRMINGHAM AND DISTRICT ELECTRIC CLUB.
7 *p.m.* At the Grand Hotel, Colmore Row, Birmingham. Mr. H. Josephs on "Electric Motors in Service."

THE JUNIOR INSTITUTION OF ENGINEERS.
7.30 *p.m.* At the Institution, 39, Victoria Street, Westminster, S.W.1. Lecturette by Mr. A. V. Ballhatchet on "Crystals for Wireless Reception."

TUESDAY, OCTOBER 30th.

THE INSTITUTION OF ELECTRICAL ENGINEERS.
(EAST MIDLAND SUB-CENTRE.)
6.45 *p.m.* At the Technical College, Derby. Paper by Mr. S. J. R. Allwood on "Economical Generation of Electric Power in Small or Medium-sized Stations."

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.
7.30 *p.m.* In the Rankine Hall, 39, Elmbank Crescent, Glasgow. General Meeting. Paper by Mr. R. Love on "Auxiliary Machinery for Diesel-engined Vessels."

THURSDAY, NOVEMBER 1st.

THE INSTITUTION OF ELECTRICAL ENGINEERS.
6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.2. Mr. W. Wilson on "Industrial Research, with special reference to Electrical Engineering Development."

MANCHESTER WIRELESS SOCIETY.
7 *p.m.* In the Council Chamber, Houldsworth Hall, 90, Deansgate, Manchester. Annual General Meeting.

FRIDAY, NOVEMBER 2nd.

THE INSTITUTION OF MECHANICAL ENGINEERS.
6 *p.m.* At the Institution, Storey's Gate, St. James's Park, London. Thomas Hawksley Lecture by Sir Westcott S. Abell on "The Mechanical Problems of the Safety of Life at Sea."

ELECTRICAL POWER ENGINEERS' ASSOCIATION (SOUTHERN DIVISION).
7 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, W.C.2. Lecture by Mr. Jas. E. Lea on "Volumetric Measurement of Coal in Relation to Power Station Problems."

JUNIOR INSTITUTION OF ENGINEERS.
7.30 *p.m.* At 39, Victoria Street, Westminster, S.W. Lecturette by Mr. D. V. Hotchkiss on "Hydraulic Propulsion."

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.
7.30 *p.m.* Lecture by Mr. H. W. Churchin on "Development of Ships, Structural Design."

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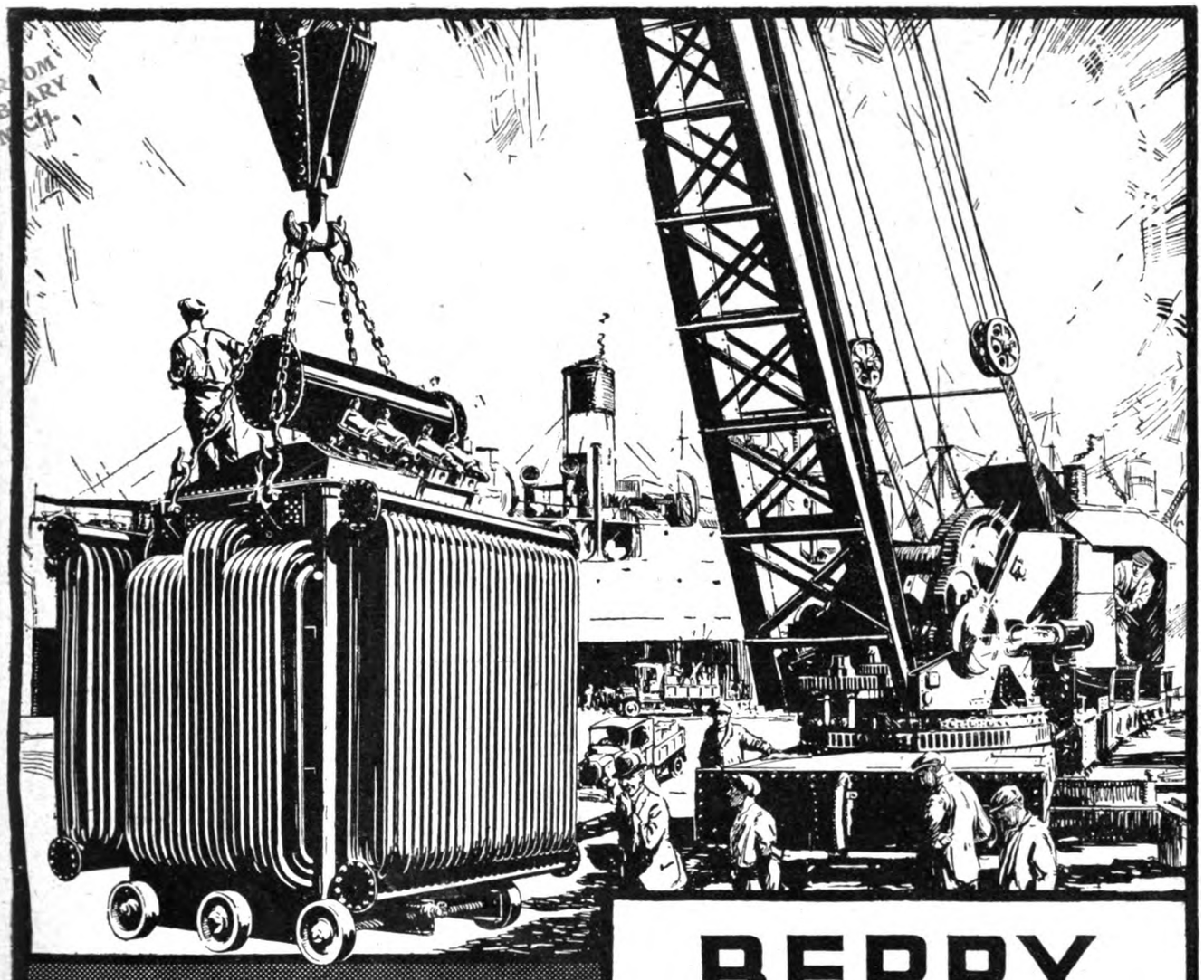

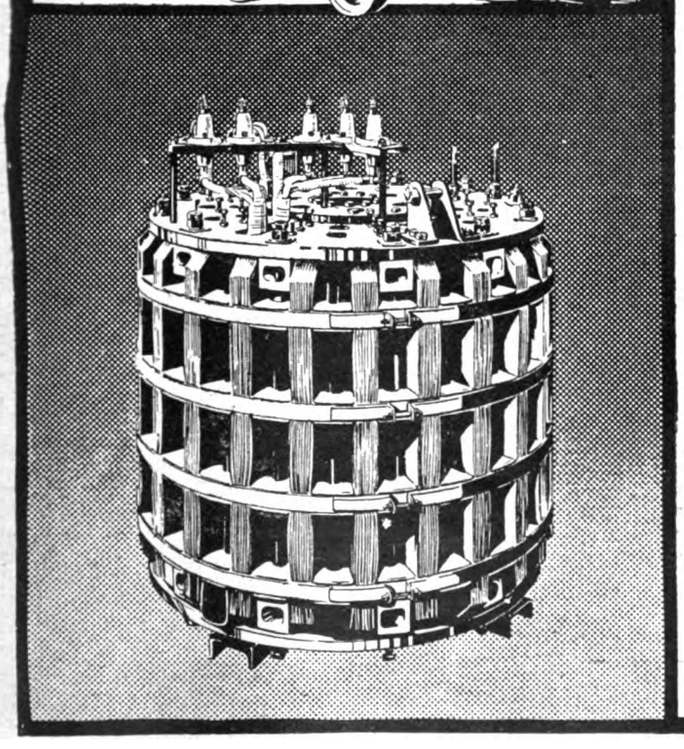

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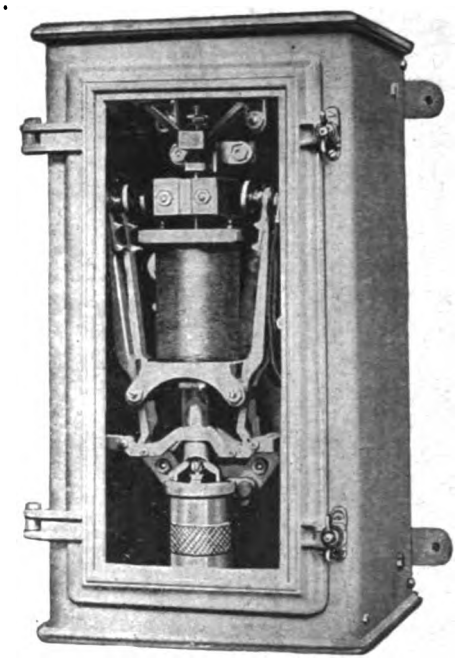

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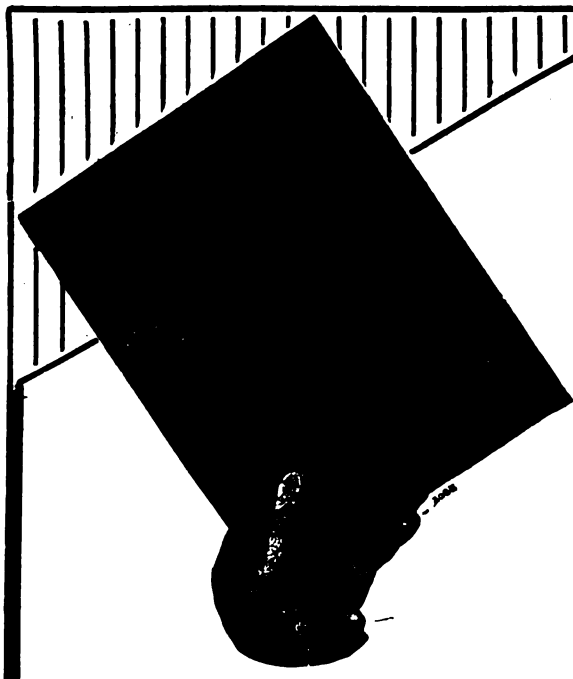

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THE ELECTRICIAN

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THERMAL STORAGE.

The use of electricity for all sorts of purposes has so many advantages that it is well occasionally to consider a few of its drawbacks. One of the greatest of these is the inability to store it easily and efficiently. It is not without interest to speculate on the position that would arise were this not the case. All talk and anxiety about such matters as peak loads, load factors, and diversity would cease; tariffs would be simplified into a mere flat rate, and many of the excuses now made for not reducing the selling price would cease to hold water. The result would be that the education of the public would become much easier and the demand both for electricity and for electrical apparatus would be greatly increased. But if we leave speculation for practical politics, means can soon be discovered for storing, not electricity, but the energy in electricity in a convenient form.

In the home, for example, an abundant supply of hot water is essential. This can be provided electrically by a comparatively small immersion heater, which is left continuously in circuit, and the energy consumed in which for obvious reasons can be charged for economically at a comparatively low rate. If some means are provided for ensuring that the total demand, whether for cooking, heating or lighting in the house, never exceeds the capacity of the water heater a much larger field for domestic electricity than exists even at present will be opened. The two essentials are some form of efficient and reliable automatic cutout and, we may be forgiven for reiterating, an attractive price. It is to be hoped that electrical manufacturers and electricity supply engineers will lose no time in devoting all their energies to discovering a solution of this dual problem.

So far little attempt has been made to solve the domestic hot-water problem by any other means than what may be called electrical storage, and little enough has been done even along those lines. Though there seems no reason why the same methods should not be satisfactorily applied in factories, electricity is not alone in that field, as a valuable analysis in the memorandum of Mr. C. E. STROHMEYER, the chief engineer of the Manchester Steam Users' Association, for the year 1922 shows. This analysis also indicates that none of the present methods is altogether satisfactory, which makes it all the more necessary that electrical engineers should devote their attention to the matter. Some time ago the suggestion was made that fireless locomotives might be run, the steam being supplied from cylindrical vessels filled with a strong solution of caustic soda into which high-pressure steam had been pressed. The idea, fortunately, came to nothing, for it has since been found that caustic soda makes the steel brittle, and though chloride of calcium and other salts do not cause the same trouble, the method has never been widely used.

A more feasible arrangement was suggested by DRUITT-HALPIN, who attached a drum to a water-tube boiler. In this a sufficiently large volume of water was stored to make the total water capacity of the boiler and storer approximately equal to that of a Lancashire boiler of the same power. Thermal storers in which the heat from non-condensing engines was collected either with or without water were also used, especially on the Continent. During the war Dr. RUTHS, of Stockholm, designed very large storers containing water, but even he does not deal with the full problem, which is not only to supply steam for peak loads in power stations, but to provide hot water for use in bleaching and similar works.

Dealing with the latter question, Mr. STROHMEYER points out that half the problem is to produce hot water at a minimum expense, and that the other is to boil it or maintain it at a boiling temperature. If steam is passed into a vat of cold water the temperature of the latter rises slowly, and, though it is not in a state in which it can be used, it is radiating heat. This radiation loss could be overcome by filling the vats with hot water; but if hot water is stored for that purpose in thermal storers, it also loses heat during a storage time which would necessarily last for long periods. Nevertheless the latter is the more efficient method, for DR. RUTHS has shown that the radiation of a thermal storer is at the rate of about 0·2 B.Th.U. per sq. ft. per hour per 1 deg. F. difference of temperature, while that of the vats would be about five times as much. The use of thermal storers has the further advantage of giving the water that degree of softness which is essential in some processes.

But, as Mr. STROHMEYER rightly points out, the question of heat or rather power storage is of greater importance. Low-pressure steam receivers are too bulky for storing very large powers, but this does not apply to thermal

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storers which have been made to take 17 000 lb. of steam or about 900 H.P. hours. If a spherical vessel were used instead of a cylindrical one this capacity could be increased to 1 800 H.P. hours and the space could be reduced by about 40 per cent. A vessel 52 ft. in diameter would have a capacity of about 14 400 horse-power hours, which would be equal to eighteen Lancashire boilers working one hour, so that if such a thermal storer were coupled to a Lancashire boiler of 800 H.P. working night and day enough steam would be available during eight working hours to produce 2 700 H.P., resulting in a considerable saving in the fuel bill.

This is rather an extreme condition. But considering the peak load question DR. RUTHS has shown that one of his four-metre thermal storers can deliver dry steam at the rate of 220 000 lb. per hour, equal to the steaming of a dozen Lancashire boilers. The problem, therefore, resolves itself into the simple one of providing a thermal storer of such capacity that it will not become exhausted during the peak load period. It seems that a good case is made out for the use of these storers in power stations where the peak loads are more than usually acute and the stand-by losses in the boiler house are therefore large. The Commissioners are now dividing generating stations into three classes: those fit for extension, those suitable for use during a transition period, and those which will be shut down as soon as possible. The use of thermal storers in stations of the second class might be worth consideration in stations of the third class for economic reasons, especially if any modifications in the steam-raising plant are necessary.

Finally, Mr. STROHMEYER raises the important question of safety. The disastrous Greenwich explosion killed the thermal storage idea for a time, though the trouble was caused less by the idea than by faults in the structural details. Dr. RUTH'S idea is the same as DRUITT-HALPIN'S, which was used at Greenwich, though it is modified by the employment of egg-ended vessels. Such a shape when used in boilers has often caused trouble, though this may be averted by the employment of a large factor of safety. Mr. STROHMEYER analyses the cases of egg-shaped and quasi-spherical vessels, but leaves the matter very inconclusive. It will have, however, to be cleared up one way or the other before this arrangement can be expected to receive general acceptance.

Current Topics.

Electrification—A Wise Move.

THE first announcements of the forthcoming electrification of the London suburban lines of the Great Northern sections of the London and North-Eastern Railway were treated to an official drenching of cold water. But the company's deeds have been better than their words. And we now understand that specifications for the work have been sent out to three of the principal electrical engineering firms, and that these specifications have been so drafted that suggestions on certain points regarding the character and extent of the electrification will be admitted. If this is so the company are to be congratulated. Their officials have had no experience of electric traction either in the making or in operation. The firms in question, on the other hand, have had wide knowledge of the problem, which they will be only too pleased to place at the company's disposal. The result should be satisfactory from every point of view. We shall await with interest the result of this co-operation, especially on the question of the system to be adopted. The scheme is made the more interesting by the further statement that an application is to be made to Parliament by the London and North-Eastern Railway Co. for powers to connect their system with the Great Northern and City Railway at Finsbury Park. This is, of course, a revival of an old idea, and it will be remembered that the tunnels of the tube railway were constructed so as to be large enough to take main-line rolling-stock. We hope that both these schemes will be brought to fruition without delay, and so a much-needed improvement in the traffic facilities of Northern London realised.

London Tube Railway Developments.

IN addition to these two schemes the London Electric Railway Co. announce that they are about to start upon a scheme of extensions which has been talked about for some time. This includes the extension of the City and South London Railway from Clapham Common to North Morden, a distance of over five miles, four and a half of which will be in tubes. There will be seven stations. Piccadilly Circus and Leicester Square stations are to be reconstructed and Waterloo Station enlarged to deal with the great increase in the number of passengers in the last fourteen years. Escalators are to be freely erected, and the existing winding and irritating passages straightened out. The new tunnels are to be constructed with the help of an electric rotary excavator which drives from 20 to 30 ft. of tunnel per day. This ambitious scheme should do much not only to improve the railway traffic facilities in the South of London, but to alleviate unemployment.

The Fulham Fiasco.

AFTER much talk and conference the members of the Electrical Trades Union employed by the Fulham electricity undertaking went on strike on Thursday afternoon in last week and the supply both for lighting and power was cut off. It had been originally arranged that drastic action should not take place until Saturday, but as the electrical workers were acting in conjunction with the dustmen and other municipal employees, and attempts were being made to replace the latter from outside sources the date was advanced. The strike was, however, short-lived; a conference between the Strike Committee and the representatives of the Town Council took place by candle-light and terms were arranged on the basis of the reinstatement of all employees on their old conditions. Payment is to be on a piecework basis (the point at issue), with a minimum wage not less than that in operation in other London boroughs. The position is to be reviewed at the end of six months. It may be added that the members of the E.P.E.A. held a watching brief, deciding not to strike themselves but refusing to work with "blackleg" labour. The episode gives rise to certain reflections. If the employees were just in their demands the Borough Council should have given way earlier before a drastic course were taken. If the employees were in the wrong the Borough Council have failed in their duty to the ratepayers in giving way so precipitately. It is, we fear, yet another example of the deplorable state into which local government in this country has fallen.

Deflation and Trade Revival.

TOWARDS the end of last week the pros and cons of the deflation policy suggested by the Lord CUNLIFFE and carried into operation by the present and previous Governments were discussed both by Mr. R. MCKENNA and Sir ERIC GEDDES, and were dealt with in detail in a report addressed to the Government by the Federation of British Industries. Mr. MCKENNA said that if we were to recover the level of trade activity attained before 1914 we must first of all establish conditions of peace and stability throughout Europe. In considering questions of trade and finance the overwhelming fact that we had a million and a quarter unemployed in this country must never be lost sight of. The cost to the State of the unemployed was £100 000 000 per annum, but the true cost was much greater. To bring them back into employment would mean increased national

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purchasing power and an alleviation of trade depression. Imperial trade would in time get better, but no substantial improvement in foreign trade could be expected under present conditions. In his view much of the present unemployment was due to the policy of deflation which had been pursued. During the past three months deflation had ceased and this change was having a good effect. If no further effort were made to bring down prices by restricting credit he believed British trade would soon be in a fair way to recovery. Sir ERIC GEDDES and the report of the Federation argued along the same lines, pointing out that deflation meant a rapid fall in prices and a dislocation of trade, causing an increase in the burden of internal debt and severe unemployment.

Mr. Baldwin on the Situation.

ON the other hand we are glad to see the PREMIER'S emphatic declaration against a policy of inflation. This declaration has not only brought back confidence to the City, but has removed a great anxiety from the commercial and industrial world. There are quite enough uncertain factors in business to-day, and the prospect which was opened up to us a week or two ago of political dabbling with the value of the pound would surely have been the last straw. After Mr. BALDWIN'S declaration business men can proceed with the knowledge that any fluctuation in the value of sterling will be natural, that a movement up or down will be the result of ordinary causes and that no political consideration, at all events so far as this country is concerned, will make prices move up or down.

Education and Demonstration.

ELECTRICAL engineers are seldom orators, heaven-born or otherwise, but they possess in Dr. FERRANTI a speaker who generally says something which is not only worth hearing but worth pondering. At the dinner given by the Hackney civic authorities last week to celebrate the opening of the latest extension to their power-station DR. FERRANTI said that, though the use of electricity would progress rapidly in any event, it would progress much more rapidly if the public generally were educated in its employment. That simple statement contains the germ of much that is worth earnest consideration by all electrical engineers. Electricity, we know, is a good thing, but the public must be taught that it is good, and taught by reiteration. The best way of doing this is by constant demonstration. For the housewife to see one joint cooking electrically, and, better still, to eat it after it has been cooked, is worth many ornate showrooms, much eloquence and reams of publicity literature (horrible antithesis !). Demonstration of this kind in a showroom or an exhibition is valuable enough. It is ten times as valuable in a working kitchen or an electric home. In days gone by we used to hear quite a lot about the satisfied consumer; her potentialities (for it is generally a she that has to be satisfied) as a business asset are still not recognised as they should be.

Station Efficiency.

IN a recent issue of the "Fuel Economy Review" some figures are given regarding the central station of l'Est de la France which are certainly interesting. These figures are quoted to show the big economy which can be effected by good boiler-house organisation. At the beginning of 1919 there was confessedly no control in the boiler-house of this generating station, and a haphazard manner of handling fuel was the order of the day. At this period the fuel consumption was 3·5 lb. of coal per kWh generated. In April, 1919, the reorganisation began, coal meters were installed, analyses carried out, stokers trained, and so forth. According to the report the effect was at once apparent, and by October, 1921, the coal consumption was brought down to 2 lb. per kWh generated, which meant a reduction of over 40 per cent. on the consumption of the first three months of the year. The size of the station is indicated by its output, which is 50 million kWh per annum. No other factors are indicated as playing a part in achieving this great movement towards fuel economy, and if, as is suggested, reorganisation of the boiler-house was the sole factor, then we can only surmise that the original régime in the boiler-house was intolerably bad. Even if allowances have to be made for contributing factors the broad moral stands that there may be in any station a margin for improvement in boiler-house operations.

Pulverised Fuel.

THE essential principles of systems of employing powdered fuel as utilised in the United States have frequently been discussed in papers before technical societies. But little has been published on the use of such methods in this country. In a paper before the North-East Coast Institution of Engineers and Shipbuilders a short time ago, Mr. J. T. DUNN gave a useful summary of the system. One of the best known instances of its use is the cement industry, where it is practically universally employed; but in the United States it has been used to a much greater extent than here, as we have often pointed out in these columns. Thus in 1919 about 11 million tons of coal were used in pulverised form, chiefly in industrial plants (cement, iron and steel and copper) only about 200 000 being applied for the generation of power. Mr. DUNN described the unit and multiple systems and the methods of drying the coal before pulverisation. The recent development of pneumatic methods of transporting the pulverised material is interesting, and the author gave details of the Fuller-Kinyon, Quigley and Holbeck processes. From the scientific standpoint the merits of pulverised fuel systems may be admitted. Amongst these, better combustion, easier regulation, possibility of using inferior fuels are important. The practical disadvantages, arising chiefly from the dissemination of the finely powdered ash, are stated to have been largely overcome. It is remarked, however, that little information as to the cost of powdered fuel equipment, applicable to conditions in this country, is available. A detailed comparison of costs of operation supplied by Edgar Allen and Co., of Sheffield, is quoted; the respective costs per ton of steel with solid and powdered fuel were given as £1 7s. and 11s. 1d. In conclusion, reference is made to the so-called colloidal fuel—i.e., mixtures of up to 30 per cent. of coal in oil, on which useful work was done in the United States during the war. It would appear, however, that this promising line of investigation has also received little attention in this country.

The Electrification of England.

THE present position with regard to the domestic load is clearly indicated by the results of a survey undertaken during the past three years by the Association of Edison Illuminating Companies in Boston, Brooklyn, Chicago, Cincinnati, Detroit, Philadelphia, Toledo and Washington. This survey, which is analysed in a recent issue of "The Electrical World" shows that of the total residence consumption only 17 to 20·6 per cent. is used for purposes other than lighting, and that "there is a deep and yawning chasm, not merely a valley, in the residence customer's load curve." Yet as our contemporary remarks, the tables could easily be turned and the "other uses" consumption made four or five times as much that for lighting. In a paper which he read before the Incorporated Municipal Electrical Association in 1922, Lieut.-Col. W. A. VIGNOLES pointed out that, bad as the state of affairs were in America, they were probably worse in this country. And the comment is, we fear, equally just in 1923. There is definite evidence of the existence of wasted opportunity and a neglected market. What is wanted is the electrification of England, and it is the duty of everyone in the electrical industry to do their utmost towards the achievement of that desirable and by no means impossible ideal.

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TRANSATLANTIC RADIO TELEPHONY.*

By H. D. ARNOLD and LLOYD ESPENSCHIED.

(*Concluded from page 426*).

The object of stepping down the received frequency is to secure the combination of a high degree of selectivity with flexibility in tuning. This high selectivity is obtained by the use of a band filter. It is further improved by applying the filter after the frequency is stepped down rather than before. The filter is not required to be of variable frequency as would be the case were it employed directly at the received frequency, since by adjusting the frequency of the beating-down oscillator the filter is in effect readily applied anywhere in a wide range of received frequencies. The receiving method, therefore, enables the filter circuit, and indeed also the intermediate frequency amplifiers, to be designed for maximum efficiency at fixed frequency values without sacrificing the frequency flexibility of the receiving set. The signals are received on a square loop 6 ft. on a side and wound with 46 turns of stranded wire.

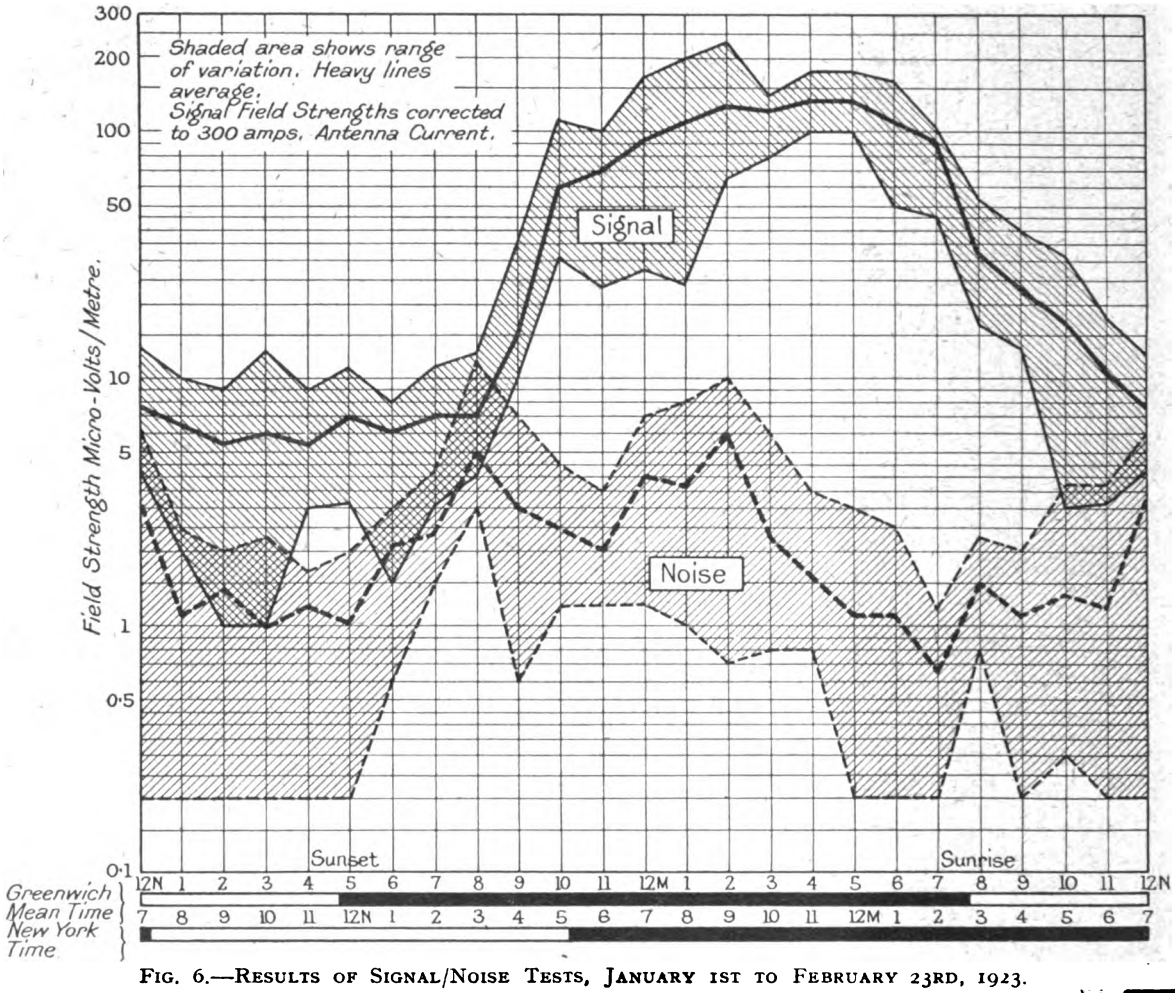

FIG. 6.—RESULTS OF SIGNAL/NOISE TESTS, JANUARY 1ST TO FEBRUARY 23RD, 1923.

It might be expected that some difficulty would be experienced in maintaining the frequency at the receiving end in sufficiently close agreement with the sending frequency. In the tests no particular difficulty was experienced, the oscillators at the two ends being so stable that only an occasional slight readjustment of the receiving oscillator was required. If serious distortion of the received speech is to be avoided, the two frequencies must be within about 50 cycles, an accuracy of 0·1 per cent. at 50 000 cycles.

Since the present experiment represents the first use of the single side-band eliminated carrier type of system, some further discussion of the characteristics and advantages of the system is appropriate.

The importance of the system in conserving frequency range will be appreciated when it is realised that the total frequency range available for transatlantic telephony is distinctly limited. Just what the most suitable range is has not been accurately determined, but it seems limited to below 60 000 cycles (5 000 metres) because of the large attenuation suffered during the daylight hours by frequencies higher than this. On the lower end of the frequency scale, transatlantic telegraphy at present pretty well pre-empts frequencies below 30 000 cycles (10 000 metres). Therefore, for the present at least, transatlantic telephony is limited to a range of some 30 000 cycles. Now transmission of speech requires as a minimum for good quality a single side-band 3 000 cycles wide. Allowing for variations and clearances between channels, it is doubtful if the channels could be made to average closer than one every 4 000 cycles for single side-band transmission and one every 7 000 cycles for the ordinary double side-band transmission. This means that even were the whole range from 30 000 to 60 000 cycles devoted to telephony to the exclusion of telegraphy, only about four channels could be obtained by the older methods and some seven by the present one.

The second of the outstanding characteristics of the present system resides in the large power economy which it permits. Transatlantic telephony requires hundreds of kilowatts of high-frequency power. Since it is difficult and expensive to produce this power, it is important that every effort be made to increase its efficiency or effectiveness in transmitting the voice. To illustrate how the present system effects economies in power, consider the case of a carrier wave completely modulated by a single frequency tone. In such a design completely modulated wave, only one-third of the total power contains the message, the remaining two-thirds conveying only the carrier frequency which can as well be supplied from an oscillator of small power at the receiving station. It is obvious, therefore, that by eliminating the carrier only

* Abstract of a Paper read before the American Institute of Electrical Engineers.

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one-third as much power need be used as would be required were all the elements of the completely modulated wave transmitted. To realise the maximum advantage of this mode of operation, the system eliminates the carrier at low power, and thereby the high-power apparatus is devoted exclusively to the amplification of the essential part of the signal.

If, after having suppressed the carrier, both side-bands were transmitted, their reception would require perfect synchronism between the carrier resupplied at the receiving end and that eliminated at the sending end, a condition which is practically impossible to meet without transmitting some form of synchronising channel, which is, indeed, much the same as transmitting the carrier itself. If the receiving carrier is not synchronised, the two side-bands will interfere with each other upon being detected. By eliminating one side-band this interference is prevented and reception may be carried on, using a locally supplied frequency which is only approximately equal to that of the suppressed carrier. The two may differ by as much as 50 cycles before the quality of the received speech is greatly impaired. The importance possibly throwing it into a series of interesting networks and causing it to become a rather elaborate wave filter. The importance, from the antenna standpoint, of narrowing the frequency band required to be transmitted is, therefore, evident.

It is extremely important that the received signal be affected as little as possible by changes in the transmission efficiency of the medium. The voice-frequency currents produced at the receiving end, after detection, are proportional to the product of the carrier wave and the side-band. If the carrier as well as the side-band is transmitted through the medium, then a given variation in the transmission efficiency of the medium will affect both components and will change the received speech in proportion to the square of the variation, as compared to the first power if only the side-band is transmitted and the carrier is supplied locally. Thus it will be seen that the omission of the carrier from the sending end and the resupplying of it from the constant source at the receiving end gives greater stability of transmission.

Without discussing the system in further detail, the advantages of it may be summarised as follows :—

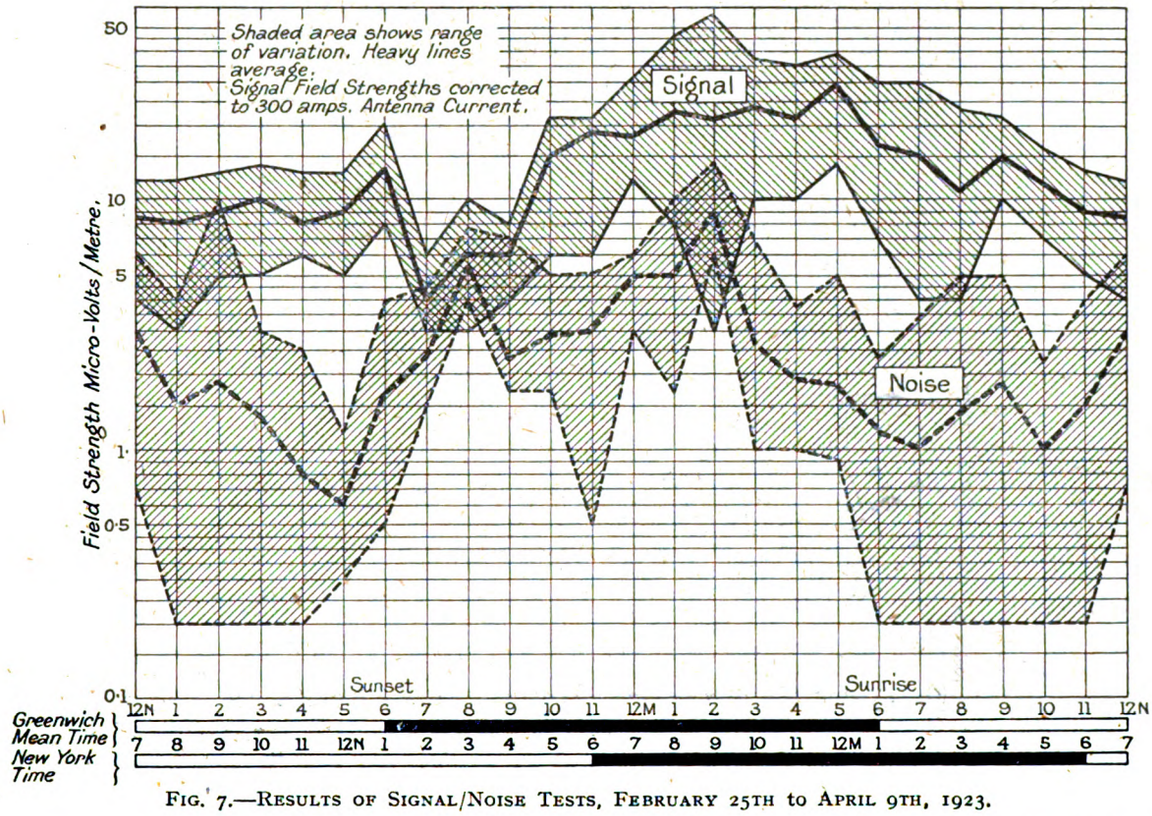

FIG. 7.—RESULTS OF SIGNAL/NOISE TESTS, FEBRUARY 25TH to APRIL 9TH, 1923.

to the carrier suppression method of eliminating one side-band will, therefore, be appreciated. The present system eliminates one side-band while still in the low-power stage. While it would be possible to do this selecting after they have both been raised to the full transmitting power, this would require the use of a filter of high-power carrying capacity, which would make the filter very costly and also render the system inflexible to change of wave length. The present system overcomes both of these difficulties by filtering out one side-band at low-power levels and by the use of the double modulation method.

Another very important reason for the transmission of a frequency band as narrow as is possible lies in the difficulty of constructing an antenna to transmit more or less uniformly at these long waves a band of frequencies which is an appreciable fraction of the main carrier frequencies. For example, in the ordinary method of transmission an antenna which was intended to transmit a 30 000-cycle carrier and its two speech side-bands would need to be designed to transmit all the frequencies from 27 000 cycles to 33 000 cycles, a band which is equal to 20 per cent. of the carrier frequency. This band is considerably wider than that given by the resonance curve of a highly efficient long-wave antenna. To accommodate both side-bands would require flattening out the resonance curve either by damping, which means sacrifice in power efficiency, or by special design of the antenna,

1. It conserves the frequency (wave length) band required for radio-telephony, which is particularly important at long wave lengths.

2. It conserves power, in that all of the power transmitted is useful signal-producing power. This is particularly important also in long-distance transmission which requires the use of large powers.

3. The fact that only a single band of frequencies is transmitted simplifies the antenna problem at long wave lengths, where the resonance band becomes too narrow to transmit both side-bands.

4. As compared with a system which eliminates the carrier but transmits both side-bands, the simple side-band system has the important advantage of not requiring an extreme accuracy of frequency in the carrier which is resupplied at the received end. Were both side-bands transmitted very perfect synchronism would be required for good quality.

5. It improves the transmission stability of the radio circuit since variations in the ether attenuation affect only one (the side-band) of the two components effective in carrying out the detecting action in the receiver.

6. The receiving part of the overall system has two advantages.

(*a*) It need accept only half the frequency band which would be required in double side-band transmission, thereby accepting only half of the "static" interfering energy.

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(*b*) By stepping down the frequency of the received currents and filtering and amplifying at the low-frequency stage, a very sharp cut-off is obtained for frequencies outside the desired band and a very stable and easily maintained amplifying system is obtained.

Considering the second major part of the investigation, namely, that having to do with the transmission of the waves across the Atlantic, the transmission efficiency of the medium varies with time of day and year, and is different for different wave lengths. The interference conditions are also influenced by these same factors. The apparatus employed in measuring the field strength of the received signals has been outlined above under receiving system and need not be gone into further. However, it will be recalled that the specially designed receiving set is provided with a local source of high frequency from which can be originated signals of predetermined strength. A measurement of the field strength of a signal received from the distant transmitter is made by listening first to the distant signal and then to the locally produced signal, shifting back and forth between these signals and adjusting the strength of the local signal until the two are substantially of the same strength. Then, knowing the power delivered by the local source, the power received from the distant station is likewise known. The relation between the power in the input of the radio receiving circuit to the field strength required to deliver that power is known through the geometry of the receiving antenna (in this case a loop), and therefore the measured power of the signal can be translated directly into the field strength of the received waves.

The measurement tone signal is transmitted from the Rocky Point sending station by substituting for the microphone telephone transmitter a source of weak alternating current of about 1/100 W at a frequency of approximately 1 500 cycles. This tone modulates the radio-telephone transmitter in the same way that voice currents would, and is radiated from the antenna as a single-frequency wave of 5 260 meters (57 000 cycles per second). It therefore constitutes a means of sending out a single-frequency continuous wave for measurement purposes. At the receiving end this continuous wave is demodulated to the same tone frequency as it originally had.

For measuring the strength of the received noise—i.e., the radio frequency currents arising from static or other station interference—the method is quite similar. In this case, however, the noise received is so different from that which can be set up artificially in any simple manner that no attempt is made to compare it directly with a local noise standard. Instead the volume of the interfering noise is expressed in terms of its effect in interfering with the audibility of a local tone signal by measuring the local signal, which can just be definitely discerned through it. This is a threshold type of measurement which is necessarily difficult to carry out with accuracy. In order to increase the sharpness of definition of the local signal and to make it correspond more closely to speech reception the signal tone is subjected to a continuous frequency fluctuation. The comparison signal has therefore a warbling tone which occupies a frequency band not unlike that of the voice and may be looked upon as artificial speech.

The three quantities which are included in the transmission measurements—namely, the signal strength, the noise strength, and the percentage of words received correctly—are observed one after another in what might be termed a unit test period, which is repeated every hour over a period varying from several hours to as long as two days' duration. The measurements were started January 1st, 1923, and are still in progress.

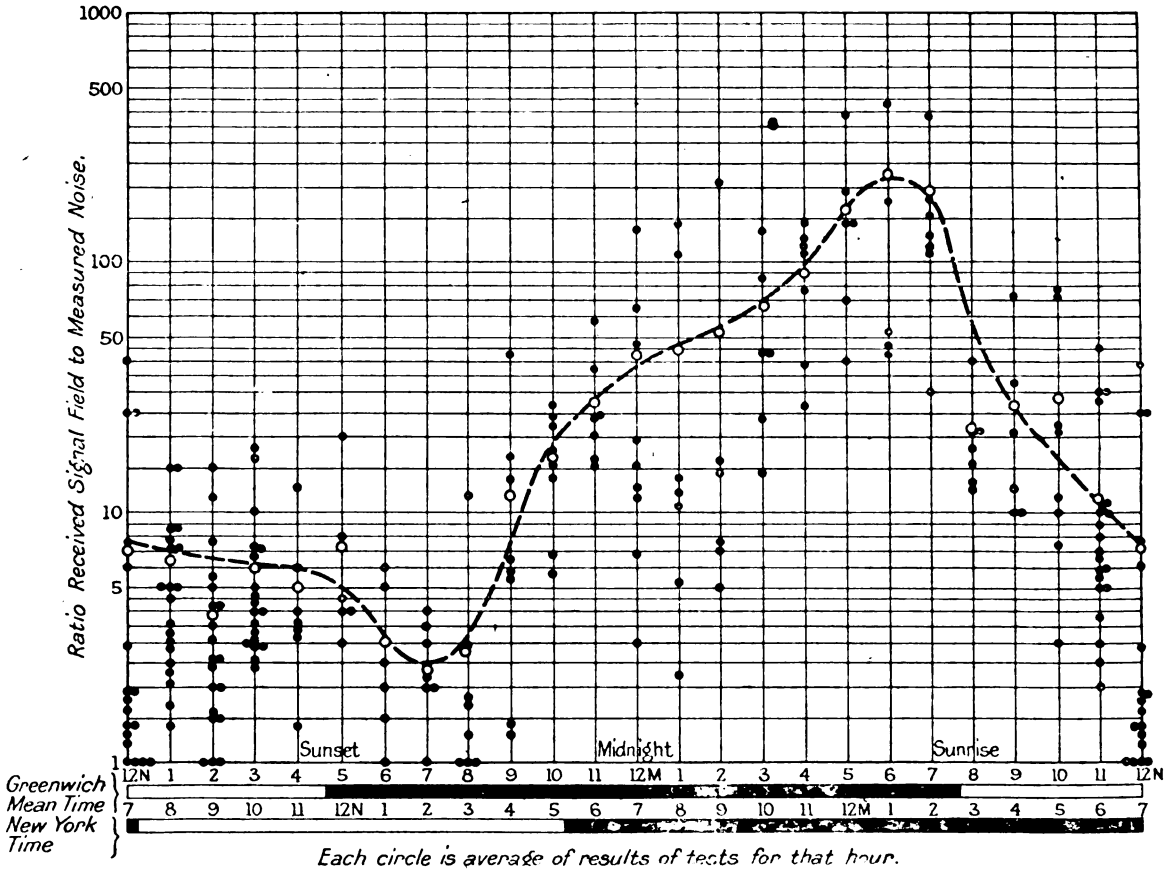

FIG. 8.—SIGNAL TO NOISE RATIO FOR PERIOD SHOWN IN FIG. 6.

At the present time (April) the results for the first three months of the tests are available and are given in Figs. 6 and 7. The data have been divided and plotted in these two sets of curves because the transmission conditions across the North Atlantic appeared to suffer a rather rapid change about February 23rd. Fig. 6 therefore covers the winter period from January 1st (when the test started) to February 23rd, and Fig. 7 covers the next period from February 25th to April 9th.

The curves are plotted between time of day as abscissas and field strength in microvolts per meter as ordinates. The time during which darkness prevailed at Rocky Point and at London is indicated by the block-fills on the time scales. The overlap of these block-fills indicates the time during which darkness extended over the entire transatlantic path. For Fig. 6 the darkness belt is as of February 1st, and for Fig. 7 as of March 21st. The curves show the mean of the results and also the boundaries of the maximum and minimum values observed.

The outstanding factors to be noted concerning the signal strength curves are :—

1. The diurnal variations are plainly in evidence. During the first test period covered by Fig. 6, for example, the field

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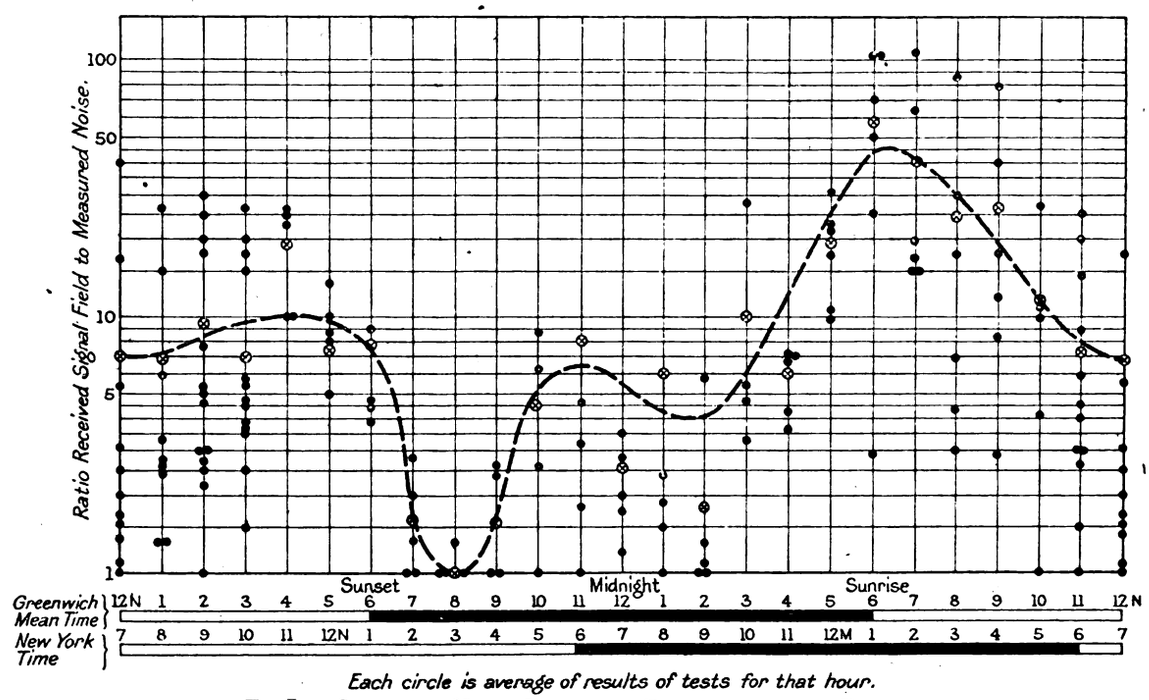
strength varied in the ratio of the order of 15 to 1 between day and night conditions.

The measured daylight values lend support to the Austin-Cohen absorption coefficient. The average of the observed daylight values for the period of these tests is between 7 and 8 microvolts per meter, while the calculated value is 9·5. Concerning the high field strengths obtaining at night, it should be noted that the maximum observed value of 237 microvolts per meter does not exceed the value of some 340 microvolts, which it is estimated should obtain at London were no absorption present in the intervening medium—i.e., were the waves attenuated in accordance with the simple inverse-with-distance law. This indication that the upper limit of the variation is the no-absorption condition suggests that the diurnal fluctuations are controlled by the absorption conditions of the medium rather than by reflection or refraction effects.

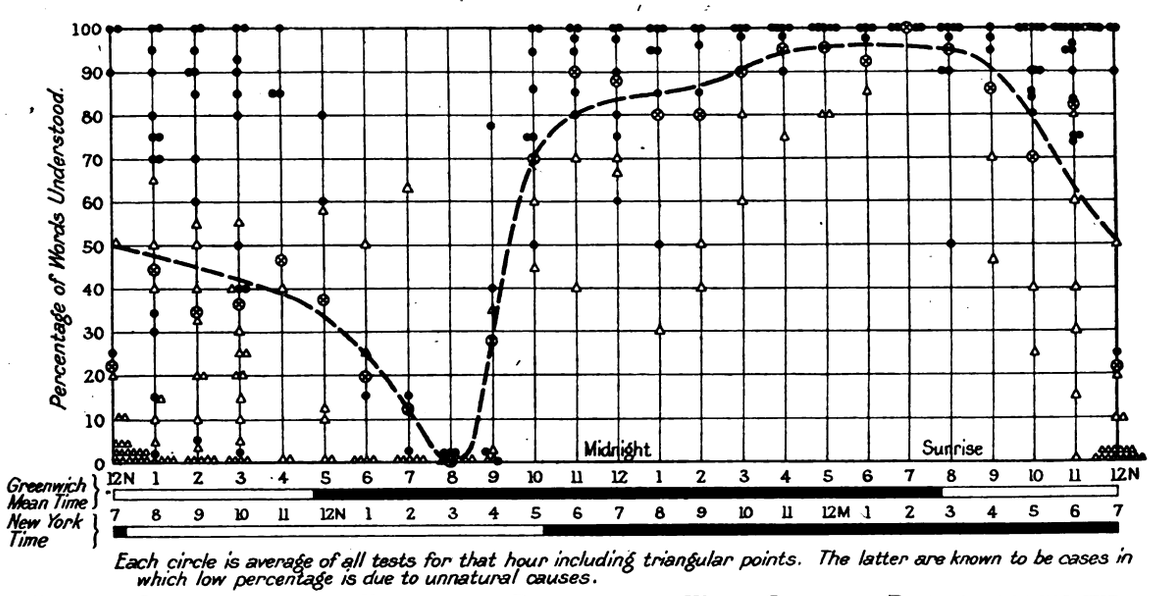
2. An indication of the seasonal variation which apparently occurs in developing from winter to early spring is found in a comparison of the signal strength curves of Figs. 6 and 7. On the whole, the signal strength received in the second test period is considerably less than that received for the first period. This drop in the average of the 24 hours is caused by a large decrease in the night-time transmission efficiency. The daylight transmission does not change much, but what little change there is lies in the direction of an increase as the season advances.

3. A decrease in the transmission efficiency is observed between the time of sundown in London and sundown in New York—that is, during the period when the sunset conditions intervene in the transmission path. This dip is particularly noticeable in the signal strength curve of Fig. 7. It is not noticeable in Fig. 6 except for the fact that the rise in signal strength corresponding to night conditions in London is delayed until the major part of the transmission path is in darkness.



Each circle is average of results of tests for that hour.

FIG. 9.—SIGNAL TO NOISE RATIO FOR PERIOD SHOWN IN FIG. 7.



Each circle is average of all tests for that hour including triangular points. The latter are known to be cases in which low percentage is due to unnatural causes.

FIG. 10.—CURVE SHOWING THE VARIATION IN PERCENTAGE OF WORDS CORRECTLY RECEIVED DURING THE TWENTY-FOUR HOURS (FIG. 6 PERIOD).

The variation in the strength of received noise is shown by the noise curves of Figs. 6 and 7.

1. The diurnal variation of that portion of the noise which is due to atmospheric or "static" disturbances is somewhat obscured by the presence of artificial noise—i.e., noise caused by interference from other stations. The rise in the noise curve at 12 noon is known to be due to artificial interference.

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In general, however, the large noise values shown to prevail throughout the night in London between about 6 p.m. and 4 a.m. are known to be due to atmospherics. The diurnal variation shows up quite prominently in both figures.

The maximum noise is reached at 2 a.m., London time. Up to this time the night belt extends over London and a sector of the earth considerably to the east and including Europe, Africa and Asia. The noise begins to drop off shortly thereafter, and reaches its minimum at sunrise in London. This could be accounted for on the assumption that the major source of the noise lies considerably to the east of London and that transmission of the stray electric waves to London is gradually diminished in efficiency as daylight overtakes the path of transmission.

2. The seasonal variation, as shown by a comparison of the noise curve of Fig. 6 with that of Fig. 7, is not so great as is the case with the transmission efficiency of the signal. However, the noise level is noticeably higher during the second period of the tests, as shown by the average curve of Fig. 7, particularly during the night when the maximum noise obtains. This indicates that the noise is largely of Continental origin lying to the east or south-east of London, which is in agreement with rough observations made by means of a loop, and suggests that the employment of directional antennas would be of considerable advantage.

In connection with these noise curves it should be noted that what they represent is in reality the strength of a local warbling tone-signal, expressed in terms of equivalent field strength in microvolts, which is just definitely audible through the noise. The actual value of the noise currents, were they measured by an integrating device such as a thermocouple, for example, would be a number of times larger than indicated.

The noise curve of Fig. 6 and that of Fig. 7 can, therefore, be read as " the strength of the signal tone which can just be heard through the noise." Actually the difference between the signal and noise curves, as shown in the figures, is proportional to the ratio of the signal to the noise strength, because the curves are plotted to a logarithmic scale.

This signal to noise ratio is plotted in Fig. 8 for the test period which corresponds to Fig. 6, and Fig. 9 for the test period which corresponds to Fig. 7. An average is taken of the points for each hour of the 24-hour period as shown by the circle points. The dash line curves of Figs. 8 and 9, therefore, trace the average diurnal variation of signal to noise ratio.

These curves show :—

1. That the signal to noise ratio reaches its minimum during the time when the sunset period intervenes between London and New York.

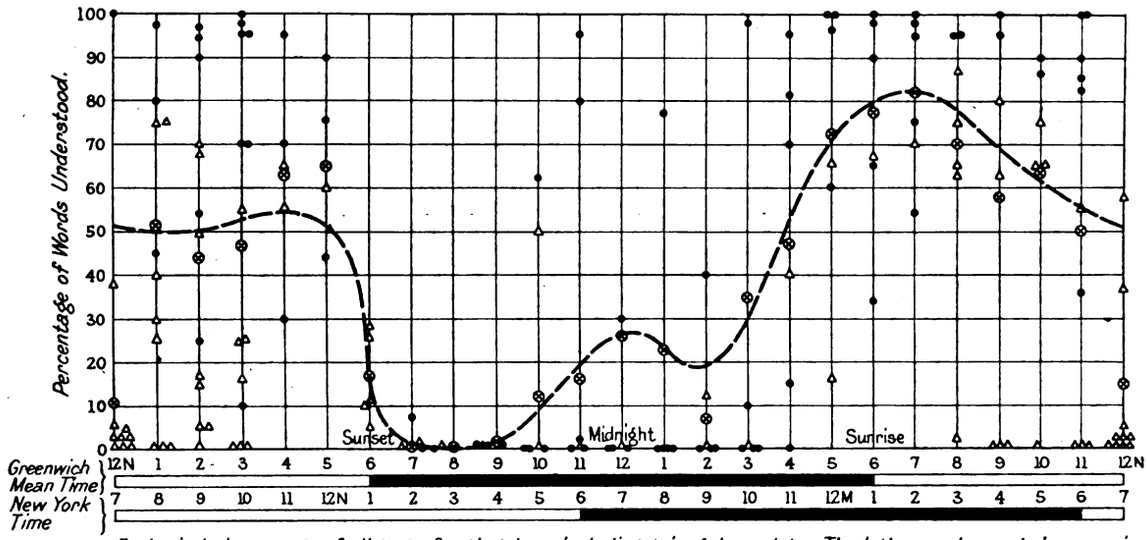
2. During the night in London the ratio increases more or less continuously and reaches a maximum around the time of sunrise in London.

3. During the course of the daylight period in London the ratio starts out high and drops rather rapidly during the forenoon, and assumes a more or less constant intermediate value during the afternoon until sundown. It is during this afternoon period in London that the business hours of the day in London and New York coincide, so that this is the most important period from a telephone communication standpoint.

The drop in the very low ratios obtaining in London in the early evening is due to the fact that an increase in noise occurring at this time is accompanied by a decrease in transmission efficiency from America, the transmission path of atmospherics from Europe and Asia being dark, while that of the signal is in daylight. Conversely, the high signal to noise ratio, obtaining at about sunrise in London, appears to be due to the fact that as the termination of the night belt, moving westward, intervenes between England and the source of atmospherics to the east, the noise level drops rapidly and has reached low values by the time sunrise arrives in London. At this time, however, darkness still extends to the west, and the transmission efficiency from America is at its maximum.

During each test period lists of disconnected words were spoken over the systems. As an approximate and easily applied method of indicating the talking efficiency of the circuit, note was made of the percentage of the words which were correctly received.

The curves in Figs. 10 and 11 show the manner in which the percentage of the words which were correctly received varies through the 24 hours. Each point corresponds to the percentage of words correctly received during one unit test period. In many of these tests the interference was noted to be caused by radio-telegraph stations, and the data in which the interference is of this character, in so far as identified, are indicated by the triangular dots. It will be seen that most of the poor receptions were due to this cause. The circle points are the average results for each hour's tests. The dash line curve is a smoothing-out curve of these points.



Each circle is average of all tests for that hour including triangular points. The latter are known to be cases in which low percentage is due to unnatural causes.

FIG. 11.—CURVES SHOWING THE VARIATION IN WORDS CORRECTLY RECEIVED DURING TWENTY-FOUR HOURS (FIG. 7 PERIOD).

Conclusion.

As has been indicated, this is a report of work which is still in progress. To date—

A new type of radio-telephone system affording important advantages for transatlantic telephony has been developed and put into successful experimental operation across the Atlantic.

Sustained one-way telephonic transmission has been obtained across the Atlantic for the first time by means of this system.

The advantages of this system which had been anticipated, particularly in respect to economies of power and wave lengths, have been realised. Furthermore, it has been demonstrated that the high-power water-cooled vacuum tubes which have seen their first prolonged operation in this installation are admirably adapted for use in high-power radio installations, and particularly for use as high-power amplifiers, in the type of system we have described.

The results of the transmission measurements show that it will probably be desirable to use a wave length longer than 5 000 metres. The measurements are now being made to include the longer wave lengths.

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THE PROGRESS OF PULVERISED FUEL IN THE UNITED STATES.

[FROM A CORRESPONDENT.]

The recent report on pulverised fuel submitted by Mr. S. W. Baynes, the chief engineer of St. Pancras Borough Council, to his Electricity Committee is a welcome sign that the enormous development in the use of pulverised fuel in the United States is beginning to attract the serious attention of British power station engineers. We understand that the Electricity Committee have recommended to the Council, in view of the great extensions in hand, and pending, at the King's Road Power Station, St. Pancras, that the chairman of the Electricity Committee (Ald. J. H. Mitchell, J.P.) and Mr. Baynes be empowered to visit the United States and inspect a number of the largest American power stations with a view to the possible adoption of pulverised fuel at St. Pancras. Mr. Baynes in his report points out the rapid growth of the use of pulverised fuel in American power stations, and a few further facts in this connection will doubtless be of interest.

As is well known pulverised fuel is a very old idea, being first used in the cement industry about 1890, but although much attention has been given to it for many years past it was not until the perfection of the "Lopulco" system that any headway was made.

The First Pulverised Fuel Station.

The first very large power station, and the real pioneer pulverised fuel plant in the world, to be fitted with "Lopulco" pulverised fuel was the new Lakeside Station of the Milwaukee Electric Railway and Light Co., on Lake Michigan. This was planned in 1915 for 200 000 kW following on the very successful results obtained with "Lopulco" pulverised fuel on the smaller Oneida St. Station, Michigan, belonging to the same company. The scheme was held up somewhat by the war, but 40 000 kW was started up in December, 1920. This consists of eight "Edgmoor" boilers of 13 080 sq. ft. heating surface (six running at a time) at 300 lb. pressure fired with "Lopulco" pulverised fuel and the results obtained have been astonishing. The plant is running week in and week out all the year round at 85 to 86 per cent. efficiency with a total expenditure of auxiliary power of 1·75 per cent. of the steam production, and with less labour, and wear and tear, depreciation, and repair costs than mechanical stoking. Since the advent of this pioneer plant the development of pulverised fuel has been extraordinary. The following is a list of the "Lopulco" installations (1) now actually in operation and (2) on order and in progress of erection. It will be noted that these include some of the largest and most famous power stations in the world, and since this list was compiled other installations have been ordered, including the Trenton Channel Station of the Detroit Edison Co.

There is a vague idea in the minds of some British power station engineers that pulverised fuel is a matter for experiment, and it can only be pointed out, therefore, that the Lakeside Station alone has burnt over 500 000 tons of coal in the pulverised condition, and very soon more than 1 000 000 H.P. will be in operation using this method of firing. At the same time still further improvements have been made in the design during the last twelve months, the chief of which is a new vertical dryer for the coal using only the hot chimney gases, so that the total auxiliary power complete is actually now less than 1 per cent. of the steam generated, whilst the efficiency guarantee for the huge Cahokia station at St. Louis is over 86 per cent. efficiency, and the figure expected is 88¼ per cent.

LIST OF "LOPULCO" INSTALLATIONS. (Now in operation.)

Name of plant.	Number of boilers.	Heating surface per boiler (sq. ft.).	Type of boiler.	Guaranteed evaporation of each boiler from and at 212° F. (in many cases this figure is exceeded).
Allegheny Steel Co., Brackenbridge, Pa.	7	3 330	Wickes	28 600
" " "	1	4 000	Erie City	34 500
Duquesne Light Co., Brunots Island, Pa.	1	8 220	Stirling	57 000
Ford Motor Co., River Rouge plant ..	4	26 470	Ladd	227 642
Lima Locomotive Co., Lima, Ohio ..	6	4 000	Wickes	20 700
" " " " ..	1	5 000	Heine	25 850
Milwaukee Elec. Rly., Lakeside plant ..	8	13 080	Edgmoor	115 000
Milwaukee Elec. Rly., Oneida St. plant	5	4 680	Edgmoor	35 500
Morris and Co., Oklahama City ..	5	5 000	Edgmoor	43 000
" " " ..	2	3 000	Edgmoor	25 800
St. Joseph Lead Co., Rivermines, Mo...	2	7 680	Stirling	53 000
West Penn. Power Co., Springdale, Pa.	1	15 320	B. and W.	159 000

LIST OF "LOPULCO" INSTALLATIONS.
(Now in course of erection, and in many cases repeat orders.)

Name of plant.	Number of boilers.	Heating surface per boiler (sq. ft.)	Type of boiler.	Guaranteed evaporation of each boiler lbs. per hour from and at 212° F.
Cleveland Elec. Illuminating Co., Cleveland and Ohio	4	30 600	Stirling	Not stated
Farr Alpaca Company	3	10 000	Wickes	Not stated
Firestone Tire and R., Akron, Ohio ..	3	6 000	Stirling	62 000
Ford Motor Co., River Rouge plant ..	4	26 470	Ladd	227 642
Ford Motor Co., Ontario, Canada ..	3	13 500	McLellan	140 000
Kobe Municipality, Kobe, Japan ..	1	5 500	B. and W.	24 600
Milwaukee Elec. Rlys., Milwaukee, Wisconsin plant, Lakeside	8	17 500	Edgmoor	Not stated
Nippon Electric Co., Japan	4	10 080	B. and W.	92 880
Pennsylvania Salt Co., Wyandotte, Mich.	1	8 220	B. and W.	71 000
Rochester Gas and Elec., Rochester, N.Y.	2	8 750	Bigelow-Hornsby	60 000
St. Joseph Lead Co., Rivermines, Mo....	1	15 000	Heine	12 900
" " " " ..	2	7 680	Stirling	53 000
St. Paul Gas Light Co., St. Paul, Min...	3	10 440	Heine	Not stated
Ste'Anonyme Union d'Electricite, Centrale de Vitry, France (Paris) ..	4	16 678	Delaunay Belleville Ladd	140 580
Tokio Electric Co., Japan	1	8 000	B. and W.	83 000
Union Electric Co., East St. Louis, Cahokia..	8	17 800	B. and W.	170 000
United Elec. Rlys., Providence, R.I. ..	3	12 600	Bigelow-Hornsby	174 000
Western Light and Power, Cheyenne, Wyo.	1	6 050	Walsh and Weidner	62 500

AUSTRALIAN ELECTRICITY STANDARDISATION.

The Australian Commonwealth and State Governments are considering standardisation proposals with a view to extending the use of electricity for power purposes and securing uniformity of service, thus avoiding confusion through the operation of two systems—direct and alternating current. In this connection a "Times" Melbourne correspondent states that the Victorian Government is establishing a fuel power plant at Morwell which will serve practically half of Victoria. The Burrinjuck scheme in New South Wales, a water-power project, is to distribute over a radius of not more than 100 miles. The chief electrical engineer of New South Wales estimates that the Snowy River hydro-electric scheme will be capable of developing 150 000 H.P. It has been calculated also that the price of power would compare with almost any other installation in the world. The Snowy River area is overlapped by the area that would be served by a Shoalhaven River plant or a fuel station at the South Coast coalmines. Part of this area supplied by the South Coast coal station could be supplied by the Maitland coalfields power plant, a portion of whose area again could be covered by a water-power plant on the Clarence River, where it appears that at the least 100 000 H.P. can be continuously developed. The Clarence River area again is overlapped by the area that could be served by the South Queensland coal measures. The Commonwealth Government believes that all these power schemes should be co-ordinated under the direction of one authority. If their development is guided by a number of bodies it is feared that the conditions which would arise would be worse than those existing in Melbourne to-day.

Books Received.

"Radio and High Frequency Currents." By Edgar T. Larner (London: Crosby Lockwood and Son.) Pp. 56. 3s. 6d. net.

"The Electrical Contractors' Year Book, 1923-24." (London: The Electrical Contractors' Association.) Pp. 362. 2s. 6d. net.

"Electrical Engineering Practice." Vol. I. By J. W. Meares and R. E. Neale. (London: Chapman and Hall.) Pp. 386. 25s. net.

"Strength and Structure of Steel and Other Metals." By W. E. Dalby. (London: Edward Arnold and Co.) Pp. ix—176. 18s. net.

"Alternating Current Bridge Methods." By B. Hague. (London: Sir Isaac Pitman and Sons.) Pp. xii+302. 15s. net.

"Principles and Practice of Wireless Transmission." By G. Parr. (London: Ernest Benn Ltd.) Pp. 163. 5s. net.

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HACKNEY'S ELECTRICITY SUPPLY.

The formal inauguration on Thursday last by the Mayor of Hackney of a 10 000 kW turbo-alternator in the generating station of that Borough gives us an opportunity of referring to the progress that has been made by the undertaking under the management of Mr. L. L. Robinson since it first started in 1902.

As is generally known, the coming of age of the undertaking has been marked by intense activity in the domestic field. Every endeavour is made by every means to make consumers, both existing and prospective, realise how much the use of electricity in the home can assist in bringing about greater comfort. Mr. Robinson's efforts to achieve this end by suitable propaganda are equally well known, but, as has been justly said, propaganda is of little value unless the price is right and the service itself is good. That the price is right in Hackney will be admitted when we say that the electric home scale in that Borough consists of a fixed charge of 1s. 6d. per quarter on each 60 W of equipment installed, with a running charge of 1d. per kWh. A supply for domestic hot water, when special apparatus of the heat storage type is used with a capacity not exceeding 3 kW, and provided the right is given to cut off the supply between the hours of 4 p.m. and 6 p.m.,

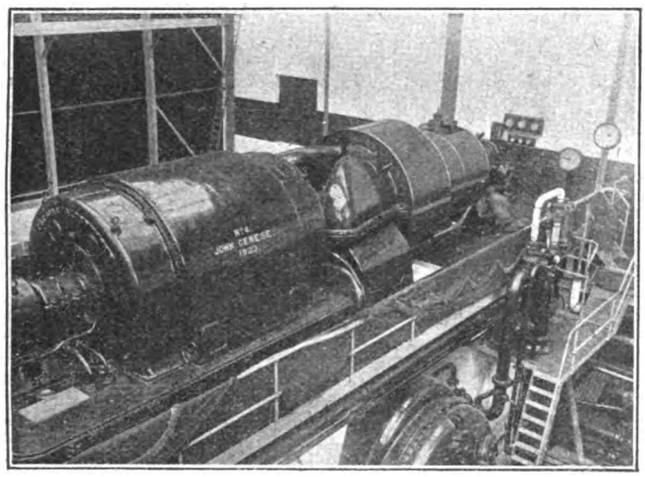

FIG. 1.—VIEW OF NEW 10 000 KW TURBO-ALTERNATOR AT HACKNEY.

is available at 0·6d. per kWh. In addition a cash discount of 5 per cent. is allowed from all accounts if paid within fourteen days. Hiring is in full swing, and under the scheme now in operation, household cookers, including a 3-pint quick-boiling kettle and switches and up to 50 ft. of wiring, can be obtained at rentals of from 5s. to 7s. 6d. per quarter, depending on the size, while radiant electric fires are also available at 5s. per quarter.

The Installation Department of the undertaking gives advice and estimates for every class of electrical work, and carries out wiring and installations generally so as to secure to the users of electricity in Hackney the best material and workmanship, and the latest skilled technical guidance on all problems relating to the employment of electrical energy.

Some Historical Statistics.

Nothing derogatory is meant when it is said that the development of the domestic electric idea in Hackney is a comparatively new activity. During the first year of working—1902–3—848 950 kWh were supplied for lighting and domestic use, and 227 000 kWh for power and factory lighting. As time went on, the figures under both these headings gradually increased but that for power went ahead the more rapidly. In 1908–9 for the first time the energy supplied to power consumers exceeded that supplied for lighting, until in the first complete year before the war the former was very nearly double the latter.

During the war, Hackney was a most active munitions area, as is evident by saying that in 1916–17 while 1 825 000 kWh were supplied for lighting, an amount rather less naturally than had been supplied during the best of the pre-war years, no less than 12 600 000 kWh were supplied for power, and this amount increased to rather over 13 000 000 kWh in the next year, the lighting consumption falling slightly. In 1916-17 for the first time 748 000 kWh were given for bulk supply, and this was increased to nearly 2 000 000 kWh in the succeeding year, and to 5 582 000 kWh in 1920–21. At the present time this figure stands at 5 291 000 kWh. As might be expected the amount supplied for power has fallen from the maximum of war years and during last year it stood at 8 574 000 kWh.

Domestic Supply Developing Rapidly.

On the other hand, the amount supplied for domestic purposes has risen from 1 713 000 kWh in 1917-18 to 4 114 000 kWh in 1922–23. This is by far the largest amount that has been sold for this purpose, and exceeds by nearly 1 000 000 kWh the amount sold under the same heading in the previous year. The net result is, therefore, that while in the best war year for power the total consumption in Hackney was just upon 17 000 000 kWh, this figure rose owing to domestic activities to nearly 17½ millions in 1920–21 and 1921–22, and increased to no less than 18 582 000 in 1922–23, an output which is the highest the undertaking has so far attained.

Without going back too much into past history, it may be remarked that in 1920-21 the coal costs were 0·74d. per kWh sold, a figure which had fallen in 1922–3 to 0·33d. When the undertaking first started, the total cost per kWh at the end of the first year's working was 1·03d. This gradually fell to a minimum of 0·6d. in 1911, and rising again, reached a maximum of 1·32d. in 1921. It now stands at 0·87d., which, considering the increased prices of fuel and other materials, and the higher salaries and wages paid, is good showing.

Generating Plant Past and Present.

Turning to the generating station, in 1902 the generating plant consisted of eight Lundell multi-polar d.c. generators with an aggregate capacity of 1 800 kW. These were replaced in due course by two 1 500 kW Bellis-Dick Kerr Westinghouse sets, while as time went on a 3 000 kW and 5 000 kW Willans-G.E.C. turbo-alternators running at 1 500 revs. per min. were installed. In 1919 a 6 000 kW Parsons turbo-alternator was erected, and it is interesting to note that this did 87 per cent. of the output during the past year.

The new set (Fig. 1) which was started up on Thursday consists of a 10 000 kW Parsons turbo-alternator running at 3 000 revs. per min., generating current at 6 600 V. with a frequency of 50. It is of the single cylinder pure reaction type with end-tightened reaction blading at the inlet end so that a large radial clearance is obtained without detriment to the efficiency. The turbine shaft is a solid forging without any built-up parts. The stator of the alternator is cast in one piece and is uniformly cooled by Parsons system of forced ventilation of alternate inlet and outlet compartments. The rotor is built from a solid forging. The set is fitted with a Heeman and Froude air filter.

Of the older plant, two of the 300 kW dynamos which were connected together on the same shaft are now driven by a 300 H.P. synchronous motor and are used for charging the batteries, performing balancing operations, correcting power factor, and testing the a.c. network.

The old 1 500 kW d.c. reciprocating sets which form the first extension to the station are still used on peak loads, while the 1 500 kW Bruce Peebles converter supplies the d.c. system in the neighbourhood of the station in co-operation with the converter mentioned above.

Steam Raising Plant.

The extensions to the generating plant have necessitated the erection of a new boiler house containing eight Babcock and Wilcox boilers each with a capacity of 3 300 lb. of steam per hour. These supply steam at 225 lb. pressure, and are fitted with superheaters, Green's cast iron economisers, induced draft, and chain grate stokers. The total steam temperature is 700 deg. F. The coal bunkers are above these boilers and all the coal used is delivered from them into boots which operate on a runway. Each boot is provided with a weighing machine so that the coal drawn from any bunker can be measured. The boiler house is well equipped with CO_2 and draft indicators, which are placed in as prominent a position as the steam gauges.

It may be added that Mr. Robinson has in mind the erection of a further boiler house in which a steam pressure of 350 lb.

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per sq. in. will be used. The new turbine has therefore been designed to run at 300 lb. pressure at the stop valve, though it is at present bladed to operate at its best efficiency at the present pressure of 200 lb. The new set is provided with a Heenan and Froude air filter, and with Hick Hargreaves condensers. These condensers have a capacity of 120 000 lb. of exhaust steam per hour, and maintain a vacuum of 28·5 in. when supplied with cooling water at a temperature of 70 deg. Fahr. The cooling surface is 19 500 sq. ft., and the amount of cooling water required is 840 000 gal. per hour. This cooling water is supplied by two vertical Rees-Roturbo pumps driven by 200 H.P. motors. The condenser is coupled direct to the turbine exhaust flange, which is supported on springs which are so proportioned that they can take the weight of the condenser and circulating water, a total of 62 tons, and so all strain on the turbo exhaust flange is eliminated.

The Hick-Breguet ejectair extracting apparatus has a capacity of 110 lb. of air per hour, while the extraction pump

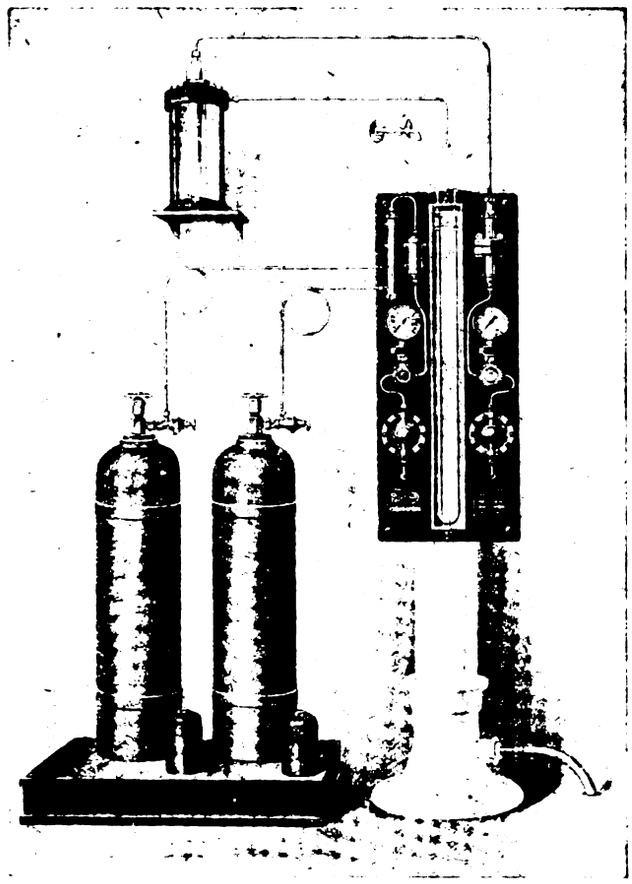

FIG. 2.—THE CHLORINATING PLANT FOR PURIFYING THE CIRCULATING WATER.

has a capacity of 160 000 lb. of water per hour when running at a speed of 1 440 revs. per min. It is directly operated by an 11 H.P. motor.

The secondary ejector of the Hick-Breguet ejectair discharges to a Royles heater condenser, and this is provided with a bye-pass arrangement to cut out the heater when required. The duty of the heater is to deal with 133 000 lb. of feed water per hour at a temperature of 90 deg. Fahr., and to condense 860 lb. of steam impregnated with air per hour at a pressure of 16 lb. per sq. in. absolute.

The necessary cooling water for the operation of the station is obtained from the River Lea through a revolving screen which is fitted with a windscreen to prevent leaves and other rubbish being blown off it in a high wind.

As already mentioned in these columns, a good deal of trouble was experienced by Mr. Robinson with the condensing owing to the character of the cooling water. When cooling water is drawn from a river, canal, fresh water lake or sea, it is frequently found that a glutinous clinging mud adheres to the tubes, and that this can be only removed by passing a stiff brush or other form of clearing rod through them. At Hackney, as a result, there was a serious drop in vacuum, and cleaning at a cost of £5 8s. per week had to be resorted to to keep the plant in a reasonably efficient condition. The character of the mud led Mr. Robinson to suspect that the trouble was due to the growth of some micro-organism, and that it might be overcome by sterilisation. As a result of a further examination of the question, the Paterson Engineering Co. installed an experimental chlorinating plant at Hackney, and within a few months it was found that a reduction in the weekly cleaning cost of the condenser from £5 8s. to £2 9s. was obtained. At the same time, the maintenance of a higher average vacuum was possible, with the result that an amount of £28 10s. per week, with coal at 23s. 3d. per ton, was saved on fuel, and there was also an economy in the energy used for pumping, owing to less circulating water being required.

The Chlorinating Plant.

The apparatus employed for this purpose is known as the chloronome, and, as illustrated in Fig. 2, its object is to chlorinate the water with pure chlorine so that the algæ are sterilised. The chloronome used is of the manometer type, the chlorine gas at a pressure of about 75 lb. being drawn off through two connecting valves and a filter which removes any impurities.

The constant pressure, which is necessary for the maintenance of a uniform rate of supply, is obtained by the use of two pressure-reducing valves arranged in series. By the manipulation of the regulating valve any required rate of discharge within the limits of the instrument can be obtained precisely as indicated on the manometer.

In operation the measured volume of the gas passes through an acid seal, and thence to the bottom of the absorption tower, which is of white glazed earthenware packed with pumice. A tiny trickle of water through the tower absorbs the measured volume of gas and flows out at the base as chlorine water. This chlorine water is applied to the circulating water and sterilises the algæ. An acid seal consisting of a quantity of sulphuric acid isolates the chloronome and its connections from the water side of the instrument. The proportion of chlorine gas required for cleaning is so minute that no corrosive effect is possible in the pipe-lines and condenser tubes. Very little attention is required at the plant, and the adjustments are of the simplest nature.

The new switchgear, which is of Reyrolle and Co.'s manufacture, comprises one 10 000 kW 1 500 A turbo-alternator panel, with Merz-Price generator protection, seven 800 A feeder panels with Merz-Price feeder protection, two 20 000 kW 2 000 A busbar coupler panels for controlling the supply between the new and the old switchgear, and two synchronising panels.

There are no reactances external to the new machine, but the 14 000 kW plant controlled by the old board is connected to the 10 000 kW on the new board through a coupling switch which is fitted with an overload device. There are duplicate busbars on the switchboard and duplicate mains throughout the system. It may be added that an interesting type of feeder pillar for use in the undertaking has been designed by Mr. Bowden, chief assistant at Hackney. These feeder pillars are fitted with solid links on the neutral side, and with two fuses in parallel on the outers. By using a leather thong, one or other of these fuses can be withdrawn for cleaning purposes, while the whole equipment is most accessible and well thought out.

ELECTRIC FURNACE PERFORMANCE.

A recent issue of "Stahl und Eisen" gives particulars of some tests of a Röchling-Rodenhauser steel furnace, having two channels and two induction coils and supplied from a three-phase circuit on the Scott system with current of 200 A at 6 000 V and a frequency of 16·6. The capacity of the furnace was 12 tons. In addition to the electric measurements, temperatures were determined by means of a radiation pyrometer, and thermocouples were distributed so as to allow of the determination of heat losses by radiation and conduction. The volume and temperature of the cooling air were also measured, and analyses were made during the heat of four hours of eleven steel samples, eight slag samples and ten gas samples. The thermal efficiency of 62 per cent. was satisfactory for electric furnaces, and would have been higher still if the channels had been better covered with dolomite, and the consumption 256 kWh per ton of steel. It is claimed this could thus have been reduced by 12 per cent. The electric efficiency of the furnace was rather low, 60 per cent., mainly owing to the low average value of the power factor, 0·35; the furnace and the copper coils had been designed for a higher power factor, and with smaller copper losses this efficiency might easily have been raised considerably.

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CONDENSER TUBE CORROSION.

Some Causes and their Remedies.

In a lengthy paper on the causes of the rapid corrosion of condenser tubes read by Messrs. G. D. BENGOUGH and R. MAY and Miss RUTH PIRRET, before the North-East Coast Institution of Engineers and Shipbuilders on October 19th, it is stated that the corrosion of condenser tubes must be considered as primarily a chemical problem, and therefore the concern of the chemist and metallurgist, rather than that of the engineer. Extended investigations have shown that some of the most important factors in accelerating corrosion are to be found in the conditions to which the tubes are subjected and that these conditions have undergone certain changes in accordance with the general progress of engineering, such as the use of higher vacua and higher water-speeds. Ordinary tubes, such as 70 : 30 brass and similar alloys, do not stand up well to certain conditions liable to occur in modern condensers and tubes of normal composition and structure may fail with a rapidity seldom or never experienced before the last few years. The type of corrosion exhibited by such tubes is characteristic of modern conditions, and it is particularly to this problem that the paper is devoted.

Protector blocks of iron, steel, zinc or aluminium have little or no effect in checking corrosive action and even currents of 3 to 5 A per 1 000 sq. ft., which tend to make the tube cathodic, do not effect any useful amount of protection. Experiments show that using a current density as high as 10 A per 1 000 sq. ft. do not prevent failure.

Two Possible Lines of Work.

The critical period for a tube is the first few weeks of its life ; if it survives this period without corrosion starting it is quite likely never to suffer.

There are two possible directions along which a palliation for this serious menace may be sought ; the search for new alloys, and a system of recording the exact positions of all tube failures in condensers with a view to the ensuring that new or untreated tubes are not placed in those positions.

Active investigation into the properties of more resistent alloys is now being conducted, but unfortunately the problem is urgent—a statement that may be illustrated by the present authors' experience of ordinary 70 : 30 brass tubes failing repeatedly in certain power-station plants within periods varying from seventeen days to six weeks, and in marine practice within three or four months. In other condensers, apparently quite similar, and working in the same station or sister ships, the average life of a tube may be measured in years. Fortunately the latter is more usual, but the uncertainty is a serious matter. Such a state of affairs calls for careful consideration from every point of view, and it is believed that engineers may be able to assist in reducing the number of very rapid cases of corrosion when once certain facts concerning the phenomena present have been placed before them.

Minor Variations Important.

In dealing with corrosion problems, minor variations may be most important, such as the actual water speed through a given tube, the variation of the speed near the tube wall, the extension of turbulent motion along any one tube, the presence or absence of entangled air and the discovery of the tubes which are passing the largest quantity of such air.

Careful analysis of the material and manufacture of condenser tubes shows that the cause of failure is not due to bad mixing, and that the presence of spots or areas of copper in corroded tubes is due to copper being redeposited from solution as the result of corrosive action. Impurities such as tin, iron, nickel, manganese, lead, bismuth and antimony have not been observed to affect the rate of corrosion in any important degree, and though the presence of arsenic may be harmful in certain conditions, and beneficial in others, its presence cannot be the main cause of the rapid type of corrosion under discussion. The only conclusion, therefore, that can be drawn from the large amount of data at present available is that there is no simple relation between the composition of ordinary tubes and their lives within the limits that commonly occur.

Quite apart from chemical composition, tubes may differ among themselves in physical properties, and it is reasonable to suggest that there may be some relation between hardness and corrodibility. Here again, however, all the evidence goes to show that there is no such direct co-relation.

Apart from recording the lives of tubes in practice and attempting a correlation between them and their chemical composition, another line of investigation was pursued in the endeavour to estimate the influence of the material of tubes on the rate of corrosion ; and the behaviour of tubes of known composition and properties when placed in different condensers, and in different positions in the same condenser were observed.

To do this the whole condenser is retubed with tubes made by, say, three different makers, A, B and C. At least 200 tubes by each maker are used, and the condenser is then run in ordinary conditions of practice. As soon as a tube fails it is withdrawn and its position and date noted on the plan. It is then replaced by another tube by the same maker. It often happens that this tube will also fail quickly, and that several tubes in the same position will fail one after another, while tubes in other parts of the condenser stand up well.

At first sight it would appear that it is the tubes that are at fault, and to test this they may be replaced by tubes of another make, in which case either no more failures will occur, showing that the first tubes were probably bad, or the second set of tubes will fail in the same, or nearly the same, position as the first. The latter is nearly always found to be the case. In order to decide definitely whether the first set of tubes were faulty, it is desirable to place them in another section of the condenser, and it is usually found that they endure as well as the second maker's did in that position. The only conclusion to be drawn, therefore, is that the main factor in determining the corrosion is to be found in the conditions in certain parts of the condenser.

The position as regards the effect of the chemical and microstructural character of condenser tubes on corrosion may be briefly summed up as follows :—

Within the limits of composition usually obtainable in 70 : 30 and Admiralty brass tubes there is no direct relation between such composition and the extremely rapid type of corrosion which is now under consideration. If, however, arsenic occurs in the tube this statement is subject to certain reservations ; with unusually large amounts of "impurity" such as 1 per cent., the tubes may behave very badly.

Definite Conclusions Formed.

The variations in crystalline structure and physical hardness which commonly occur between different batches of such tubes are not directly related to the rapid type of corrosion under consideration ; they are no more than minor factors.

The proportion of certain minor constituents of brass tubes, particularly arsenic and iron, exert an influence on the nature of the corrosion products, especially as regards the presence or absence of metallic copper. All tubes which reach the market are not, therefore, good, and the most frequent defects to be found in ordinary 70 : 30 and Admiralty tubes are the presence of flaws, laminations and spills. Such flaws have in the past been cited as one of the initiating causes of local corrosion. The authors have made a very large number of observations on this matter, and have formed the definite conclusion that they are not originating causes of the rapid corrosive action now being considered. Tubes known to be quite free from such flaws have suffered the rapid type of action, and tubes containing them have not corroded more rapidly in the early stages than normal tubes. In the later stages of corrosion, flawed tubes are liable to considerable losses of metal by "exfoliation," a process of mechanical loosening which is sometimes associated with corrosion.

Tubes containing flaws and laminations should be rejected by users on mechanical grounds, as once corrosive action is started the tube wall is liable to lose an undue amount of metal. They do not therefore initiate rapid corrosion in conditions which could not occur in their absence, and cannot, therefore, be regarded as the cause of the action under discussion.

Dealing with the conditions in which tubes are placed, it is pointed out that the constituents of waters that are harmful in boiler waters may be almost innocuous in condensers. The reasons for the difference are that the behaviour of steel and brass towards the same water may be widely different, the temperatures obtaining in boilers and condensers are widely

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different, and the degree of concentration of certain salts in solution may be much greater in the case of boilers, even when cooling towers are used for condenser water, whereas the degree of concentration of other salts, especially sodium chloride, may be much greater in condenser circulating waters. By far the greatest number of corrosion troubles arise from high chloride waters.

Such waters may contain anything from about 500 to 2 500 or more parts of chloride per 100 000. The scale formed on a brass tube contains not only constituents formed from the copper, but also some formed from the zinc; and the rate of corrosion of copper or brass in a liquid is largely determined by the rates at which metalions are removed from the metal surface and oxygen reaches it. If the corrosion products form a scale which is highly pervious, rapid corrosion will take place; if the scale is only slightly pervious, the metal will be largely protected. Thus the chemical stability of copper and many of its alloys in natural waters is mainly dependent on the nature of the scale formed.

Other Physical Factors.

Other physical factors which determine the protective powers of a scale of given composition are its power of adhesion to metal when wet and when dry, its resistance to erosion, its thickness, its state of aggregation, whether crystalline, gelatinous or porous, and its permeability to water and oxygen (in solution). An indirect factor is the temperature, which affects certain of the above direct factors and also the composition of certain scales. In addition to the above characteristics a scale of high protective value should be chemically stable in the prevailing conditions. The local chemical breakdown of a scale is one of the causes of local action, and in the older condenser practice characterised by a low vacuum, a low water speed, and a minimum of foaming and turbulence, the most important one.

The physical conditions of many scales is notably different when wet and when dry; when wet, the scale is distinctly gelatinous in character: when dry, it may be largely crystalline. The protective value of a scale cannot always be judged by its properties in a dried state. The properties of a scale, as regards adhesion to metal, resistance to erosion and other physical factors, are a matter of great practical importance and have been studied in detail by the present authors, who give a detailed description of the apparatus employed in the experiments.

These experiments have led to most interesting results, which may be briefly summarised as follows: (1) The presence of entangled air in a stream of sea-water greatly increases the power of corrosion of that stream on 70:30 brass and a variety of copper alloys. (2) If the temperature of the water be raised from atmospheric to 40 deg. C., the rate of corrosion of copper and some of its alloys, such as 80:20 copper-nickel, is increased; the rate of corrosion of 70:30 brass is decreased. (3) The higher the water-speed up to 25 feet per second the greater the corrosion. (4) The volume and state of subdivision of the air affect the rate of corrosion. (5) Electrolytic protection of the ordinary type has but a very limited effect in preventing the corrosion. Protection is effective only near the ends of the tubes, and sometimes fails even at these. (6) The critical period in the life of a tube is its early life when there is little or no sea-scale on the tube; at this stage tubes are very susceptible to attack by aerated sea-water. (7) Certain types of sea-scale may be very resistant to erosion by air-water jet, and, consequently, protect the tube. The scales on old tubes that have stood up well in practice may be hardly noticeably attacked in conditions in which a new tube would be severely corroded. (8) To some extent the production of scales resistant to rapid air-water attack can be carried out artificially. (9) Such scales should be useful in tiding the tube over its early critical period and preventing rapid failure. In due course such scale may or may not break down owing to chemical changes; in the former case the tube may eventually fail by local pitting or general thinning. (10) Certain scales even when very thin, *i.e.*, only a few hundredths of a mm. thick, may be highly protective.

The First Question to Decide.

In reviewing the practical conditions in the light of experimental results and experience, the authors state that the first question to decide in studying a plant in which rapid corrosion has occurred is whether or not entangled air is present in the water stream flowing through the condensers. If severe corrosion of new tubes appears in any plant it is advisable to collect evidence on this point. There are three obvious sources of entangled air in an ordinary condenser plant, namely, air leaks in the pipe line, water-ends and valves whenever the pressure is below atmospheric pressure; air which has passed out of solution in the water owing to local reductions of pressure resulting from sudden changes of velocity in pumps, water-ends, pipe lines, etc., and entangled air already present in the water supply and sucked in with it.

In many power stations condensers are found at the top of a siphon. In such cases the water-ends and a considerable length of inlet piping may be the seat of air-leaks, and a single loose nut may be the cause of the corrosion of new tubes.

A particular instance of failure may be quoted in which three tubes failed successively in identically the same position in a condenser in the course of three months. In such a case as this it is quite clear that the failures are not due to faults in the tubes, for it is incredible that three bad tubes should have been successively selected for replacement in that position, and that all three tubes should have been faulty at the end which happened to have been placed at the inlet end of the first pass, for it was there and there only that failures occurred.

HIGH-FREQUENCY INDUCTION HEATING.*

BY E. FR. RUSS.

The high-frequency induction furnace is, by itself, of great simplicity. It is of quite a different construction to the usual melting furnace, the chief difference being in the use of current at high frequency (10 000 to 12 000 periods). When currents of such high frequencies are used, a peculiar inductive effect without linking of the magnetic circuit is possible. A conducting material between the walls of a simple cylindrical hearth, or in a crucible, can thus be heated, and a furnace can be charged with fresh material, worked, and emptied, continuously, in the same way as with ordinary furnaces. Naturally the construction offers some difficulties. At present the maximum input is about 20kW per phase—60kW for a three-phase furnace. This limitation is due to the high-frequency converting apparatus, for which a group of condensers is used. By the correct dimensioning of the capacity and self-induction of the oscillatory circuit the desired frequency can be reached.

The high-frequency "generator" consists of three essential parts: an oil-cooled transformer with internal reactance, a set of static condensers, and a metallic spark-gap. These are mounted in a metal housing, standing on the floor, with a switchboard in front. A main switch is provided, together with a wattmeter and fuses. A circular handle raises or lowers the electrodes of the spark-gap, thus regulating the energy absorbed. The number of condensers is practically proportional to the kilowatt rating of the generator, a 20kW set having 12 units, six on one side and six on the other side of the oscillatory circuit. By means of the transformer the high-frequency and normal-frequency circuits are kept separate.

A 20kW generator occupies a space of 73 cm. long, 103 cm. deep and 168 cm. high. The cost of transformer and condensers reaches 80 or 90 per cent. of the total cost of the furnace equipment.

In practice the high-frequency furnace has been found to be reliable and efficient, so long as the limit of 60-kW is not exceeded. For simplicity, ease of working, length of life, and cost, it is not to be equalled within the range mentioned.

High-frequency furnaces for practically all metals have been built. There are several classes:—

1. *High temperature and vacuum furnaces.*—The inductor-coils of such furnaces are usually composed of copper-tube spirals, circulated internally with water for cooling. The high-frequency potential is applied to the ends of this spiral.
2. *Electric crucible furnaces.*—The crucibles and the inductor coils surrounding them are of conical shape. These furnaces are specially suited to working the precious metals, mainly gold and platinum. The heating is very quick.
3. *Coinage furnaces.*—These are cylindrical, with a surrounding helix of copper tubing carrying the high-frequency energy.
4. *Graphiting furnaces.*
5. *Mixed types, etc.*

The application of high-frequency induction heating is practically without limit, provided that the high-frequency current is obtainable in sufficient quantities and at an economical price.

* Abstract of an article in the "Electrotechnische Zeitschrift."

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INDIVIDUAL-AXLE DRIVE BY TWIN MOTORS FOR ELECTRIC LOCOMOTIVES.*

By J. WERZ.

The superiority of the individual-axle drive over side-rods for electric locomotive transmission, where the speeds exceed 50 km per hour, has led to its adoption for most modern types in such cases. Several different forms of individual axle drive have been developed by such firms as Brown, Boveri and Cō., the Maschinenfabrik Oerlikon, and the S.A. des Ateliers de Sécheron, of Geneva. The various forms can be divided into two main groups: first, where the gear wheels are situated outside the driving wheels, and second, where the gears are between the road wheels. Both the B.B.C. and M.F.O. designs belong to the former group, and these have already been described in various places. To the second group belongs the Sécheron arrangement. The main difference

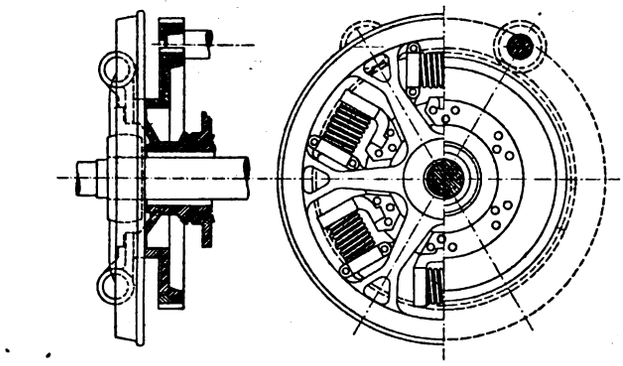

FIG. 1.—DIAGRAM OF QUILL AND SPRING DRIVE.

between the two groups is that with inside gearing a ratio of 1 : 6 can be reached, whereas with external gear wheels the highest ratio obtainable without additional means is about 1 : 2·5. These figures are for the customary driving wheels of 1 600 mm. diameter.

The Sécheron system employs a pair of motors, in a common housing, driving on to a single gear wheel at one side. Both motors and gear wheel are mounted on a hollow quill embracing the driving axle. The gear wheel is rigidly connected to the quill, which runs in bearings on the motor housing: the latter is fixed to the frame. The driving connection between gear wheel and road wheel is by means of a set of circumferential spiral springs, as indicated diagrammatically in Fig. 1.

With high voltage d.c. traction, the twin motor drive provides an easy means of series-parallel speed control, as for

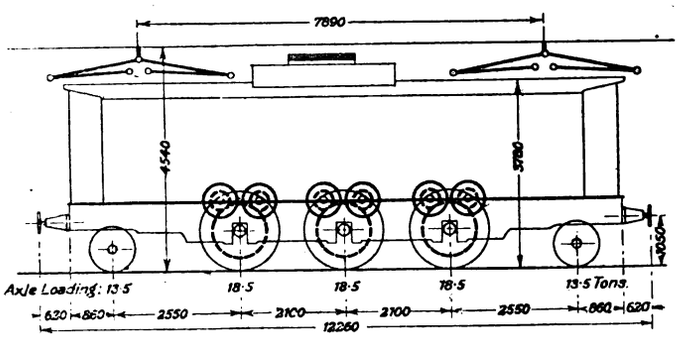

FIG. 2.—1AAA1 SINGLE PHASE LOCOMOTIVE WITH TWIN MOTOR INDIVIDUAL-AXLE DRIVE.

every axle there are two armatures, giving in most cases a convenient number for switching arrangements, and at the same time keeping the voltage per motor within desirable limits. With single-phase locomotives the possibility of connecting two armatures permanently in series enables the voltage per pair of motors to be raised, thus reducing the current demand on the secondary side of the transformer. This leads to lighter switching apparatus. Further, a pair of motors forming a "twin motor" weighs less than a corresponding single motor of the same output.

* Abstract of an article in the "Electrotechnische Zeitschrift."

Summarised, the advantages of the twin motor over the single machine are: (1) smaller weight; (2) smaller space occupied; (3) better power factor on account of higher speed; (4) smaller inertia in rotating masses; (5) series connection of two armatures (lighter apparatus); and (6) simpler construction.

As disadvantages must be mentioned the more numerous bearings, the limitations in the lengths of the motor axes, and the inaccessibility of the commutators. The latter is not serious, however, as the commutators are small.

The twin-motor quill drive is built by the S.A.A. Sécheron under licence from the Westinghouse Co. of America.

1 AAA 1 Locomotives for the Swiss Railways.

The following are, in brief, the particulars of a series of locomotives supplied to the S.F.R. by the Sécheron Co.:—

Length over buffers	12 260 mm.
Total wheel base	9 300 mm.
Driving wheel base	4 200 mm.
Driving wheel diameter	1 610 mm.
Pony wheel diameter	930 mm.
Gear ratio	1 : 5
Total weight	81 tons
Weight of mechanical part	44 tons
Weight of electrical part	37 tons
Adhesive weight	55·5 tons
Axle loading	18·5 tons
Power at wheel rim (1 hour)	2 000 H.P.
,, ,, (continuous)	1 700 H.P.
Line voltage	15 000 V.
Frequency	16⅔ cycles
Motors	Single phase, neutralised series.
Rating at motor shaft (1 hour)	700 H.P.
,, ,, (continuous)	600 H.P.
Speed at 1 hour rating	1 080 revs. per min. = 65 km per hr.
Speed (maximum)	90 km per hr.
Voltage per twin-motor	680 V.

A locomotive is shown diagrammatically in Fig 2. After 1½ years' operation the Westinghouse spring drive has been found to be very satisfactory. A very flexible drive is obtained, giving good utilisation of the adhesion. At starting the motors can rotate by about 20° and oscillate by this amount before the driving wheels have actually started their motion. In this way the starting conditions of the motors are vastly improved, as there is much less risk of overheating of the coils standing under the brushes.

THE DARIMONT PRIMARY BATTERY.

In these days it is unusual to meet any new type of primary battery with characteristics differing materially from those with which everyone is familiar. The new Darimont battery however, appears to be an exception to this rule, as it is capable of giving a considerable current at a steady voltage for much longer periods than cells of the Leclanché type. The Darimont cell, which has been invented by Mr. L. Darimont,

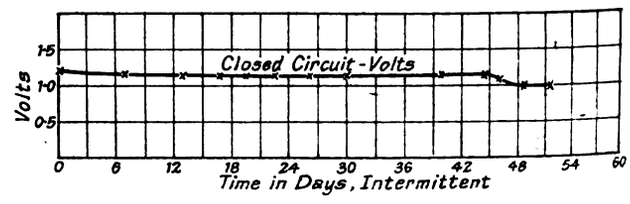

FIG. 1.—VOLTAGE MAINTENANCE CURVE OF DARIMONT CELL.

is of the two-fluid type. It, therefore, has a porous pot, but diffusion between the two liquids is practically negligible. The plates are of carbon and zinc, and the liquid depolariser round the carbon consists largely of ferric chloride. The electrolyte around the zinc consists of a paste or viscous emulsion made up of sodium chloride, calcium carbonate and other materials, so that the electrolyte is always maintained neutral. Consequently, local action is practically non-

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existent, and the electrolytic corrosion of the zinc during the action of the cell is extremely uniform. Notwithstanding the fact that the cell is a two-fluid one, we understand it can be used not merely to give small currents continuously, but to give intermittent currents for long periods.

The e.m.f. is about 1·6 V, and the internal resistance varies very little during discharge. There is no smell nor crystallisation of salts, and the chemicals used are not dangerous or objectionable in any way. The cell is easily recharged, and the paste and depolariser are supplied in appropriate quantities for this purpose.

Such a cell should find considerable application in such work as railway-track signalling, wireless telegraphy, telegraphs and telephones, burglar alarms, testing laboratories, emergency lighting, etc. Fig. 2 is a view of the cell in a glass container, and Fig. 1 shows how the e.m.f. is maintained

FIG. 2.—GENERAL VIEW OF DARIMONT CELL.

in the case of the T.15 type when giving an intermittent current of 0·75 A for two hours daily. For working valve sets a current of this magnitude is frequently required for heating the filament, and so far accumulators have been largely used for this purpose. In many localities, however, the charging of accumulators presents difficulties, and a reliable, easily-managed primary battery would be welcomed.

The battery is made in various sizes by Darimont Electric Batteries, of 536, Salisbury House, London, E.C.2.

A GENERATOR FOR WIRELESS WORK.

Evershed and Vignoles' New Design.

The problem of providing the high tension energy for wireless transmission is one that has received a number of solutions. For this purpose a high frequency alternator possesses many advantages, but it has the drawback that the voltage wave is never free from ripples and that a humming is therefore set up which interferes with the operation of the apparatus. This can be to some extent overcome by careful design and to a greater extent for the use of a smoothing device. But however carefully the generator is constructed some ripple can be detected, but it can be reduced to such a value that unless the circuit has resonant characteristics of commensurate frequency it will be quite unnoticeable. If on the other hand low frequency oscillations are built up by resonance it is possible by modifying the circuit to eliminate the oscillations unless the initial ripple is sufficiently powerful to set up forced vibrations. This is the course that has been followed in the new wireless generator made by Evershed and Vignoles, by whose use it is claimed transmission comparable with that obtainable with high tension batteries is secured, while smoothing devices can be dispensed with. This is effected by so arranging the commutator segment, the distribution of the flux between the pole pieces and the armature design that the currents generated when superimposed will give a steady uni-directional current.

No pains have been spared to make the Evershed Generator as sound mechanically as it is electrically, and for this reason the general lines of the Megger generator, developed as the result of thirty years experience, have been followed. For instance, the special form of commutator and brushgear which characterises the Megger, has been adopted, whilst the armature spindle is mounted on roller bearings and may be run for prolonged periods without attention. An insulating strip on the crank handle is provided to prevent body capacity effects through contact of knuckles with the metal crank.

Two types have been standardised, differing only in the method of driving. In the hand driven unit, a spur gear reduction with a ratio of 27 to 1, is interposed between the

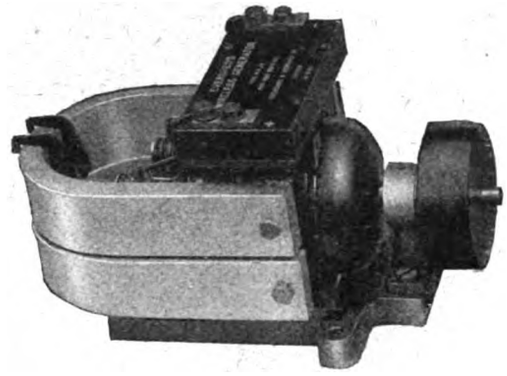

FIG. 1.—GENERAL VIEW OF EVERSHED'S NEW WIRELESS GENERATOR.

driving handle and the spindle, with a ratchet gear to prevent rotation in the wrong direction. The ratchet drive also serves another useful purpose in that it allows the armature to overrun the handle if this is suddenly slowed down or stopped, thus preventing damage to the machine. The belt driven type may be run by a small motor, $\frac{1}{10}$ or $\frac{1}{8}$ h.p. being ample, connected up to a house lighting circuit, and to ensure that the best results are obtained, they are prepared to supply belts of the most suitable form.

Both types of generator are built to give outputs of the order indicated on the curves reproduced herewith (Fig. 2). They may, of course, be much more heavily loaded, but over-

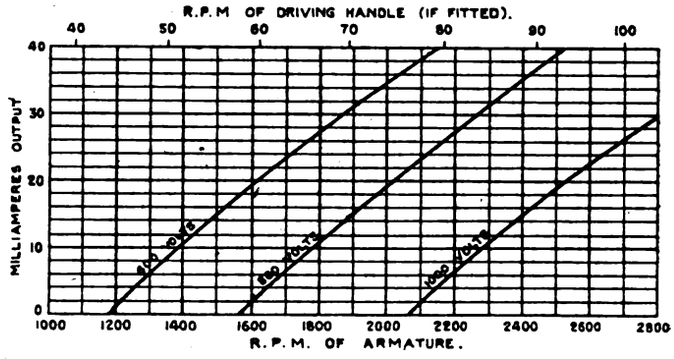

FIG. 2.

loading, if excessive, is attended by imperfect commutation. It is also necessary to guard against short-circuiting the terminals of the generator.

It is important to notice that when the generator is motor driven the motor should be kept at least 18 in. away from it and not be directly coupled unless a flexible coupling and intermediate shaft of non-magnetic material are used.

The annual meeting of the Provincial Electric Supply Committee took place at the Holborn Restaurant on Tuesday, Sir Harry Renwick, chairman, presiding. Among those present were Lord Erskine, Sir James Devonshire, Sir James Szlumper, Sir Henry Mance, Dr. J. A. Hosker, Alderman C. Spurgeon, Messrs. C. G. Tegetmeier, C. J. Somerville, G. W. Spencer Hawes, A. A. Campbell Swinton, F. E. Gripper, E. MacGregor Duncan, J. H. Edwards, W. B. Esson, H. Bentham, A. N. Rye, Napier Prentice, H. D. Leather, Talfourd Ely, F. C. McQuown, T. W. Cole, G. E. S. Venner, H. B. Harvey, G. Verity, G. H. Jackson, J. A. Saner, E. Gimingham, W. Rendell-Baker, H. C. Walker, and H. Brown. The usual business was transacted, including the re-election of the executive committee *en bloc*.

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"SALE OR RETURN."

By "A SPECTATOR."

The second E.D.A. Salesmanship Conference of the season was remarkable for several reasons. A large and critical audience, an excellent Paper full of sound common sense and practical notions, and a Chairman in the person of a central station engineer sincerely meaning to achieve co-operation, are the cardinal factors which explain why the meeting was such a success.

The author took as his subject "How to Organise and Promote Retail Showroom Sales," and there is no more vital subject in the whole problem of electrical merchandising; and whatever is vital to merchandising is as much so to other sections of the industry. It is not irrelevant to stress this point, because it is the habit of so many to argue that electrical merchandising is the tail of the electrical dog. I shall not make the mistake of suggesting that the reverse is true, because in my judgment there is far too much use made of the "dog" analogy. A dog's tail is an important part of the dog, and whichever section is the tail of the industry, it is entitled to equality.

Showroom Sales Vital to the Industry.

As I have said, to organise and promote showroom sales is vital to the whole industry, and for an electrical contractor and retailer trading as a private individual there is no other issue which need take up any time. Strong supporter though I am of the contractor and retailer, I cannot shut my eyes to the fact that unless we have a great change of thought and more vision displayed, the system of private traders as channels of distribution for electrical merchandise cannot survive. One of two things will, in fact must, come about. Either supply undertakings will go "all out" with a bold merchandising programme, or manufacturers will set up a system of direct trading with the public. What are the reasons for this? The fact is that the average contractor is too much concerned with his position as "contractor" and loses sight of the fact that a "merchant" is a trader who works on a system going back for generations and which has made many men wealthy. "Tyre, whose merchants are princes" should be an inspiration to those who fear that they will lose by leaving the narrow path of contracting. But enthusiasm and vision for an idea will not make merchant princes of us unless we learn also the economics of business, By this I mean a sound knowledge of how to buy as well as how to sell; recognition of the fact that stocking one's showroom with material on "sale or return," and buying on long credit, is grossly unsound, and any business built on such a plan is a business built on sand.

Only One Method of Business Building.

There is only one method by which a business can be built up that has been proved in every trade. This method is to buy merchandise in the best market, free from any obligations and "tied up" indebtedness to any particular manufacturer. No buyer can perform his task with energy and perception if he, or the company he represents, is labouring along under such a state of affairs. The industry is chock full of fallacies, and I am sorely tempted to try and disentangle some truths from them, but this is not the time and it cannot be done in a few sentences. Many of these fallacies are dying slowly, very largely as a result of the E.D.A. conferences. One or two, however, persist, and of these is the fallacy of thought on this "sale or return" question.

It was, however, strikingly significant that there should have been such marked approbation and support of the remarks made by the author of the Paper, and the speakers in the discussion, who exposed this fallacy. There is something prophetic in the fact that one speaker who tried to support this false idea met with little support. To argue that because manufacturers are so "foolish" as to offer these terms they must be taken advantage of, simply reveals how barren we are of clear sound thinking. Granted that the buyer must secure showroom fittings and other appliances at the most advantageous terms, and prices, it is possible to obtain, there are other sound alternatives.

There is no purpose in any digression on this question because it is one which cannot be dealt with in a few words, but one simple method can be mentioned very briefly. Plan to buy merchandise from a very selected list of manufacturers, and if the matter is put frankly it will be found that they will deal both frankly and generously with the buyer. Many manufacturers make use of what is known as the "showroom discount" idea. This plan is to supply a well assorted range of material, particularly fittings, at an extreme discount—very often 20 per cent. better than their ordinary trade terms. This plan has proved to be one of the most simple, and like all simple schemes the most efficacious. It also creates in the mind of the manufacturer a feeling of confidence in the contractor and retailer, and that he is a man of solid worth. If this is achieved and an extra 20 per cent. secured, then the buyer has brought off a good deal.

Commission to Salesmen.

Next in order of important issues which the author touched upon was commission to showroom salesmen. It was plainly put that in his opinion the only sound sales-producing method to adopt was to pay commission on the *selling* price. The sound wisdom of such a policy cannot be denied. It is surprising, however, how hostile so many are to any suggestion on this question. How many like to treat it as a "private" matter between themselves and their employees. No problem is any the worse for being regarded from a fresh viewpoint. But when all is said and done, whatever commission basis is adopted, it cannot of itself bring increased turnover. We need a higher standard among salesmen, and such men can only be recruited by a good basis salary *and a commission on sales in addition*. I would stress this point because we are only beating the air if we attempt to solve our problem of the lack of first-class salesmen and yet fail to admit this fundamental. In our ignorance of what is real economy we employ men at low salaries or on commission only, and they are therefore simply canvassers and hawkers. They are the type of man one speaker in the discussion gave us a graphic description of—"slovenly looking, sadly needing a wash, a soft collar a few days the worse for wear, a pair of old flannel bags and a sports jacket!"

Lady Salesmen.

Several useful expressions of opinion were made on this question of lady "salesmen." It is very much of an innovation for some of the older school, but the idea must prevail. It is but a few short years ago that other retail trades worked almost exclusively with male assistants, but the conditions have changed. And so it must be with our own trade if we are to succeed in making the "idea electrical" a question of domestic interest. We shall not be hampered by the lack of electrical knowledge or experience which the majority of lady applicants lack. They do not need it, and the trade does not need it. They only need enthusiasm and a sincere belief in the "idea electrical." The lady from Hackney is striking proof of this. The feminine and refreshing views which she expressed on Friday shook us up, loath though some of us will be to admit it. We shall gain considerable help if we enlist the womanish and maybe illogical point of view. We suffer from too much logic which cramps our imagination.

An Electrical League Needed.

As at previous conferences, the call was for co-operation. Everyone desires it, but no practical plan seems to take shape in the minds of any of us. We have, of course, several established institutions which, on the face of things, should be able to achieve this much-desired co-operation, but they suffer from the political and family squabbles of the past. The author of the Paper referred to an "Electrical League," and on this point perhaps I may be permitted to remark here that I made a suggestion on these lines in THE ELECTRICIAN last February. The idea, even at that time, was not original. "Electrical Leagues" have proved quite a success in U.S.A. and there is no reason why they should not be even more so here. It would be a new institution "starting in" with a fresh standpoint, and, as I have said, free from all the old bickerings. Further, it would be able to embrace every section of the industry on the retailing, supply, factoring and manufacturing sides. The E.D.A. is a powerful force for good, but it cannot function in every direction and on everything. Further, the machinery of the E.D.A. is not adaptable for the development of "local" co-operation. On the score of this local co-operation much could be said and done. We certainly want more co-operation in London. We do need an Electrical League.

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CORRESPONDENCE.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

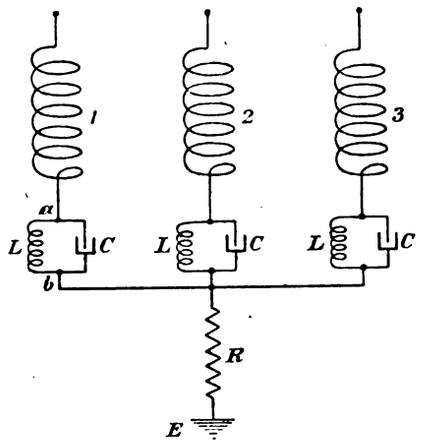
IMPROVING THE SHAPE OF ALTERNATOR WAVES.

[To the Editor.]

Sir,—In their recent paper before the British Association, entitled "A Method of Improving the Wave Shape of Alternators," Prof. Marchant and Mr. Turney described (see THE ELECTRICIAN, October 5th, p. 362), an arrangement consisting of a condenser and reactance shunted across the line, the condenser and reactance being related in well-known manner for producing resonance.

A brief description of an harmonic filter which is being successfully used by the British Thomson-Houston Co. for the same purpose may be of interest. This was referred to by Mr. Jack in the discussion on the above paper. He spoke extempore, however, and the localities he mentioned were not actually where the device had been used.

When the matter was first investigated, the machine concerned was a 550 kVA, three-phase, 3 300 V, 50 cycle generator, run with neutral earthed through the usual resistance, and interference with telephones was experienced. This was traced to 35th and 37th harmonics in the voltage wave, resulting from a design feature which has been corrected on later machines. Trials were made with various forms of harmonic filters. One of the circuits tried was that first described by Albert Campbell and applied by him to the exact measurement of frequency. In this circuit a combination of mutual inductance and capacity was used, their product being adjusted to correspond to the frequency. The trial showed that the adjustment could be made sufficiently delicate to cut out either the 35th or the 37th separately and completely, leaving the other harmonic. The arrangement was not adopted, however, as it involved the use of a condenser suitable for full phase volts.



The scheme finally used consisted in placing at the neutral point in each phase, an air-cored inductance of low valve and a condenser connected in parallel, the circuit being tuned to the mean of the two harmonic frequencies. This formed a so-called "rejector" circuit, which allowed the 50 cycle load current to pass freely, but interposed a high impedance in the path of the objectionable harmonics.

In the Figure, 1, 2 and 3 are the phase windings of the machine, L and C the inductance coils and condensers forming the filter, and R the usual earthing resistance.

It will be noted in this arrangement that, firstly, the condensers are not required to withstand the full 50 cycle line voltage, but only the smaller voltage of the harmonic, and secondly, the whole apparatus is normally at earth potential. The effectiveness of such an arrangement depends, of course, primarily upon the extent to which the effective resistances of coil and condenser at the harmonic frequency can be reduced. The resistance offered to the harmonic current between the filter terminals a and b is closely equal to $\frac{L}{CR}$ ohms, where R is the sum of the resistances of coil and condenser. The above-described arrangement, which is in successful use, is a "filter" rather than a "resonant shunt" as used by Prof. Marchant.

As already pointed out, the filter appears to have an advantage over the shunt, in that the condenser has not to withstand the full line voltage, so that a condenser breakdown would not introduce risk of damage, nor necessitate shutting down.

In conclusion, we think a word of caution should be given. The device was applied by the British Thomson-Houston Co. to meet a complaint regarding telephonic interference, and it afforded a solution because the complaint was in regard to two similar notes and not in regard to a number of notes of widely different frequencies which combine together to make a disturbing noise. A number of other investigations of telephone disturbance shows that often the disturbing current is of so complicated a wave shape that the simple devices here under discussion are not applicable without introducing undesirable complications.—Yours, etc.,

R. C. Clinker.

Rugby.
October 24th.

THUNDERSTORMS.

[To the Editor.]

Sir,—In Dr. Russell's Presidential Address, as reported in your issue of October 26th, and also in your leading article "Thunderstorms," on page 449 of the same issue, I note the statement: "The voltage . . . is too small to produce a lightning flash, which requires *thousands of millions of volts.*" The italics are mine.

I agree that the generally accepted idea is that a lightning flash represents a great many millions of volts, but since seeing some experiments conducted last year by Prof. H. J. Ryan, at Stanford University, California, I think that a very much lower figure is represented.

Prof. Ryan has worked out a new law relative to the distances covered by high voltage discharges, which is represented by the following equation:—

$$KV = 585 \log_{10} \frac{D}{10} + 40, \text{ where } D = \text{distance in inches.}$$

It will be seen that the space traversed by the spark increases according to the logarithm of the distance and not in proportion to the increase in voltage.

Up to 600 kV this has been checked experimentally, and by extrapolation one obtains the following figures:—

kV	D in inches.
600	90 (experimental).
1 000	435
2 000	22 000
3 000	1 000 000 (18 miles).

Thus, if the figure of 18 miles for 3 000 kV is anywhere nearly correct—and it is always wise to treat seriously anything emanating from Professor Ryan—it is not correct to talk about *thousands of millions* of volts as being necessary for a lightning flash.—I am, etc.,

C. F. Elwell.

London.
October 27th.

HIGH STARTING TORQUE SQUIRREL CAGE MOTOR.

[To the Editor.]

Sir,—I notice in your issue of October 5th a description of a "Squirrel Cage Induction Motor with High Starting Torque and Low Starting Current in the Line," by Dr. T. F. Wall. A number of similar solutions have been made here, but in the United States patent to me, 1 134 776, dated April 6th, 1915, "Induction Motor," the application for which was filed December 11th, 1913, or nearly ten years ago, a construction quite closely similar to the arrangement Dr. Wall describes is embodied.

It will be only necessary to quote the first claim of the patent to show this great similarity.

"1. A winding for the secondary member of induction motors, including a plurality of low resistance conductors, sheaths of magnetic material therefor, said sheaths completely incasing said conductors and providing a current path of high resistance parallel to that of said conductors, and means electrically connecting the ends of said conductors."—I am, etc.,

Elihu Thomson.

West Lynn, Mass.
October 19th, 1923.

ETHER AND ELECTRONS.

[To the Editor.]

Sir,—Two sentences from Mr. Awbery's two letters exhibit to my mind the contradiction which he fails to see.

In his first letter he agrees "that an electrostatic field is

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determined by an excess of electrons on the one hand and a defect on the other." In his second letter he takes the view that "the electricity and the field are two distinct entities, and not different aspects of the same."

We then arrive at the position that phenomena which the experimental evidence available to us exhibits as always interconnected and interdependent are distinct and independent entities. I suppose the difference between us is psychological.

As to the bell analogy, the sound is transmitted because there is an intervening medium possessing certain properties common to itself and the bell metal. It may be solid, liquid or gaseous.

I am obliged by Mr. Press's reference to his article. I shall take an early opportunity to consult it. Hypervelocity surface waves and longitudinal waves at infinite velocity sound rather terrible.

It is beyond me to comment on Mr. Hume's ether hypothesis. I do not notice any symptoms that the physicists and mathematicians of to-day are hidebound to any traditional theories. —I am, etc.,

London, October 29th. HENRY M. SAYERS.

"STINKING FISH."

[TO THE EDITOR.]

SIR,—It is a source of irritation to me as an electrical engineer to find that journals such as THE ELECTRICIAN should, when competition between gas and electricity is the subject of its comments, offer its views in such a cheap and nasty fashion.

The paragraph headed "Stinking Fish" is gentlemanly compared with previous efforts, but it shows a deplorable tendency to imitate the worst efforts of our gas competitors.

Industrial and domestic applications of electricity must inevitably increase, and do so at the expense of gas. Your policy, then, appears to me to be "Hit the man who is down!" National taste and tradition are against doing so.

In order that you may be assured of my connection with the electrical industry, I enclose my card.—I am, etc.,

J. HUNTER WARD.

Leeds, Oct. 27th.

[If Mr. Ward studied gas propaganda as closely as we do he would realise that we are not hitting "the man who is down."—ED. E.]

THE BOOKSHELF.

A.C. Protective Systems and Gears. By J. HENDERSON and C. W. MARSHALL. (London: Sir Isaac Pitman and Sons). Pp. 108. 2s. 6d. net.

This is a valuable little book and marks a certain departure in technical publications, in that it is written by electricity supply engineers, and gives actual results obtained upon a large supply system—namely, that of the Glasgow Corporation. There can be no doubt that there is a vast amount of very valuable information in the possession of the electricity supply authorities which, if it could be rendered available, would be of the greatest possible service in the development of the electrical industry. Unfortunately, in some quarters, a deliberate policy of secrecy is followed. This may be in the interests of certain individuals, but from a national point of view it is deplorable. The authors of this book are to be congratulated upon the broadminded manner in which they have placed their valuable personal experience at the disposal of anybody who will spend half a crown in purchasing the volume. The book should specially appeal to the operating staffs of central stations. No switchboard attendant or shift engineer should be without it. The illustrations are excellent and the explanations are given in a clear and concise mannner. In a subsequent edition the method of calculating the short circuit current given in Chapter 1 might be improved. Curves are now available which enable the approximate short circuit currents of various systems to be easily determined.

It must be remembered that the results given are admittedly based upon the experience of one, though very important, supply system. Care must be exercised therefore in applying the results elsewhere that the possibly different conditions are taken into account. This remark is made as some of the statements of the authors are somewhat dogmatic, although in all such cases good reasons are given for the opinions expressed. We can recommend the book to all engineers who have anything to do with electric protective gear.

C. C. G.

THE MAKING OF WEALTH.*

By SIR ERNEST J. P. BENN.

John Stuart Mill gives us the standard definition of wealth. He says that "wealth consists of all things useful and agreeable having an exchange value." Henry George gives a definition which appeals to me most strongly. He says that "wealth consists of natural products that have been secured, moved, combined, separated, or in other ways modified by human exertions so as to fit them for the gratification of human desires." I hold that the very essence of the problem of wealth is exchange, that wealth really arises from exchange. It can be argued that there is no wealth until exchange takes place. At all events, we are not very much concerned in these days with questions of production. We know all about production; at all events we are able to produce enough to keep us all fairly happy. The great problem is how to move the things about, how to distribute wealth, how to exchange wealth. The next theory of wealth will, I believe, be that it arises not from land or labour or capital—all these things contribute towards it—but that it really consists in exchange. I submit that we live by exchange and that money is the medium of exchange and nothing else. Incidentally, it is the attempt to use money for other purposes than exchange which has brought us into a good deal of our present troubles.

It is interesting to notice, in considering this question of wealth and wealth distribution, the common habit into which collective man seems to fall of looking at things through the wrong end of the telescope. The public generally, on a question like profits, look through the wrong end of the telescope. They think of the thousand pounds profit and how they can tax it, how they can get some of it, and what they can do with it, but they overlook altogether the many thousands of pounds of wages and turn-over which have been involved before any question of profit could arise. Hence the tendency to diminish turn-over and wages. My contention is that the exchanger, the profiteer, if you like, the *entrepreneur*, transcends in importance every other factor in wealth production because he is concerned, and concerned only, with the distribution of wealth.

Responsibility of the Individual.

Trade and commerce is rapidly becoming a lost art. The enterprise, the brains, the skill, the initiative which ought to be employed in business and exchange, and maintaining and creating markets, and providing us with employment and the amenities of life, has been so affected by social changes that business men are becoming experts in the intricacies of legislation, skilled in the arts of committee work, marvellous manipulators of memoranda, facile form fillers, tariff dodgers, limitators, anything but business men, and in consequence the standard of life is going down and civilisation is going backwards. I suggest that we must raise again the banner of freedom; we must return, if you like to *laissez faire*, and once again enthrone the individual as the only thing that matters. Far too many of our people regard themselves as dependent. We are encouraging the growth of a dependent class, but you cannot depend unless you have somebody to depend upon, and if only enough of us become dependent, the whole thing collapses. We shall never achieve our best until we each realise that the only thing we can really depend upon is ourselves. The history of the last 100 years can be very roughly divided into two periods: 75 years of progress and wealth production and 25 years of standing still.

My submission is that if we review recent history—such history as we can review, because it is only in the last 100 years that we really know what has been happening regarding the economic condition of the people—we must come to the conclusion that each successive generation has enjoyed advantages beyond the wildest dreams of its fathers. But it seems to me to be rather sad that, having discovered how to do the job, we should have decided to stop progress and to go in for wholesale control of the economic circumstances of life. If only we could get a whole-hearted return to the feeling of the responsibility of the individual, and would go wholeheartedly for doing things instead of talking about them, think what a fair and happy land this would be.

DRYING OUT H.T. TRANSFORMERS.

The best method of drying out high tension transformers is, according to the "Electrical World," to apply heat to the transformer completely assembled and under oil. The whole unit may then be heated, the moisture being driven into the oil which is continuously dehydrated during the process.

Heating is generally done by blanketing the tank, short-circuiting the low voltage winding and supplying sufficient potential to the full high voltage winding to give from two-thirds to full load current. This will require 3 or 4 per cent. of the rated voltage, depending on the impedance of the particular transformer, and such a value of voltage with suitable control is rarely ever available.

Several days will be required to raise the temperature to a suitable value, and, since the coils will be very much hotter than the oil, great care is necessary unless the temperature is brought up very slowly. These methods require skilled attendance during the entire run, as resistance checks have to be made frequently and a little negligence may result in permanent injury.

* Abstract of a Lecture before the Industrial League and Council at the Caxton Hall on October 24th.

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NEWS IN A NUTSHELL.

A system of electric traffic signals for pedestrians is being tried experimentally in Paris.

Ten cases of lead poisoning among operatives employed in electric accumulator works were reported during September.

Dr. J. A. Cranston addressed members of the Royal Philosophical Society of Glasgow, last week, on "The Electrical Structure of Matter."

It has been found necessary to postpone the date of the annual meeting of the Federation of British Industries until early in the New Year.

The Newcastle-on-Tyne Local Committee of the Electrical Trades' Benevolent Institution will hold its fifth annual ball in the Heaton Assembly Rooms on December 14th.

Speaking at Plymouth last Saturday, Sir Arthur Shirley Benn urged the Corporation to replace the present light tramway metals with heavy rails at a cost of about £250 000.

During 1922 approximately 6 805 000 tons of coal were used in electricity generating stations in Great Britain and Ireland. This figure exceeds that for the preceding year by 355 000 tons.

Chester Electricity Committee has decided to lease the building at the Queensferry power station, known as "The Workshop," to the Electrolytic Plant Co., at an annual rental of £225 for five years.

Mr. W. F. Massey, the Prime Minister of New Zealand, estimates that the country will require to spend about £4 000 000 within the next two years in connection with hydro-electric, railway, and telegraph works.

There is no profession to compare with engineering in its contribution to the commonwealth of humanity, stated Mr. N. E. Yerbury, of the Sheffield Electricity Supply Department, in his presidential address to the Yorkshire Association of the Institution of Civil Engineers.

Lecturing before the Eastbourne Ratepayers' Association on "The Local Electricity Undertaking," on October 26th, Mr. J. K. Brydges, the borough electrical engineer, mentioned that the Eastbourne Front was the first in the South of England to be lighted electrically.

Of the insured workpeople in the electrical engineering industry of Great Britain and Northern Ireland, 4 209 were unemployed on September 24th, an increase of 202 compared with August. Other unemployment figures include: electrical wiring and contracting, 1 729, an increase of 123; and electrical cable, wire, and electric lamp manufacture, 6 775, a decrease of 444.

At the Birmingham and District Electric Club, on October 26th, a paper was read by Mr. Henry Joseph on "Electric Motors in Service." The lecturer dealt with the installation of motors, the various methods of transmission of power, and the causes of breakdown. There was in the paper a considerable amount of criticism of the design of modern motors. It was suggested that the craze for mere cheapness in small motors had seriously militated against reliability.

J. J. Armfield and Co. have issued an interesting handbook for the preparation of preliminary schemes in the development of water power. It is pointed out that one absolutely essential condition for the success of a water power scheme is that the machinery shall exactly meet the particular circumstances and requirements of the site. Some useful notes on turbine installation are given, as well as a catalogue of water turbines and other plant for the development of power from water.

The following companies will be struck off the Register of Joint Stock Companies unless cause to the contrary is shown before January 23rd. Dawson Electrical Installations, Dome Battery and Accessories Co., Electro-Chemical Industries, G.M. Wireless Patents Syndicate, Hampstead Electrical Co., Holloway Electric Supply Co., Nazeing and District Electric Supply Co., Owen Magnetic Transmission Syndicate, Provincial Wireless Colleges, Riviera Kearney High-Speed Railway Syndicate, South Coast Kearney High-Speed Railway.

Last week the Durham City Traders held a shopping week, one of the features of which was the offer of a prize by the Newcastle-upon-Tyne Electric Supply Co., for the best illuminated shop window, which was won by Boots (Cash Chemists), Ltd. A demonstration of flood lighting was also given by the Newcastle-upon-Tyne Electric Supply Co., a statue in the Market Place being illuminated by a 1 000 W lamp installed on the Town Hall. A similar lighting unit was also installed to illuminate the main portion of Saddler Street and the entrance to the Market Place.

Members of the National Joint Industrial Council for the Electricity Supply Industry entertained their chairman, Alderman W. Walker, to dinner on October 18th, to mark the occasion of his re-election as chairman of the National Council for the fifth year in succession. Mr. J. Rowan, the vice-chairman of the Council, presided. During the evening the following telegram was sent to the Speaker of the House of Commons, the author of the Whitley movement: "All parties in National Joint Industrial Council for Electric Supply Industry now dining together in honour of their chairman, Alderman Walker, have pleasure in greeting you and offering you their congratulations on the success of this Whitley Council." Mr. Whitley replied trusting "that harmony for the good of your industry may long continue."

The new hydro-electric power station at Navan (Ireland) was formally opened last week.

During August American electrical exports totalled $6 183 186 in value, an increase of $1 430 276 over the corresponding month of last year.

One-half of all the copper consumed in the United States is used in the electrical industry, according to the American Bureau of Metal statistics.

Electric reading lamps with a switch under the control of the passenger are provided on a new type of third-class vestibule carriage introduced on the L.M. and S. Railway.

The construction and application of hand-operated and automatic starters for a.c. motors was explained to the Nottingham Society of Engineers last week, by Mr. O. C. Dinerman.

Entries for the "Cosmos" fire competition, for which the prize is a Wolseley 10 H.P. motor car, will be received up to November 30th instead of October 30th as originally announced.

Liverpool Corporation Markets Committee claims that the new electric lighting installation in St. John's public market makes it the best lighted establishment of its kind in the country.

It is anticipated that the Nippon Electric Co., of Tokyo, a subsidiary company of the International Western Electric Co., will be able to resume manufacturing operations by the end of the year.

Mr. Thomas Edison, in opening an American electrical exhibition, stated that the development of electrical devices would be very marked in the next ten years. With their aid a four-hour working day would soon be possible.

Orders are likely to be placed in this country for electrical appliances for seed-crushing mills at Odessa, Moscow, Petrograd, and Libau, which are to be re-opened after lying idle since 1917, states the "Birmingham Post."

There are to be fifteen miles of roads in the British Empire Exhibition. We understand that there will be three kinds of mechanical transport available—a "never-stop" railway, a road-rail system, and a fleet of electric cars.

Two electric signs on a New York bank are claimed to be the highest in the world. The signs, which are on the top of the building which is 347 ft. high, are themselves 67 ft. high and 86 ft. wide. The letters are 12 ft. high, and each sign contains 1 000 50 W lamps.

The Diesel-electric fruit-carrying ship "La Playa," which has completed successful demonstration trials, was fully described in our Annual Marine Number, published on July 27th last. A view of the propelling motor is reproduced on our picture page this week.

A "battery" of eight electric lifts is being installed at Lewis's emporium, Liverpool. In addition to being of large capacity, carrying thirty passengers each at a speed of 350 ft. per minute, the lifts are so constructed as to level themselves automatically at each floor, independently of the attendant.

At the installation meeting of the Kelvin Lodge, on October 26th, Mr. Andrew Forbes Dick was installed as Master for the ensuing twelve months. Among those who were present at the banquet which followed were Mr. C. F. Quicke, Mr. F. P. Baxter, Major Pike, Mr. L. E. Wilson, Mr. Gillespie, Mr. Hobdell, and Mr. Ellis.

The opening concert of the Manchester Electro-Harmonic Society was held at the Albion Hotel, Manchester, last Friday, when there was an attendance of about 150 members and friends, under the presidency of Mr. S. L. Pearce. During the evening Mr. W. J. Smith (Hon. Musical Director) presented a gold fountain pen to the retiring treasurer, Mr. Hall.

Mr. W. J. Holdsworth, chairman of the Auckland (N.Z.) Electric Power Board, states that it is the policy of the Board to order British goods, and orders for such goods amounting to hundreds of thousands of pounds are now being carried out. The Board has been pleased with the quality of plant obtained from the United Kingdon, where repeat orders have been placed without calling for tenders.

Speaking on the incidence and relief of local rate burdens of Cardiff, Mr. J. Allcock, the City treasurer, dealt with the subject of transferred profits from municipally owned trading undertakings, and advocated the adoption of the Cardiff system, under which undertakings were expected to secure sufficient profits to enable a transfer to be made annually of sums representing 1½ per cent. of the capital employed.

A striking feature of the recent Newport Electrical Exhibition was the "all-electric" house, consisting of dining-room and kitchen with adjoining passage, arranged by Mr. Nichols Moore in conjunction with a local furnishing company. It is well decorated and made to dismantle and re-erect with ease. We understand from Mr. Nichols Moore that he will be glad to consider applications from other supply engineers with regard to the purchase or hire of this structure for exhibition work.

The Hydraulic Engineering Co. have sent us a copy of a catalogue dealing with the Magnall-Irving Thrust Borer, which was described in these columns a short time ago. In this system the hole is formed by the displacement and compression of the surrounding earth. The result is that the skin of the boring is usually hard and smooth. The costs of boring and of the upkeep of the equipment are said to be much less than when other systems are used. Full descriptions of the various types of apparatus are given.

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MERCHANDISE TO SELL AND PROFIT BY.

The "Pea-nut" Valve.

The rate of progress and development in the industry is so rapid that to refer to any new discovery or to any announcement of new apparatus as a step forward has a commonplace sound. What is new to-day is old-fashioned to-morrow, and particularly does this apply in the wireless section of the industry. In spite of this, however, there are from time to time announcements of new apparatus which must have more than passing attention because undoubtedly these events are the signposts to the future greatness of the industry. One such is the advent of the new wireless valve which has just been placed on the market by the WESTERN ELECTRIC CO. This valve will be known as the No. 44 215 Wecovalve, but it will be more popularly known, we hazard the guess, as the "peanut" valve. We illustrate (Fig. 2) the valve and the illustration will convey how small it is. The actual dimensions are $\frac{5}{8}$ in. diameter by $2\frac{1}{8}$ in. long. The dimensions of the valve, however, are not of much account. Of far more importance are the details which go to strengthen the opinion that its advent will almost revolutionise wireless practice. These details can be briefly summarised thus: (*a*) It requires only 0·25 A at 0·8 to 1·1 V, therefore it is (it is claimed by the manufacturers) the most economical type of valve on the market to-day; (*b*) it has more than twice the life of tungsten and other dull-emitter valves; (*c*) it is of robust construction and risk of mechanical failure is reduced to a minimum; (*d*) it has low self-capacity.

One detail of this valve which in itself is a great step forward is the bayonet cap. In this connection we also illustrate the valve socket which has been developed for use with the new valve. This is known as No. 44 090 and it is illustrated under that number. We also illustrate the No. 44 092 valve adaptor which is a useful accessory. It has been designed to fit in the valve sockets which ordinarily carry the four-pin type valves so that the latter may be replaced by the new pea-nut valve with a minimum of trouble and expense.

Hellesen Low Tension Wireless Batteries.

The advent of the "Pea-nut" valve for wireless work must obviously create a large demand for low tension dry batteries. In spite of the fact that the valve has only been on the market a short while, the tendency to adopt dry batteries in place of accumulators has already shown itself. It has been our practice to lay great stress on what may be called the *duty* of every electrical retailer to see that the public are supplied with only the products of the best manufacturers of dry batteries. It is for this reason that the publication by A. H. HUNT, LTD., of their leaflet No. 142 describing Hellesen low tension dry batteries for valve filament lighting is most opportune. From the specification which we have before us it appears that the manufacturers have given every care and attention to the production of batteries really suitable for wireless work. These batteries are constructed of an entirely new composition which enables them to stand up satisfactorily to the longer period of use demanded by wireless sets; and at the same time to give a current which the ordinary dry battery would not be capable of giving except intermittently. A good deal has been written in the trade press just lately on the subject of the "Pea-nut" valve and their many advantages over the ordinary type, and it is our view that there is not the slightest doubt that the winter "wireless" season will show the retailer a large and profitable turnover on the sales of these batteries.

The Market for Portable Handlamps.

As we have often pointed out there is a large and ever-growing domestic market for a well-made and reliable handlamp. It is not our intention to reiterate the points which we have put forward to prove this, but we feel that it will be of some service to the trade if we call attention to the range of handlamps manufactured by WORSNOP AND CO. We illustrate (Fig. 5) a simple handlamp manufactured by this Company. This is listed at 45s. complete with accumulator.

A "Silvertown" Development.

The recent publication by the INDIA RUBBER, GUTTA PERCHA AND TELEGRAPH WORKS CO. of a list describing their new self-contained electrical measuring set is of much interest and importance to engineers. To those readers of THE ELECTRICIAN who have not received a copy of the list we tender the advice to ask the Silvertown company for a copy. We illustrate (Fig. 6) the set, although we are unable to give a full technical description of its method of operation. It may be remarked, however, with some usefulness, that the manufacturers claim that the instrument combines the usual functions of a Wheatstone Bridge with a greatly increased speed of operation and general practical convenience. The instrument is entirely self-contained and ready for use at any time; moreover, it can be used by unskilled persons having no knowledge of the technicalities of the Wheatstone Bridge. The arrangement of the index and ratio switch makes it impossible to obtain a false value for the resistance under test. The whole of the instrument is made of metal excepting the insulation and forms a robust and convenient apparatus for general testing in the test room, workshop or street, for locating faults on cables, etc. There are no plugs to manipulate or get mislaid, or levelling screws to adjust, and no mental calculation is necessary.

Automatic Electrically-Heated Boiler.

At an E.D.A. Salesmen's Conference last winter the author of a paper on the subject of heating and cooking apparatus emphasised the market that was waiting at the door of the electrical contractor with this apparatus for restaurants, railway buffets and teashops; also at those establishments which are more popularly known as "good pull-ups for carmen." We were impressed with the force of the statement, and it has been our purpose to call special attention to apparatus in these columns which, in our opinion, will help to secure this business. It is for this reason that we illustrate (Fig. 1) and comment on the patent automatic electrically-heated boiler manufactured by W. M. STILL AND SONS. The working of the boiler is entirely automatic in its action, both water and current being automatically controlled. The operator is only required to turn on the water at the main and switch on the current each morning, reversing the operation every night when no more water or coffee is required. The boiler takes about twenty minutes to boil, when the apparatus is put into action the first thing in the morning. The loading for the small size boiler is approximately 7·5 kW, and for the large size 15 kW. The output of boiling water is 150 pints and 300 pints, respectively, in the first hour, and 120 and 240 pints in subsequent hours. Obviously these figures vary in accordance with the temperature of the feed water.

The heating unit is wired so that one section of approximately 0·75 kW is used as a by-pass; this prevents undue wear on the automatic switch. The remainder of the load is connected to, and controlled by, the automatic switch just referred to, which breaks contact when the pressure on the boiler reaches $4\frac{1}{2}$ lb., and reverses the action when the pressure falls to $2\frac{1}{2}$ lb.

The water supply to the boiler is controlled by Still's Patent auto-control valve which only allows sufficient water to enter the boiler for the heating units to cope with, with the result that the boiler is never flooded with cold water, and a steam pressure of about 2 lb. is always maintained. The great advantage of this valve is that variations in pressure and temperature do not affect the working of the boiler, with the exception that the output is correspondingly increased or decreased according to the rise or fall in the temperature of the feed water.

This is but a brief description of Still's apparatus, but it will serve to show that it warrants the attention of all contractors and others who are serious in their intentions to see that more of our restaurants "do it electrically."

Sunco Fires.

We have just received from the SUN ELECTRIC CO. their list No. 307 describing "Sunco" electric fires. We were not able to illustrate or comment on these fires in our recent issue when we described some of the best designs on the market, but it is obvious from the design which we now illustrate that the Sun Co.'s catalogue must have the careful study of every buyer. The trade has the opportunity of merchandising no less than six excellent designs—two in the Jacobean school, two in the Adam school and the remaining two in the Heppelwhite style. The fire which we illustrate (Fig. 4) is the Sun Co.'s number H.3120, and, as will be appreciated, the designer has followed the last named. Finished in best black enamel, the list price is £4 10s. The fire can also be supplied in antique copper at a list price of £4 17s. 6d., and in sanded brass £5 10s. It should not be supposed that the Sun Co. have limited their programme to the higher-priced fire; a "Sunco" fire built on Jacobean lines fitted with two elements, each taking 500 W, can be supplied at a list price of £2 10s. in black enamel finish. This same fire can also be supplied in armour bright, at a list price of £3 7s. 6d. Reviewing the list one is struck at once by the originality and design of the whole range of "Sunco" fires and they merit a place in all showrooms.

A Simple Frame Aerial.

We illustrate (Fig. 3) an indoor frame aerial which we can recommend to wireless retailers as a line of good "merchandise to sell and profit by." The strong case for simplicity in the design of apparatus which was made out by a contributor in a recent issue of THE ELECTRICIAN is full of sound logical sense, and it does not only apply to receiving sets. It also applies to aerials. In fact there is more to be said for simplicity in aerial equipment than for the apparatus proper. Many are not able to indulge in "wireless" although it makes a great appeal to them, owing to the tryanny of landlords in some cases in refusing the erection of outdoor aerials, and the majority of the great community of flat-dwellers cannot use an outdoor aerial. There are, of course, many indoor aerials marketed which can be offered to fill the wants of this public, but some err on the side of being too elaborate, and consequently too costly an equipment. There are, therefore, many points of practical utility and simplicity, which results from that utility, which will make this frame aerial appeal to the public. Apart from this the public dearly love a novelty and if the product is thoroughly sound, withal its "novelty" features, there is no need why the electrical retailer should not reap the turnover. The aerial is complete and is manufactured by W. BERESFORD.

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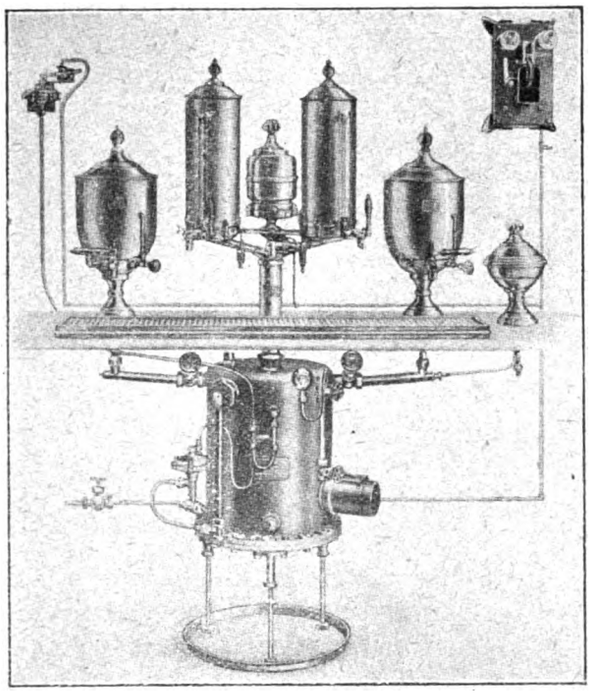

FIG. 1.—A SOLUTION OF THE WATER PROBLEM.
BY W. M. STILL & SONS.

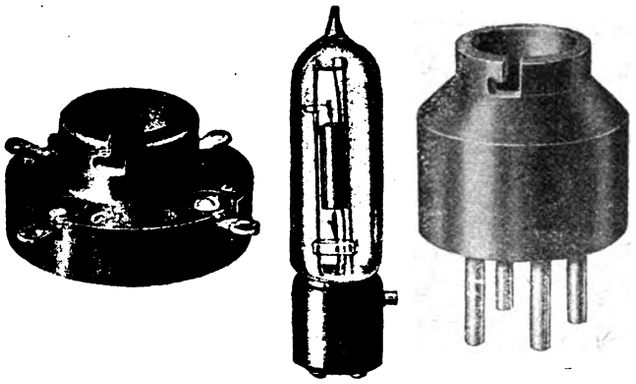

FIG. 2.—PEANUT VALVES AND ACCESSORIES.
BY THE WESTERN ELECTRIC CO.

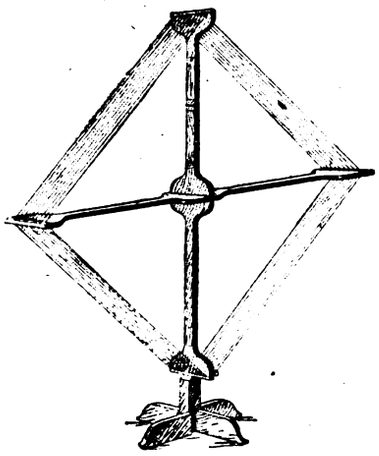

FIG. 3.—A BOON TO BROADCASTERS. BY W. BERESFORD.

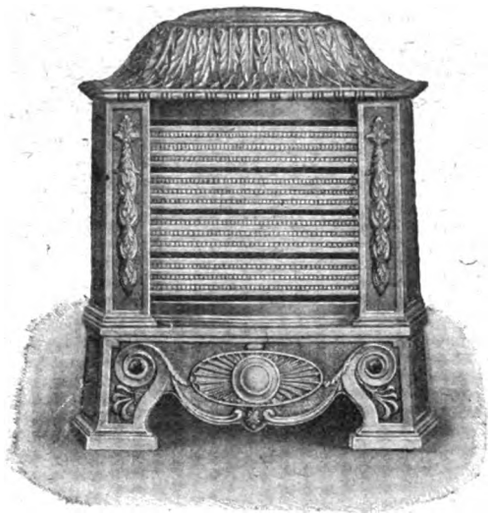

FIG. 4.—AN ARTISTIC FIRE. BY THE SUN ELECTRIC CO.

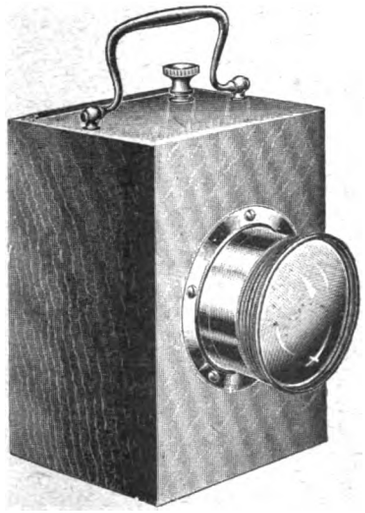

FIG. 5.—A SIMPLE HANDLAMP.
BY WORSNOP & CO.

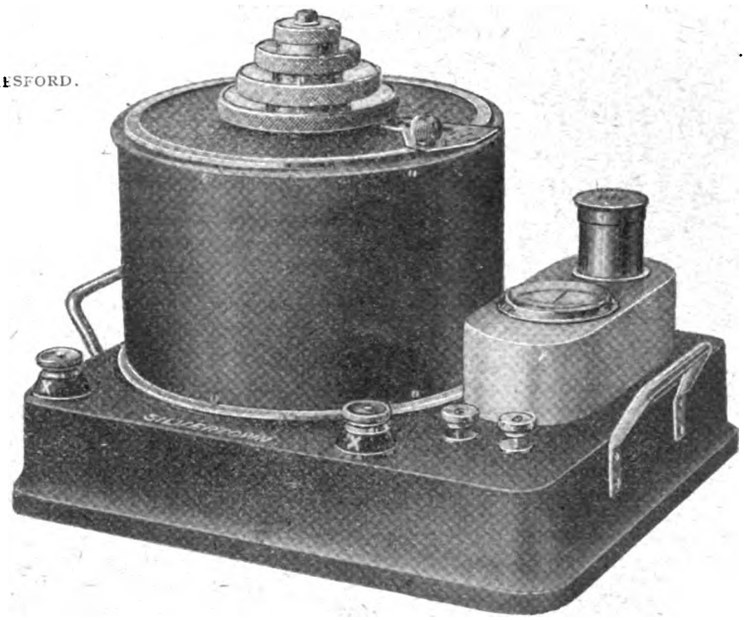

FIG. 6.—A NEW SELF-CONTAINED MEASURING SET.
BY INDIA RUBBER, GUTTA PERCHA AND TELEGRAPH WORKS CO.

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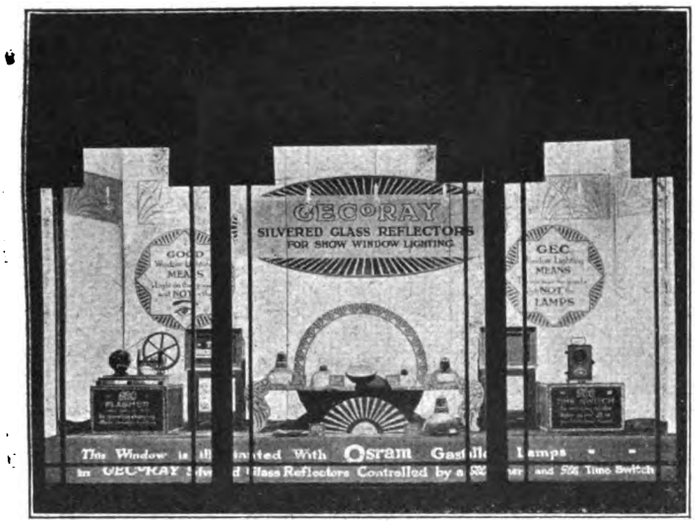
WINDOW LIGHTING.

Increased Illumination as a Lure for Shoppers.

An interesting paper on "Modern Methods of Shop Window Illumination" was read by Mr. E. L. Randall, of the illuminating engineering department of the General Electric Co., before the British Association of Display Men at Magnet House, Kingsway, on October 25th. After a short introductory speech by Mr. J. Y. Fletcher, a director of the General Electric Co., Mr. Randall's paper was read, and was followed by an interesting discussion, in which Mr. L. Gaster, Mr. J. S. Dow and many members of the British Association of Display Men, took part. Afterwards various demonstrations of window-lighting effects were given, and some interesting show-cases containing exhibits showing the value of various factors in scientific illumination were demonstrated. Some remarkable coloured lighting effects were produced in a model window by means of the "Gecoray" window-lighting equipment.

In the course of his paper Mr. Randall said that a well-lighted shop window was one of the most vital factors in business-getting machinery. Co-operation between the merchant and the artist had resulted in shop window display reaching a standard in artistic expression upon which it would be difficult to improve.

For nearly six months in the year the windows were entirely dependent upon artificial illumination for 30 per cent. at least of



AN EFFICIENTLY-LIGHTED SHOW WINDOW.

their effective day. A perfect window illumination did not merely consist of sufficient and glareless light. It must be of such a nature that the artist was given a fresh means of expression which would not merely attract but actually arrest the passer-by. Such an illumination was obtainable by the use of special silvered glass reflectors with various colour screens, flood-lights and spot-lights.

It had been proved beyond all shadow of doubt, continued Mr. Randall, that the number of people who would stop to examine a window, and the number of people who entered a shop to make purchases increased in proportion as the intensity of light in the window was increased. Within fairly wide limits, the increased profit per hour obtained when the window-lighting was improved was twenty times the amount of money spent per hour on the increased current.

In order to illustrate the facility with which varying colour effects could be obtained, Mr. Randall suggested that a window might be dressed with a figure draped in white material and illuminated by means of red and blue coloured screens to give a general mauve tone. The draperies on the figure would naturally assume the tone of the general lighting, and appear no longer white but mauve. When spot-lights with clear lamps, fitted at each end of the window, were trained on to this figure the dress would instantly change to white, but the shadows would remain illuminated by the mauve light. By switching off first the red lamps (when the shadows would be changed to blue), and then changing over from the blue lamps to the red (when red shadows would be produced), very beautiful effects could be obtained, and these effects would be reproduced automatically by the installation of a suitable flashing device.

Mr. Randall laid great stress upon the importance of leaving shop-windows illuminated after closing time. It was an encouraging fact that many of the electricity undertakings were now granting reduced rates for window-lighting after business hours.

As a proof of the value of late lighting Mr. Randall quoted some figures, the result of his own observation in various London shopping centres. He found that, making a conservative estimate, 250 persons per hour would stop to examine a window, the cost of illuminating which was 2¼d. per hour. Two hundred and fifty people reached in this convincing manner at a cost of 2¼d. was a proposition which no trader, however small, could afford to overlook.

CALCULATING OF PROFITS.

Relation of Overhead Charges to Selling Price.

Lecturing on "Profit" at the first of a series of salesmanship conferences held in Newcastle-on-Tyne, on October 25th, Mr. J. Edgar presiding, Mr. A. Albrecht said it was essential to any business that a profit should be obtained, and that the amount of profit should be correctly proportioned. The correct proportion and amount of profit required in any business was ascertainable, because the amount of profit definitely followed certain laws and formulæ.

To determine the selling price it was necessary to take the cost of the article and add the required amount of profit, say, 10 per cent., the actual amount of profit being, of course, determined by the extent of competition; but this was not sufficient; to it must be added establishment or overhead charges. The formula then was: cost plus establishment charges equals selling price.

Salesmen had to realise that it was perfectly legitimate to add a reasonable profit to the cost price. Further, it was possible that the amount of profit over the cost price was not all clear profit. Many business firms had faced difficult problems recently under circumstances where they found they were only just able to pay expenses, due possibly to the increased establishment charges. Under present conditions it was not feasible to increase the selling price in order to obtain a profit and there was little opportunity of reducing the establishment charges. How was a profit to be obtained? The most satisfactory way was to extend the business and to endeavour to increase the turnover. If it was possible to double the turnover, the increase in the establishment charges would probably not be greater than 50 per cent.; thus the relative amount of the establishment charges to the selling price would be appreciably reduced, and a margin would be left for profit.

Increased Turnover the Solution.

Considering establishment charges and their effect on wages, Mr. Albrecht thought that if it was possible to convince the wage-earner that the only hope of increased wages was by means of increased profit, all present troubles would be solved. There was also a constant demand for better and better service, with, of course, increased service costs. The only solution to these conflicting interests was the increase of turnover, and it was therefore necessary that support should be given wherever possible to the firm which endeavoured to give proper service.

Mistakes were often made in calculating the profit required. If a 10 per cent. clear profit was required it was not sufficient to add 10 per cent. to the total costs; this would only result in a profit of 9 per cent. It was therefore necessary to add 11 per cent. to the costs in order to obtain a clear profit of 10 per cent., i.e. 10 per cent. of the turnover. Attention was also drawn to ten hidden losses which were apt to be overlooked when estimating establishment costs. These were stated as being: (1) Not including the employer's salary as an expense; (2) goods stored on shelves and lost sight of; (3) disregard of depreciation; (4) failure to take discounts; (5) unsystematic book-keeping; (6) unsystematic deliveries or service; (7) losses by marking down; (8) bad accounts; (9) lack of understanding or sympathy by salesmen; (10) loss of customers.

In the course of the discussion, the difficulty of restoring the balance of establishment charges and selling price was particularly emphasised. The advantages of increased turnover were also elaborated, but with the caution that the capital of the business should be maintained as small as possible and turned over as quickly as possible.

One speaker introduced a little diversion by expressing the opinion that there was nowadays too great a tendency to uphold "ring" prices, and that progress could only be obtained by keen competition. The tendency, he said, must be to bring costs down rather than put prices up.

BENEFICIAL EFFECTS OF LARGE UNITS.

As Mr. Faraday Proctor, chief engineer and general manager of the Bristol electricity undertaking, remarks in his report, the employment of large machines for generation of electricity has a marked effect in the reduction of costs. Until 1917 the average size of the machines in the Bristol station was 700 kW, and the present average is 2 000 kW, the largest machine being 6 000 kW. During the past year the coal cost per unit has been reduced by more than 50 per cent. compared with the previous year, and the total costs by 33 per cent. The gross profit and other credits increased from £107 478 to £147 822, and the net profit from £31 924 to £58 316, although the revenue decreased from £345 139 to £337 227. Energy sold was 43 116 425 kWh, compared with 3 707 902, maximum co-incidental load was 19 800 kVA, against 15 972 kVA, and load factor 27·59 (28·6) per cent. Total working costs were 1·01d. (1·52d.), and total costs, 1·5d. (2d.). Mr. Faraday Proctor states that every effort is being made to carry out extensions on the three-phase system recently adopted as the most suitable standard throughout Great Britain. Wherever possible portions of the single phase system are being converted and connected to the three-phase system.

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HACKNEY'S ELECTRICITY.

Celebration of the Opening of the New Extension.

The formal opening of the extension of the Hackney Electricity Works which are described on page 484, was celebrated on Thursday, October 25th, and as an opportunity was taken of giving the consumers of electricity in the borough a chance of seeing the plant which supplies them with the commodity of which they are taking ever-increasing advantage, a large assembly was present in the marquee which had been erected outside the generating station. Councillor W. Hammer, gave a short account of the development of the electricity works and paid a tribute to the enterprise of Mr. L. L. Robinson.

In declaring the extension of the electricity works open, the Mayor, Councillor John Genese, mentioned that some years ago he had two ambitions, one to curb Mr. Robinson's activities, and the other to become Mayor. The latter ambition he had achieved, but the former he had so far been unsuccessful in effecting, and he was not quite certain that he now wished to do so.

A procession headed by the Mayor, Aldermen and Council was then made to the Electricity Works, where both the extension and the original plant were inspected. Round the 10 000 kW turbo-alternator a short religious ceremony was conducted, and the machine was named John Genese by Mrs. Alderman Hammer with an appropriate liquid and electrical ceremony.

In the evening a] dinner, by invitation of the Mayor, Aldermen and Councillors was given in the King's Hall, Holborn Restaurant, to a number of Hackney residents who are connected with the development of the electricity undertaking, and to a number of interested electrical engineers and others.

In proposing the toast of "Hackney Electricity," Sir Charles Parsons said that no one had any doubt that Hackney would march forward towards a greater and greater electrical development. It was 34 years since the first turbo-alternator had been started in Newcastle, and 28 years since the first machine of similar design was used in the Manchester Square Station in London. This machine was not one-sixteenth the size nor one quarter as economical in coal consumption as the set which had been started up that afternoon. The large sets that were now being used in this country were comparatively small compared with those used in the United States, but these larger sets only gave a comparatively small gain in coal consumption.

In replying to this toast, Councillor G. Hammer mentioned that the opening of the extension meant that the undertaking would move into Class G of the National Joint Board scale, and that therefore everybody employed by the electricity undertaking would receive an increase in salary. He paid a tribute to the skill and energy of Mr. Robinson and to Mr. Bowden his deputy.

Hackney Housewives.

Dr. S. Z. de Ferranti proposed the toast of "Hackney Housewives," saying that those who wished electricity to come into universal use recognised the help that had been given by the housewives of Hackney towards realising that ideal. Hackney housewives were the missionaries of electricity development, and the lady whose name was coupled with this toast was the high priestess of electricity in the home.

Mrs. Alderman Hammer replied in a characteristic speech in which she offered the thanks of the housewives of Hackney to the men, who, like wizards, had harnessed that terrible element electricity for their good. Women who used electricity found that they had half the labour to perform at half the cost. They got all the kudos for good cooking, and the electric cooker did all the work. They had, however, not reached the last act of the play yet. What had been done was simply the curtain raiser.

Mr. Robinson, in proposing the "Supporters of Hackney" referred to those who had been responsible for the inauguration of electricity in Hackney, including the late Mr. Robert Hammond, and Messrs. John May, H. S. Hawes and E. Slater.

He paid special tribute to Mr. Bowden for his splendid work, and to Mr. Barham, the constructional engineer. The high thermal efficiency which they had attained was due to the staff collectively for their splendid team work.

The cooking load in Hackney was going ahead; 243 cookers had been installed by the department, and many more had been sold that there was no record of. The education of the public was necessary, but it would cost money and take much time and work to carry out. He had no doubt that in the end the Hackney electricity home service would be adopted throughout the Borough to the everlasting benefit of its burgesses. In conclusion, he referred to the yeoman aid he had received from Mr. Beauchamp who, by his counsel and advice had been a tower of strength in helping him start publicity and intelligent salesmanship in the undertaking. As a mark of their gratitude he presented Mr. Beauchamp with a silver salver in recognition of his valuable services to Hackney electricity.

In reply, Mr. Beauchamp said that he spoke on behalf of the supporters of Hackney, whose support was given because of the personality, affability and driving power of Mr. Robinson. In ten years' time they would look on Mr. Robinson as a real pioneer

ELECTRICITY SCHEMES.

Commissioners' Order for Mid-Lancashire District.

Having considered the representations made at the Preston inquiry in July last (reported in THE ELECTRICIAN of August 3rd), the Electricity Commissioners have made an Order giving effect to the approved scheme. The preliminary proceedings were reported in our issues of February 23rd and March 2nd last.

Besides constituting the Mid-Lancashire Electricity District, the Order establishes the Mid-Lancashire Electricity Advisory Board, composed of members of the Corporations of Accrington (2), Bacup (1), Blackburn (4), Blackpool (3), Burnley (4), Colne (1), Darwen (1), Haslingden (1), Lytham St. Anne's (1), Nelson (2), Preston (4), and Rawtenstall (2); the urban district councils of Brierfield (1) and Fleetwood (1); the Lancashire Electric Power Co. (1); the Lancashire County Council (1); the Blackburn and Preston Chambers of Commerce (jointly, 1); the Cotton Spinners' and Manufacturers' Association (1); and the London Midland and Scottish Railway Co. (1). The constitution of the Board can only be altered by arrangement between the Commissioners and the Board. The Board is to appoint an Engineering Advisory Committee consisting of the borough electrical engineers for the time being of Accrington, Blackburn, Blackpool, Burnley, Preston, and Rawtenstall, and two electrical engineers to be nominated by the Lancashire Electric Power Co. and the L.M. and S. Railway Co. Provision is made for co-opting an additional member when the Committee discusses questions affecting any constituent body not already represented.

The Technical Scheme.

The technical scheme lays down that the standard type of current for generating shall be 3-phase a.c. at 50 cycles; main transmission will be at 33 000 V, and secondary transmission 11 000 V and 6 600 V. The exception to the standard 3-phase 50-cycle a.c. system is that part of the system at Blackpool now supplied at a frequency of 83 cycles per second, which is not to be extended and is to be converted to the standard frequency when conditions justify such a course.

The following generating stations belonging to the authorised undertakers respectively specified will be utilised under the scheme:—Accrington (Accrington Corporation), Blackpool (Blackpool Corporation), Burnley (Burnley Corporation), Colne (Colne Corporation), Darwen (Darwen Corporation), Fleetwood (Fleetwood Urban District Council), Nelson (Nelson Corporation). Rawtenstall (Rawtenstall Corporation), Ribble—under construction—(Preston Corporation), St. Anne's (Lytham St. Anne's Corporation), Whitebirk (Blackburn Corporation). The following generating stations belonging to the authorised undertakers respectively specified will be closed down as soon as other supplies are made available under conditions justifying such a course:—Bispham (Blackpool Corporation), Blackpool and Fleetwood—Tramway Station—(Blackpool Corporation), Crown Street (Preston Corporation), Deepdale (Preston Corporation), Jubilee Street (Blackburn Corporation).

A new generating station will be erected as and when required in the neighbourhood of Burnley by the Burnley Corporation or the Lancashire Electric Power Co. In order to make effective use of the generating stations to be utilised under the scheme and to supplement existing interconnecting cables, main transmission lines are to be laid connecting (*a*) Preston (Ribble) and Blackburn (Jubilee Street), (*b*) Blackburn (Whitebirk) and Accrington, (*c*) Accrington and Burnley, (*d*) Burnley and Nelson, (*e*) Rawtenstall with the foregoing main transmission system, and (*f*) Blackpool and Lytham St. Anne's.

A scheme of control of inter-connected generating stations, providing if necessary for the appointment of an officer or officers with full powers to secure the running of the plant in the generating stations in such manner as to ensure the maximum economy in production, is to be prepared by the Engineers' Committee for approval by the Board, who shall within six months from the date of the commencement of the Order giving effect to this scheme submit the same to the Commissioners for their approval.

LIVERPOOL TRAMWAY ENTERPRISE.

Several modifications and improvements have now been made in the illuminated tramcar which toured Liverpool streets recently in connection with a charitable appeal. We understand from Mr. P. Priestly, the general manager, that the car is to be kept permanently for use in connection with collections for various charities.

The car is equipped with 5 209 different lamps, and the wiring is so arranged that, by the insertion of automatic switches and a rotating drum in the lighting circuits, no fewer than 19 different designs can be shown. The centre panel, which shows the City Arms—composed of a Liver Bird, etc.—can be taken out and a special illuminated panel inserted in its place. On this panel descriptive matter can be displayed, showing for what purpose the particular collection is being made.

The whole of the work in connection with the decoration and equipment of the car has been carried out by the Liverpool Corporation Tramways Department.

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BUSINESS OPPORTUNITIES AT HOME AND ABROAD.

Contracts Open.

CASTLEFORD URBAN COUNCIL.—Electric light wiring and fitting at the baths.

BELFAST CORPORATION, November 12th.—Pump wells, etc., in connection with extension to Harbour power station. Specifications, etc. (£10 10s. deposit), from Mr. S. C. Hunter, 2, Wellington Place, Belfast.

KEYNSHAM GUARDIANS, November 12th.—Electric light wiring and fitting Poor Law Institution. Specification may be seen at the Institution.

GREAT WESTERN RAILWAY CO., November 13th.—Telegraph instruments, insulators, telegraph ironwork and tools, telegraph drysalteries, electric lamps, rubber goods, varnishes, paints, oils, ironmongery, etc.* November 23rd.—Electric wires and cables, etc. Specifications from the Stores Superintendent, Swindon.

MANCHESTER CORPORATION. November 13th.—Tramcar trucks and motors, laths, etc. Specifications from the General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

TAUNTON CORPORATION, November 16th.—1 000 kW steam turbine, with condensing plant and accessories. Particulars the Borough Electrical Engineer.

BELFAST CORPORATION, November 19th.—Steam, water and other piping, etc., at Harbour power station. Specification (W.16) from Mr. Johnstone Wright, City Electrical Engineer and Manager, East Bridge Street, Belfast, on deposit of £2 2s.

HAVANT JOINT HOSPITAL DISTRICT BOARD, November 19th.—Electric light wiring and fitting of hospital. Particulars can be obtained at the Hospital.

CHESHIRE LINES COMMITTEE. November 20th.—Twelve months' supply of telegraph materials, etc. Specifications from the Stores Superintendent, Warrington.

BIRMINGHAM CORPORATION, November 21st.—Reconstruction of 700 yards solid double track and 3 000 yards wooden sleeper double track tramway. Specifications (£5 deposit) from the City Engineer.

PRESTON CORPORATION, November 26th.—Two 1 500 kW rotary converter equipments (specification R.P.S.6); h.t. and l.t. switchgear (R.P.S.7); and h.t. cables (R.P.S.8). Specifications, etc. (£2 2s. deposit each), from the Town Clerk. Additional copies of specifications, 10s. per copy (not returnable), from Mr. J. A. Robertson, 20, Brazennose Street, Manchester.

Overseas.

JOHANNESBURG CORPORATION, November 15th.*—Test transformer and other transformers.

JOHANNESBURG MUNICIPALITY, November 19th.*—Cables.

CAPE TOWN MUNICIPALITY, November 29th.*—Transformers.

AUCKLAND ELECTRIC POWER BOARD, November 24th.*—Transformers and accessories.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS, December 5th.*—Transformers for White Bay power house. December 19th.*—Transformers for Meek's Road sub-station.

COMMONWEALTH OF AUSTRALIA, December 12th (in London), or December 15th (in Australia).—Cable terminal boxes (S.A. 676). Particulars, the Supply Officer, Australia House, Strand, London, W.C.2.

VICTORIAN ELECTRICITY COMMISSION, December 15th.*—Transformers and spares.

VICTORIAN ELECTRICITY COMMISSION, December 15th.—Four 1 000 kVA single phase transformers and spares. Specification (No. 23/145) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

VICTORIAN ELECTRICITY COMMISSION, January 3rd.*—Aluminium steel cored cable and accessories.

SYDNEY CITY COUNCIL. January 14th (extended from November 10th.)—Stepdown transformers (Contract 758).

VICTORIAN ELECTRICITY COMMISSION, January 19th.—Transformers, switchgear and accessories for sub-station B. Specification (No. 24/2) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2, upon deposit of £2 2s.

Tenders Accepted.

BIRKENHEAD CORPORATION.—Hackbridge Cable Co., six miles 0·0225 sq. in. cable, £766 10s.

L.M. AND S. RAILWAY CO.—Siemens and English Electric Lamp Co., gas-filled lamps for three months.

C. H. Johnson and Sons have a contract for two coal conveyors for SWANSEA ELECTRICITY COMMITTEE at £520.

LAUNCESTON BOARD OF GUARDIANS has accepted the tender of F. Chapman for electric wiring and fitting at £90.

DEPTFORD (LONDON) BOROUGH COUNCIL.—Duncan Watson and Co., turbine suction-cleaner, £80 (recommended).

SOUTHERN RAILWAY CO.—Siemens and English Electric Lamp Co., vacuum and gas-filled lamps for four months.

SHEFFIELD CORPORATION has accepted the tender of the Express Lift Co., for an electric lift at the Town Hall, at £855.

The tender of Mawdsleys, Ltd., for electric battery charging plant, at £647, has been accepted by WARRINGTON CORPORATION.

* Particulars from the Department of Overseas Trade.

The tender of the Metropolitan-Vickers Electrical Co. for a main switchboard, at £1 190, has been accepted by DUMFRIES CORPORATION.

GLASGOW CORPORATION.—C. A. Parsons and Co., two turbo-alternators, £90 000 each. A. Reyrolle and Co., h.t. switchgear, £34 000.

BRIGHTON CORPORATION.—Siemens Bros. and Co., cable for Carden Avenue electricity supply extension, £685. Bennis and Co., elevator, £373.

MINISTRY OF PUBLIC WORKS, CAIRO.—Associated British Manufacturers (Egypt), three 8 b.h.p. c.c. motors for Government workshops, £E.234.

RUGBY URBAN COUNCIL.—Richard Garratt and Son, 2½-ton electric scavenging vehicle, £995. Hewittic Electrical Co., mercury vapour rectifier outfit, £183.

The tender of the Siemens and English Electric Lamp Company for nine months' supply of vacuum and gasfilled Siemens lamps has been accepted by H.M. OFFICE OF WORKS.

BRADFORD TRAMWAYS COMMITTEE.—National Rail and Tramway Appliances Co., 15-tons Peckham hand-brake shoes, £165. Cole, Marchent and Morley, 40 tons track-brake shoes, £400.

SUNDERLAND GUARDIANS.—Reid, Ferens and Co., transformer station and mains, £963 13s. 6d.; wiring at workhouse, £918 4s.; motors, £320 15s. Watson, Norrie, Ltd., wiring cottage homes, £256 11s.

PORTSMOUTH CORPORATION.—Johnson and Phillips, switchgear for six sub-stations, £6 960; General Electric Co., 6 transformers, £237 each; British Electric Transformer Co., 750 kVA single-phase oil-cooled transformer, £509.

The tender of J. H. Piggott (lowest tender) for electric wiring and fitting at East Cliff House, Princess Mary's Hospital for Children, at £158, is recommended for acceptance by the METROPOLITAN ASYLUMS BOARD. Twenty-two tenders were received, the highest being £400 3s. 10d.

Among the tenders accepted by BERMONDSEY (LONDON) BOROUGH COUNCIL are the following: Chamberlain and Hookham, 12 50A meters at £4 1s. each, six 5A two-rate meters, £4 5s. 6d. each, six 10A two-rate meters, £4 15s. each; Lucy and Co., feeder pillar, £8 5s.; Babcock and Wilcox, boiler parts, £97 19s. 6d.

PORTSMOUTH CORPORATION has accepted the following tenders in connection with the extension of electricity supply to Havant and Emsworth district: Johnson and Phillips switchgear for six substations, £6 960; General Electric Co., Ltd., six transformers, £237 each; British Electric Transformer Co., 750kVA transformer, £509.

OBITUARY.

Dr. C. P. Steinmetz.

We regret to learn of the death at Schenectady, New York, last Friday, of Dr. Charles Proteus Steinmetz, chief consulting engineer to the General Electric Co. (U.S.A.). He was born at Breslau in 1865, and after studying electrical engineering, and chemistry at Breslau, Berlin and Zurich, was associated with Mr. Rudolph Eickemeyer from 1889 to 1893, when he entered the service of the American General Electric Co., with whom he has remained since that time. In 1903 he was elected professor of electrical engineering at the Union University, New York. He undertook a vast amount of research work and had a remarkable private laboratory at his Schenectady home. One of his great beliefs was that the future of civilisation depended on the wider distribution and application of electrical energy, and he advocated a national supply for the States under Federal control. He was a past president of the American Institute of Electrical Engineers and the Illuminating Engineering Society. Dr. Steinmetz was the author of a large number of books, monographs and papers on electrical matters. Among his best known works are "Theory and Calculation of Alternating Current Phenomena," "Theoretical Elements of Electrical Engineering," "General Lectures on Electrical Engineering," "Theory and Calculation of Transient Electric Phenomena and Oscillations," "Radiation, Light and Illumination," "Engineering Mathematics," and "Electric Discharges, Waves and Impulses."

Mr. V. Mallalieu.

The funeral took place at Cheadle Hulme, last Friday, of Mr. Vernon Mallalieu, who met his death as the result of an accident while on business at Nelson for the English Electric Co. His first electrical experience was obtained as a youth at Stafford, with Siemens Brothers' Dynamo Co. He then went to the Brush Electrical Engineering Co., and took up, in 1911, a position with the Siemens Schuckertwerke, in Berlin, where he remained for one year. Returning to England, he served from 1912 to 1915 with Siemens Brothers' Dynamo Works, London, after which he spent two years with the British Westinghouse Co. From 1917 to 1919 he was a member of the Lancashire Anti-Submarine Committee, Manchester, and in the latter year joined the staff of the Metropolitan-Vickers Electrical Co. Quite a few months ago he took up a position with the English Electrical Co. Only 37 years old, Mr. Mallalieu, who specialised in the application of electrical driving to textile factories, was a well-known member of the Textile Institute. He had been an associate member of the Institution of Electrical Engineers since 1912. He is survived by his widow and two young children.

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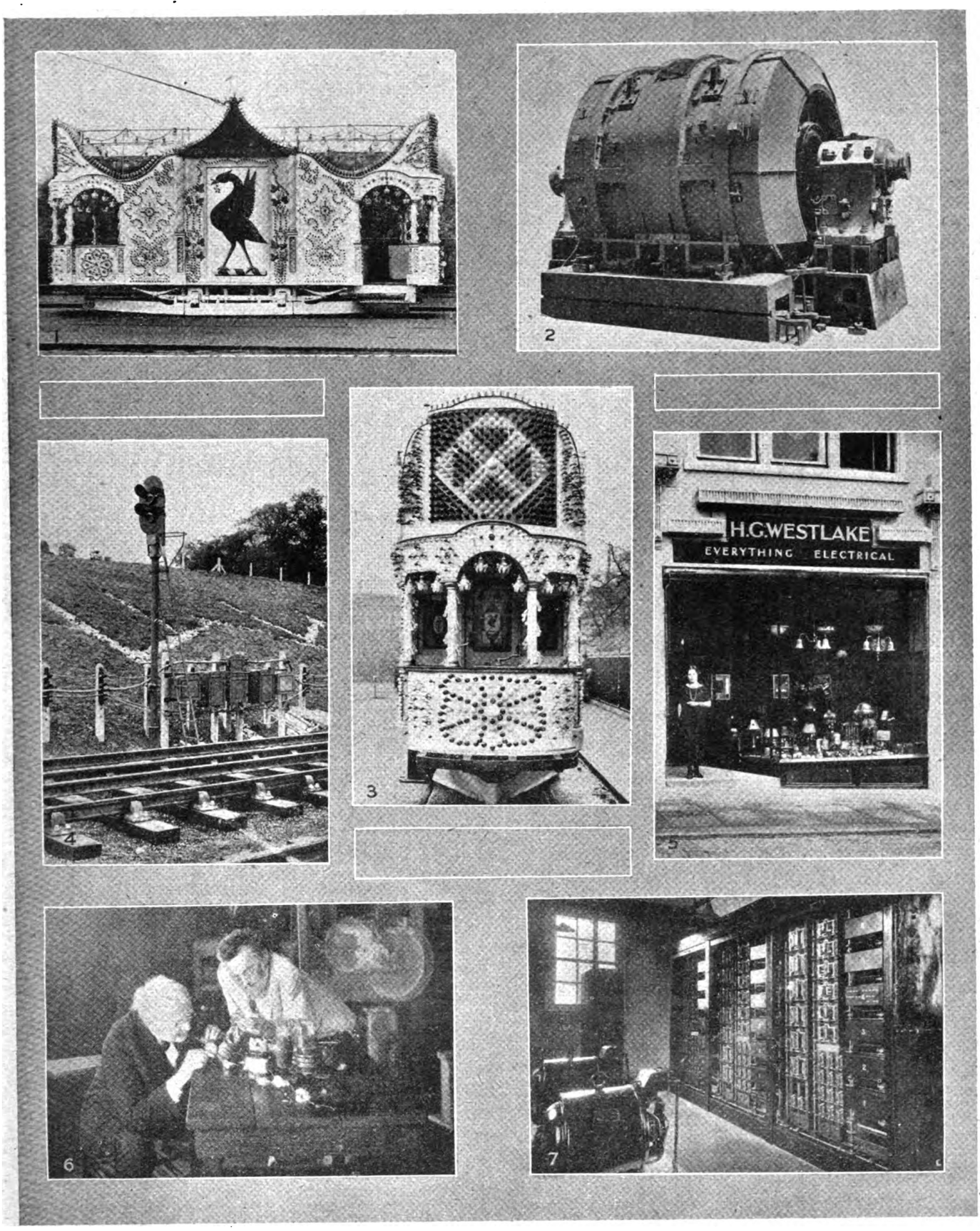

ELECTRICAL NEWS IN PICTURES.

1.—Side view of Liverpool's permanently decorated tramcar, showing the removable panel in centre (p. 497).
2.—Main propelling motor on the Diesel-electric ship "La Playa" (p. 493).
3.—Liverpool's "super-electric" tramcar, seen from the driver's end (p. 497).
4.—One of the electrically-operated day and night signals on the Edgware extension of the "Underground" railways, which is rapidly nearing completion.
5.—The distinctive effect of good lettering on shop signs is a noticeable feature of these new Halifax showroom premises.
6.—Dr. C. P. Steinmetz (right), whose death is announced, discussing matters electrical with Mr. T. A. Edison at Schenectady (p. 498).
7.—Hull's new municipal automatic telephone exchange, which was formally opened last week.

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ELECTRICITY SUPPLY.

Latest Extensions and Developments.

New electricity mains are being laid in Nottingham to provide work for the unemployed.

CHESTERFIELD Town Council has received sanction to a loan of £5 125 for mains and services.

MANCHESTER Electricity Committee proposes to spend £50 000 on the provision of feeder mains.

The new power station of the Wareham Electric Supply Co. was officially opened last week.

BOLTON Electricity Committee is to experiment with a hire-purchase system for cooking appliances.

BARROW Town Council has decided to apply for sanction to borrow £13 356 for extensions to electricity mains.

The West Wilts Distributing Corporation has provisionally arranged with the BATH Corporation for a supply of electricity in bulk.

It is reported that Hull Electricity Committee has approved in principle a scheme for the development of the municipal electricity undertaking at an estimated cost of £100 000.

WELSHPOOL Town Council has declined to support an application of the Welshpool Gas Co. for an Order to undertake an electricity supply scheme, and has decided to apply for an Order itself.

A grant of £700 000 has, it is reported, been authorised by the Treasury for the erection of a new power station at Stourport for the Shropshire, Staffordshire and Worcestershire Electric Power Co.

The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board has decided to apply to the Commissioners for sanction to erect a new generating station at Hartshead, and to make application to the Unemployed Grants Committee for financial assistance.

POPLAR Electricity Committee reports that it has considered a report on a prepayment system of supply of current for domestic purposes, and approved experimental installations of slot meters in connection with a few of the existing cooking and hot water appliances.

Tapping New Areas.

BRIGHTON Corporation is negotiating with regard to the supply of electricity to the Southwick Urban Council.

CARNARVON Town Council has arranged to take a bulk supply from the North Wales Power Co., and it is hoped that this supply will be available in a few months.

BIRKENHEAD Corporation is applying to the Commissioners for powers to extend its electricity supply to include the Bebington and Bromborough District Council's area.

HINDERWELL Urban Council has decided to communicate with the Cleveland and South Durham Electric Supply Co., with respect to the provision of a supply of electricity for the Council's area.

Application is being made by the Gayton Park Electricity Co. for authority to supply electricity in the urban districts of Bebington and Bromborough and Neston and Parkgate, and the parishes in the Wirral Rural District Council's area of Arrowe, Barnston, Brimstage, Burton, Childer Thornton, Heswall-cum-Oldfield, Hooton, Irby, Landican, Ledsham, Moreton, Ness, Pensby, Poulton-cum-Spital, Puddington, Raby, Saughall Massie, Storeton, Great Sutton, Little Sutton, Thingwall, Thornton Hough, Thurstaston, Willaston and Woodchurch.

Alterations in Charges.

LUTON Town Council has abolished, after the reading of the meters for the quarter ended September last, the additional charge of 25 per cent. above the pre-war prices.

The North Metropolitan Electric Power Supply Co. has reduced the charge for electricity for lighting at Hertford from 9d. to 8d. per kWh, and for heating, from 3d. to 2½d. For power, the surcharge of 50 per cent. is reduced to 33⅓ per cent.

Subject to the installation being carried out in accordance with the requirements of the borough electrical engineer, electricity used for the purpose of illuminating displayed outside signs at Bedford will be charged at a fixed price of 12s. per annum per 50 W lamp installed, payable in advance for not less than one year's service.

Hammersmith Electricity Department proposes to reduce its charge for current for general lighting from 6d. to 5d. per kWh, and the power supply charge from 1·75d. to 1·5d. Proportionate reductions will also be made in the tariffs for large consumers at special rates, combined power and lighting, showroom supplies, and supplies to cinemas and 'bus garages.

Inquiries and Orders.

ANDOVER Town Council has decided to consent to the application of the Western Electric Distributing Corporation for a special Order to supply electricity in the borough.

A Board of Trade inquiry was held last week relative to the question of erecting overhead electric wires at Cuckfield and Lindfield, by the Haywards Heath and District Electricity Supply Co. Objections were based on the ground that overhead wires would spoil the beauty of the district, and it was understood that a compromise was likely and that underground mains would be laid in a portion of the area.

PERSONAL GOSSIP.

Out of over a hundred applicants Mr. R. E. Rushworth has been appointed electrical engineer to the Skipton District Council.

Mr. W. T. Upton, electrical engineer, of George Street, Oxford, has been appointed Reg. of M. of the Alfred Lodge of Mark Master Masons.

Mr. Percy Russell Jocklin, of 44, Sussex Square, Brighton, electrical engineer, is a candidate in the King's Cliffe Ward for a seat on the Town Council.

Mr. George Kerslake Blatchford, who has consented to serve as Mayor of Okehampton for the ensuing year, is proprietor of the local electricity undertaking.

Mr. James Scott has been nominated to fill the vacancy caused on the Merseyside Electricity Committee by the resignation of the Lord Mayor of Liverpool.

At the annual festival of St. John of the Manor Lodge of Freemasons, at Blackburn, Brother P. P. Wheelwright, electrical engineer, was installed as steward.

Chester Town Council has decided to grant an honorarium of £500 to Mr. S. E. Britton, the city electrical engineer, in recognition of the services he has performed in recent years in the capacity of consulting engineer.

Mr. E. W. Jones, general manager of the Mountain Ash Urban Council's electricity undertaking, has had his salary increased from £400 to £450 per annum as from October 1st, with two further annual increments of £25 each, to make the maximum salary £500.

Mr. Percy Still, who has been hon. secretary of the Diesel Engine Users' Association since 1914, has asked the committee to relieve him of his duties after the end of the year as the growth of the work in recent years is taking up too much of his time. With a view to retaining Mr. Still's services the committee is considering a suggestion under which the work might be carried on by joint honorary secretaries.

At the inspection of the Newcastle Tramways Department's new depot at Byker last Friday, Alderman Mayne, on behalf of the Tramways Committee, presented Mr. Ernest Hatton, the engineer and general manager, with a grandfather clock as a memento of the completion of the high level tramway extension. In making the presentation he said that the extension of the system generally was very largely due to the enterprise of Mr. Hatton, to whom alone was due the credit for the High Level Bridge extension.

LEGAL INTELLIGENCE.

Theft of Electricity.

How electrical energy for lighting was obtained through a power meter at 1½d. per kWh instead of 5d., the municipal undertaking's charge for lighting, was described before Brighton magistrates on October 24th, when Mrs. A. Clayton was fined £10 for diversion.—It appeared that when the power and lighting meters in the defendant's house were inspected in August, the lighting meter had registered nothing since June, although a light was burning at the time of the inspection. An attachment to the power meter was then noticed.—The defendant, who pleaded not guilty, said she had no idea she was doing wrong, but the magistrates expressed the opinion that she knew more about electricity than she would admit.—Ernest Oakley, described as a cutler and electrician, who was summoned for aiding and abetting, denied that he had made the attachment connecting the lighting installation with the power meter; he was discharged.

Telephone Instrument Rentals.

In the Mayor's and City of London Court, on Tuesday, before Judge Shewell Cooper, the London Telephone (New System) Co., Ltd., Donnington House, Norfolk Street, Strand, claimed £4 7s. 8d. against Barry Bros., fruit importers, 28, Martin's Lane, and Liverpool, one quarter's rent of telephone instruments due in advance.—Mr. W. Price, for the plaintiffs, said the claim was in respect of nine instruments installed on defendant's premises at £4 7s. 8d. a quarter.—The defence was that the contract was entered into by one Marshall, without the authority of the defendants.—Judgment was given for the plaintiffs, with costs.

Supply Company's Disputed Account.

In the Mayor's and City of London Court, on Tuesday, before Judge Shewell Cooper, the County of London Electric Supply Co. sued Mr. D. J. Reading, motor engineer, Peckham, for £10 13s. 11d. meter rental and electricity supplied.—Mr. Harry Strouts, the plaintiffs' solicitor, said they abandoned £4 of the claim and only claimed £6 13s. 11d. for electrical energy for the March-June quarter and up to July 27th, when the supply was disconnected for non-payment of the account. The defendant wanted credit for the £3 deposited by the previous consumer.—The defendant said he took over his business, lock, stock and barrel. All receipts were handed to him and therefore he thought he was entitled to the deposit of £3, which they kept because his predecessor owed the plaintiff company £1 8s.—Mr. Strouts said if the defendant would get his predecessor's authority to say that defendant might have the deposit they would give it to the defendant. The defendant said he did not know where the former tenant was.—Judge Shewell Cooper found for the plaintiffs for £6 13s. 11d., with costs.

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WIRELESS CHAT.

A deputation from the Empire Press Union was received by a Committee of the Imperial Economic Conference last week. Mr. Robert Donald (the chairman) pointed out that the remarkable progress that had been made in commercial long-distance wireless during the last two years had affected every wireless organisation in the world except the British Post Office. After detailing the high-power stations erected in foreign countries, Mr. Donald said the progressive schemes of other countries were rapidly occupying the wave-lengths suitable for long-distance transmission, so that it would soon be difficult to obtain the wave-lengths required for the Imperial scheme within the usual wave-band of from 10 000 to 26 000 metres. If the latest proposal of the Post Office to divide the Empire into two wireless spheres was carried out, the comprehensive world scheme adopted by Australia would be destroyed. The Australian scheme provided for the erection of a station at Vancouver, and another was to be built at Montreal. If the Post Office took over Canada as part of its division of the Empire the Australian plan would fall through, and who would build the necessary stations at Vancouver and Montreal? Other members of the deputation gave their views, and the Committee promised that the suggestions of the Empire Press Union would be considered by the Conference.

Wireless Stations in Russia.

A translation of a Decree of the Council of Peoples' Commissaries of the Union of Soviet Socialist Republics, regarding the installation of wireless stations by State, trade union and Communist party organisations in Russia, has been received by the Department of Overseas Trade from the British Commercial Mission, Moscow. The Decree lays down the fundamental rules to be observed in connection with the construction and exploitation of wireless stations for special purposes which are stated to be industrial and commercial wireless stations, wireless stations for educational and scientific purposes and amateur wireless stations. The translation of the Decree may be seen by United Kingdom firms on application to the Department of Overseas Trade (Room 53), 35, Old Queen Street, London, S.W.1.

Duplicating Broadcast Programmes.

Arrangements for the acquisition of a building in Wardour Street, London, for a new transmitting station for the British Broadcasting Company are reported to have fallen through, but it is hoped to secure premises before long so that two London programmes can be given simultaneously.

The company hopes to be able to retain its present station at Savoy Hill, Strand. From one of the stations it may be possible, if the authorities agree, to transmit Parliamentary debates, educational matters, or lectures.

Wireless on Trains.

As previously reported in THE ELECTRICIAN, the French postal authorities have been experimenting with wireless receiving apparatus on both slow and express trains between Paris and Mantes, and between Paris and Le Havre. The results are said to have been successful in so far as connections were maintained with the Paris wireless stations, and English messages were also picked up all the way to Mantes. These connections were momentarily severed, however, by obstacles on the route, such as tunnels and iron bridges. When transmitting on short wave-lengths the messages were weakened when passing ground elevations. In addition, certain murmurings registered were attributed to such causes as the proximity of powerful telegraph lines, electric signalling apparatus, or factories, and to the generation of electricity by the dynamos beneath the railway carriages. Similar attempts on the Paris-Orleans line resulted in maintaining a connection as far as Angoulême.

Wireless News in Brief.

Wednesday was the last day for the issue of interim licences for "listeners-in."

Mr. C. G. Greenshields, of the Canadian Marconi Co., states (according to Reuter) that if the British Government persists in its proposals for conducting the wireless service with Canada by British Government stations the Canadian Marconi Co. will have to abandon its plans for the erection of two large Canadian stations.

INSTITUTION NOTES.

The joint meeting of the Institution of Electrical Engineers with the British Section of the Société des Ingénieurs Civils de France, which was to have been held on Thursday, November 15th, has been postponed to Thursday, November 22nd, when a paper by M. Bachellary, entitled "The Electrification of the Midi Railway," will be read and discussed.

Sir J. Fortescue Flannery has accepted the invitation of the Council to become President of the Junior Institution of Engineers in succession to Captain H. Riall Sankey. His induction will take place at a meeting to be held at the Royal Society of Arts on Friday, December 7th, when he will deliver his Presidential Address, "Marine Propulsion during 50 years." Tickets for the meeting, which commences at 7.30 p.m., may be obtained from the Secretary of the Institution, 39, Victoria Street.

ELECTRIC TRACTION.

Tramway Extensions and Developments.

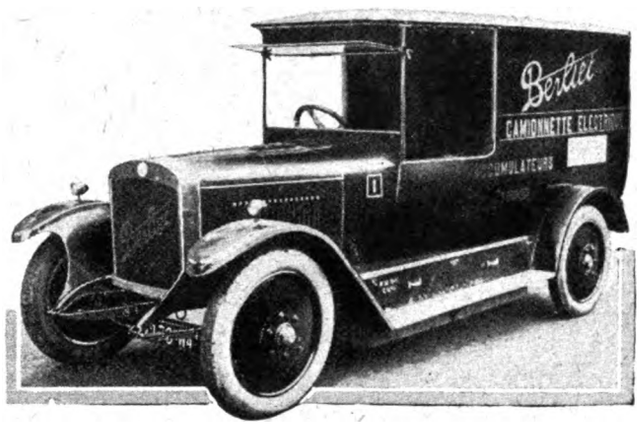
Experiments are being made with trackless trams in Ipswich.

Important extensions of the Portsmouth tramway system are proposed, the estimated cost being £170 000.

London County Council is considering the desirability of promoting a Bill to enable it to construct tramways across Southwark Bridge.

Birkenhead Council has decided to apply to the Ministry of Health for sanction to the Corporation borrowing £50 534, the estimated cost of renewing certain portions of the tramway track.

One of the new trolley omnibuses, which are to run shortly on the Wednesfield Road (Wolverhampton) route in substitution for the overhead tramway system, was given a trial trip last week.



A SMART ELECTRIC DELIVERY VAN WHICH TOOK PART IN THE RECENT FRENCH ELECTRIC VEHICLE TRIALS. THE INFLUENCE OF PETROL VEHICLE DESIGN IS A NOTICEABLE FEATURE IN CURRENT FRENCH MODELS.

The Swan Lane tram extension at Bolton was formally opened on October 26th, by the chairman of the Committee (Councillor J. R. Horrocks), who was accompanied by the general manager (Mr. J. Barnard), the Mayor and other representatives. The chairman mentioned that the department had provided for depreciation and had set apart £113 000 for this purpose.

Edinburgh Tramways Committee is considering the advisability of substituting mastic rock asphalt for granite paving on the tramway tracks. This method, it is stated, effects a saving of approximately £2 000 a mile on single track. The Committee recommends that four car bodies with electrical equipment be built in the Corporation workshops, and that tenders be invited for the construction of twenty other cars and equipment. The approximate total expenditure will be over £33 000.

Fares, Receipts and Passengers.

During the week ended October 20th traffic receipts on London tramways controlled by the Underground group totalled £38 527, a decrease of £5 103 on the corresponding week last year.

Liverpool Tramways Committee recommends that a new scheme of overlapping penny stages be put into operation. A suggestion that the adoption of such a course will adversely affect the revenue is made by the general manager, Mr. P. Priestly, in a recent report on the fare question.

Electric Railway Items.

Traffic receipts on the Mersey Railway for the week ended October 20th totalled £4 167, bringing the total for the year to date to £189 483.

The London Midland and Sottish Railway Co. is constructing a new station on the Liverpool and Southport electric line about two miles from the Southport terminus.

Another effort is to be made by Brighton Town Council to obtain an interview with the directors of the Southern Railway to urge the acceleration of the electrification of the line from London to Brighton.

Miscellaneous Traction News.

A service of electric motor 'buses between Modane and Lanslebourg, French Savoy, was formally inaugurated last week.

It is understood that the Minister of Transport has again declined to support corporations which desire legislation to hold up other traffic when a tramcar halts at its recognised stopping place.

At the annual social of the Blackpool Electricity and Tramways Institute last week Councillor Lumb presented the Lumb Trophy to the Foundry Department, and a number of gold medals to individual employees.

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COMPANY NEWS.

Meetings, Reports and Dividends.

City of Buenos Aires Tramways Co.—A quarterly dividend at the rate of 5 per cent. per annum, or 1s. 3d. per share, less tax, is payable on November 16th.

Calcutta Electric Supply Corporation.—The directors have declared an interim dividend on the ordinary share capital at the rate of 4 per cent. actual for the half-year ended June 30th, 1923, payable on November 15.

English Electric Co.—It is announced that a new block of preference shares just issued is in part consideration for the 4½ per cent. debentures of the Coventry Ordnance Works, the rest of the consideration being in ordinary shares and 6 per cent. debentures.

Oriental Telephone and Electric Co.—Interim dividends have been declared at the rate of 3¼ per cent. on the old fully paid 7 per cent. cumulative preference shares, less tax, and at 4 per cent. on the old fully paid ordinary shares, tax free. Warrants were posted on Wednesday.

Brisbane Electric Tramways Investment Co.—It is announced that the Full Court of Queensland gave a majority judgment on August 28th, that the purchase money for the tramways undertaking is to be determined in accordance with the decision of the House of Lords in the cases of the Edinburgh and London street tramways. Instructions for an appeal to the Privy Council have been given, but the case can hardly be heard before the middle of next year.

South Wales Electrical Power Distribution Co.—A circular is being sent to the preference shareholders setting forth the advantages that will accrue to them if the provisional agreement, outlined in The Electrician of August 31st, is carried into effect. The object of the agreement, which is between the South Wales Power Co. and the Distribution Co., is to constitute the former a holding company, in which the whole of the capital issues, including loan capital, of the Distribution Co. will be vested, while the administration of the electricity undertaking will become vested in the Distribution Co.

Ateliers de Construction Oerlikon.—For the year ended June 30th last a net profit was made of 1 845 878 francs. A dividend of 8 per cent. is again to be paid on the capital of 16 000 000 francs. The report refers to growing competition and ascribes this in part to the increased domestic production of many European countries during and since the war. The directors point out that it would not be politic to continue to keep the works going at any cost, as was done during the war. Swiss electrical goods will only maintain their position by retaining a high standard of technical perfection, coupled with quick delivery at a reasonable price.

North Melbourne Electric Tramways and Lighting Co.—The report states that the sum realised on the sale of the undertaking, and the assets and cash in hand—after allowing of payments and expenses authorised by the debenture holders—amounted to £118 820, which has been paid to the debenture holders, making a total distribution of 71·15 per cent. of the face value of the debentures. The company has no other assets, and is not carrying on any business, and it is proposed that the company be wound up voluntarily, and that Mr. W. W. Stacey be appointed liquidator. The meeting will be held at 9, Cloak Lane, London, E.C.4, on November 7th at noon.

International Light and Power Co.—Strong reference was made by Mr. Follett Holt at a meeting of shareholders in London last week to the withholding, for the fifth year in succession, of the Mérida Company's cash deposits with the Reguladora, a Government institution in the State of Yucatan. In Paraná, Argentina, the year had been, on the whole, encouraging. The company seemed now to have turned the corner, and its cash position was such that the directors hoped to commence the payment of accrued arrears of dividend early in 1924. Proxies were signed in favour of resolutions to be submitted at the annual meeting in Toronto on November 19th.

Erinoid Co.—Trading profits of £30 077 are shown in the report for the year ended August 31st, 1923, and after allowing for depreciation of plant, etc., the net profits are £17 125, which with the amount brought forward leaves a balance of £19 820. The directors recommend the payment of a dividend of 4 per cent. less tax, at 4s. 9½d., transferring to general reserve £5 000, and carrying forward £7 480. The re-equipment of the factory of the French company, the Compagnie Française de l'Omnilith, was completed during the year, and that company is now supplying the French market. The annual meeting will be held at the Institute of Chartered Accountants, London, E.C., on November 6th, at noon.

London Electric Railway Co.—Offers have been invited for £2 356 000 4½ per cent. redeemable second debenture stock, 1942-72, of the London Electric Railway, and £3 760 000 4½ per cent. redeemable second debenture stock, 1942-72, of the City and South London Railway, both at 95½ per cent. Both the issues are guaranteed as to principal and interest under the Trade Facilities Acts, and are available for trustees. The stocks are repayable at par on June 30th, 1972, but they may be redeemed at par on or after July 1st, 1942, on three months' notice. At the issue price of 95½ the flat yield is £4 14s. 3d. per cent. The money is required for the extension of the City and South London Railway from Clapham Common to North Morden and the extension of the Hampstead section of the London Electric Railway from its present terminus at Charing Cross to Kennington, the construction of a new central station at Piccadilly Circus, and the reconstruction of the station at Leicester Square. The subscription list was closed early on Tuesday.

New Companies.

Malmesbury Electric Supply Co., Ltd.—Cap., £6 000. Business indicated by title. Reg. office: The Electricity Works, Malmesbury, Wilts.

Sea Houses and District Electric Supply Co., Ltd.—Cap., £5 000. Business indicated by title. Reg. office: The Power Station, Sea Houses, Northumberland.

Taylors Radio Electric, Ltd.—Cap., £500. Radio specialists, wireless and electrical engineers, etc. Solicitor: E. Horley, Andrews Buildings, 67, Queen Street, Cardiff.

Melide, Ltd.—Cap., £100. Electrical engineers, manufacturers of wireless, electrical and other implements and machinery, &c. Solicitors: De La Chapelle Bartlett & Co., 34-6, Gresham Street, London, E.C.2.

Bell Electrical Co. (Northern), Ltd.—Cap., £100. To acquire concessions relating to the manufacture of electrical distribution boards, manufacturers of, agents for and dealers in electrical apparatus. Reg. office: Palatine Chambers, 6, Market Street, Halifax.

Van den Plas (England) 1923, Ltd.—Cap., £6 000. Manufacturers and repairers of and dealers in electric carriages and mechanically propelled vehicles of all kinds, etc. Solicitors: Soames, Edwards and Jones, Lennox House, Norfolk Street, London, W.C.2.

FORTY YEARS' AGO.

"The Electrician," November 3rd, 1883.

The Explosions in the Underground Railways.—In both the Metropolitan and the District Railway tunnels the explosions of Tuesday night destroyed the telegraph wires on the spot and caused temporary interruption of traffic, the safe working of which is mainly dependent on telegraphic signalling.

* * *

Is it a Joke?—We mentioned recently a true tale of a railway company's charges, but the following is perhaps better. We are told that a gentleman ordered some Swan lamps. The lamps were invoiced to burn with 45 volts. A reply came back that the lamps had been safely received, but that, though the packages had been carefully hunted through, no sign of the 45 volts was to be found.

* * *

The Society of Telegraph Engineers and of Electricians.—The members of this society, accompanied by lady friends, held a conversazione, under the presidency of Mr. Willoughby Smith, at the South Kensington Museum on Thursday evening last. The first ordinary general meeting this winter will be held by the Society at the Institution of Civil Engineers, 25, Great George Street, Westminster, on Thursday next, 8th inst., at 8 p.m., when a paper will be read by the president, Mr. Willoughby Smith, on "Volta-Electric Induction," illustrated by experiments.

* * *

Factory Lighting.—A very successful application of the Ferranti system to the lighting of a woollen factory has recently been made at the works of Messrs. George Brook, jun., and Co., of Bradford, the result being so entirely satisfactory that the firm has decided not to lay on gas, the mill being, therefore, entirely dependent on the electric light for its illumination. An experiment was in the first place made by fixing incandescent lamps on movable brackets on to the looms, caused by the motion of the shuttle frame. The lamps were next fixed on telescope brackets, with movable joints, suspended from the roof over the looms so as to admit of the lamp being moved about in any direction. The efficient lighting of every part of the looms was thus fully secured. The installation was made under the direction of Mr. Alfred Thompson.

BUSINESS MEMS.

Mr. F. Creedy, electrical and mechanical engineer, informs us that he has removed to 40, Madeley Road, Ealing, London, W.5.

T. Wing and Son, electrical and general engineers, have taken over the business of Goodburn and Co., Clarendon Road, Broadstairs.

Mr. J. E. Dyson, electrical engineer, of 1, Ramsden Street, and Corporation Street, Huddersfield, announces that he is closing down his business.

The title of the business of S. P. Marsh, electrical engineers, 63, Regent Street, Rugby, owned by Mr. F. Pritchard, has been changed to The Rugby Electrical Engineering Co.

W. H. Willcox and Co., 38, Southwark Street, London, S.E.1, have altered their telegraphic address to "Enginsflys, Boroh, London." The cable address is "Enginsflys, London."

Medway's Safety Lift Co. has transferred its works from Rolt Street, Deptford, London, to Victoria Works, Maidstone. The company's selling organisation will be continued at 35, Surrey Street, Strand, London, W.C.2.

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TELEGRAPH & TELEPHONE NOTES.

A new telephone exchange at Southall relieves Ealing of 256 subscribers' lines.

Restrictions on the use of telegraph codes in Japan are withdrawn in areas not under martial law.

A new telephone exchange has been opened at Ellesmere Port to replace the existing installation.

New underground wiring works are to be put into operation immediately by the Postmaster-General to alleviate unemployment.

A "Times" correspondent states that the Bombay telephone system will probably be converted to automatic working by May next.

Many London theatrical managers are understood to have declined to allow their performances to be transmitted over the "electrophone."

Restoration of direct service on the lines of the Indo-European Telegraph Co. to Crimea, Iraq, India and the Far East was accomplished at the beginning of this month, so that just nine years after the outbreak of the world war the three main telegraph routes between Great Britain and the Far East are again in daily operation.

Post Office telephone engineers are said to be experimenting with a new apparatus to enable people to use the ordinary call boxes for long-distance telephoning. The box is designed to take silver as well as copper, so that almost any trunk call can be made from an ordinary call box. If the call is not effective, pressure of a button returns the money.

If the necessary grant can be obtained from Parliament when it reassembles, the completion of the Post Office tube railway will be undertaken early next year at a cost of about £500 000. The tube, which is to carry mails on electric trucks from Whitechapel to Paddington, with six stations en route for the reception and discharge of mails, will be 6½ miles in length.

In the new telephone directory a notice to architects and property owners states that it would be advantageous if the Post Office were notified in advance of the contemplated construction or reconstruction of buildings which will contain a number of offices or flats, so that wiring can be completed before the work is finished, and prompt provision of a telephone, when required, may be possible.

The Commercial Secretary at Rome has forwarded to the Department of Overseas Trade a copy of the technical programme prepared by the Minister of Posts and Telegraphs, relative to the transfer of the Italian telephone system to private enterprise. This document can be inspected by British firms at the Department of Overseas Trade (Room 54), 35, Old Queen Street, London, S.W.1. (Reference 18817/F.W./C.P.)

METAL & CHEMICAL PRICES.

TUESDAY, October 30th

		Price.	Inc.	Dec.
***Copper*—**				
Best Selected ..	per ton	£62 5 0	—	£1
Electro Wirebars ..	„	£64 0 0	—	15s.
H.C. Wire, basis ..	per lb.	9 1/16d.	—	1/16d.
Sheet	„	9 1/8d.	—	—
***Phosphor Bronze Wire (Telephone)*—**				
Phosphor Bronze Wire, basis	per lb.	1s. 1 1/16d.	—	1/16d.
***Brass* 60/40—**				
Rod, basis	„	7½d.	—	—
Sheet, basis ..	„	10d.	—	—
Wire, basis	„	10d.	—	—
***Pig Iron*—**				
Cleveland Warrants	per ton	£5 5 0	2s 6d.	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
***Lead Pig*—**				
English	„	£32 0 0	£2 10s.	—
Foreign or Colonial	„	£30 10 0	£2 10s.	—
***Tin*—**				
Ingot	„	£205 10 0	£3 12s. 6d.	—
Wire, basis	per lb.	2s. 8½d.	¼d.	—
Aluminium Ingots ..	per ton	£120 0 0	—	—
Spelter	„	£33 10 0	2s. 6d.	—
Mercury	per bottle	£9 10 0	—	5s.

***Sulphur* (Flowers)**—Ton £8 10s. ***Sodium Chlorate*—Per lb. 2½d.**
„ **(Roll-Brimstone)**—„ £8 10s. ***Sulphuric Acid* (Pyrites, 168°)**
Copper Sulphate.. „ £25 10s. per ton, £7 10s.
***Boric Acid* (Crystals)**. „ £48 ***Sodium Bichromate*.—Per lb. 4½d.**
***Rubber*.—Para fine, 1s. 0½d.; plantation 1st latex, 1s. 1½d.**

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co.

The Berlin tramway service has been suspended to enable a new company to make arrangements for running the system. About half the services are to be abandoned to save expense. In spite of higher fares the service made a deficit of 517 000 000 000 marks during the six days' working prior to the stoppage.

COMMERCIAL INFORMATION

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ACME ELECTRICAL CO., 250, Stanley Road, Bootle, electricians. £11 0s. 8d. September 25th.

CENTRAL ELECTRICAL CO., 159, Pentonville Road, King's Cross. £15 18s. 6d. September 26th.

MOODY, G. H. and R. C., 33, Trinity Road, Tooting, wireless engineers. £109 4s. 9d. August 29th.

NORTHERN ARMATURE WINDING CO., Stockton Street, West Hartlepool, electrical engineers. £19 14s. 4d. September 26th

PEEL, H. C. AND CO., 123, Northumberland Road, Newcastle-on-Tyne, electricians. £41 9s. September 27th.

RADIO STOCKS, LTD., 89, Newman Street, Oxford Street. £15 7s. 10d., September 4th; and £25 15s. 5d., September 19th.

RILEY, J. (trading as CARK ELECTRICAL SWITCH BLOCK AND CASES CO.), Power Station, Flookburgh, Cark-in-Cartmel. £47 10s. 2d. August 14th.

SHIRTCLIFFE, Mr. (trading as ABBEY ENGINEERING CO.), 27, Harbour Lane, Whitstable. £14 6s. 3d. September 21st.

Receivership.

BRITISH RADIO SALES CO., LTD. J. J. Bamberger of St Stephens Buildings, Gresse Street, Tottenham Court Road. W.C., was appointed receiver and manager on September 12th, under powers contained in debenture dated August 18th, 1923.

Private Meetings.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

ALEXANDRA (A. C.) AND CO., LTD.—By order of the Court, on October 23rd, the Official Receiver was appointed provisional liquidator of this company, pending the production by the company of a scheme of reconstruction.

FER (CHARLES) AND CO., LTD., manufacturers of scientific instruments, 42, Newgate Street, London, E.C., also trading as THE DOMESTIC ELECTRICAL APPLIANCES CO., at 287A, Finchley Road, N.W.3; 24, Market Place, Reading; 74, Prince of Wales Road, Norwich; and 14, Queen Street Arcade, Cardiff. This company is in voluntary liquidation, following upon the appointment of a receiver for the debenture holders, and the statutory meeting of creditors was held on October 30th, at the Institute of Chartered Accountants, Moorgate Place, E.C. The statement of affairs presented showed unsecured liabilities of £8 065 (trade creditors, £1 591), and net assets £529, insufficient to meet the debentures.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Companies Winding-up.

KEENE (WILLIAM J. A.), LTD., 10, North End Road, Golder's Green, Middlesex. Winding-up order, October 23rd.

Company Winding-up Voluntarily.

BOOTLE ELECTRICAL CO., LTD.—C. Hodgson, 70, Central Buildings, 41, North John Street, Liverpool, Certified Accountant, appointed Liquidator. Meeting of creditors at 70, Central Buildings, 41, North John Street, Liverpool, on November 13th, at 11 a.m. Claims by December 13th.

CROOKELL (W.) AND CO., LTD. J. Burgess, Bridge Chambers, Market Place, Stockport, chartered accountant, appointed liquidator.

Partnerships Dissolved.

B. KEWELL AND CO. (Samuel Wilberforce CORRIN, Edgar BANKS, Enoch GORSE, and Bertie KEWELL), electricians, 24, Paxton Street, Barrow-in-Furness, as from December 31st, 1922, so far as concerns E. Gorse, who has retired from the firm. Debts received and paid by Messrs. Corrin, Banks and Kewell, who will continue the business.

THOBEC ELECTRICAL SUPPLIES (Richard David Williams THOMPSON and George Noel BUCKTON), general electrical engineers, 28, Victoria Street, Westminster, by mutual consent as from October 11th, 1923. Debts received and paid by G. N. Buckton.

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PATENT RECORD.

Applications for Patents.

October 10th.

25 202 P. J. Seman. Wireless receiving sets.
25 204 S. C. Weatherdon. Wireless aerial.
25 206 W. Bennison and T. E. de Vries. Crystal rectifiers.
25 229 F. Schmidt. Alternating current arc welding apparatus.
25 241 L. H. Saundy and J. M. Turner. Wireless receiving sets.
25 255 Edison-Swan Electric Co. and T. C. Black. Wireless valves.
25 257 R. E. V. Ely and G. Hilhouse. Radio receiving and transmitting apparatus.
25 260 A. F. W. Richards and A. M. Coombs. Electric lampholders, etc.
25 269 British Thomson-Houston Co. J. H. Butcher and A. P. Young. Loud speaking telephones.
25 279 L. Casale. Apparatus for electrolysis of water.
25 286 Tilling-Stevens Motors, Ltd. and H. K. Whitehorn. Electric vehicles.
25 298 J. F. Oultram. Method of supporting casings for electric light wires, etc.
25 300 T. L. Jones. Electric switches.
25 302 F. Kirchner. Production of galvanic castings (19/6/23, Austria).

October 11th.

25 310 J. H. McGee and E. Mackey. Wireless receiving apparatus.
25 332 H. Schofield. Filter for electric welding screens.
25 341 A. B. Taylor. Means for operating electric switch for closing or opening a door.
25 344 S. M. Rowlands and H. C. Woodhall. Variometers for wireless signalling.
25 367 A. Courtecuisse. Variable condenser.
25 371 H. J. Garnett and W. S. Smith. Magnetic alloys and their use in telegraph cables, etc.
25 372 Marconi's Wireless Telegraph Co. Electrostatic shielding material (3/11/22, U.S.).
25 373 Metropolitan-Vickers Electrical Co. and D. R. Davies and E. M. Johnson. Electric switchgear.
25 379 British Thomson-Houston Co., J. H. Butcher and A. P. Young. Sound transmitting or emitting instruments.
25 380 General Electric Co., Ltd. Apparatus for projecting pictures on a screen

October 12th.

25 392 C. R. Heron and J. F. Jackson. Mounting panels for wireless instruments, etc.
25 409 E. O. Brown. Wireless receiving apparatus.
25 430 E. Burgess and H. G. Smith. Electric or gas lamp shades.
25 442 Pictorial Machinery, Ltd. and C. P. Lingwood and C. G. Lowen. Electro-mechanical starting and stopping device for photographic shutters, etc.
25 455 F. W. Burlton. Crystal holders for wireless sets.
25 456 Marconi's Wireless Telegraph Co. Reception of radio signals (28/12/22, U.S.).
25 457 Igranic Electric Co., A. H. Curtis and A. H. Mackley. Electric control devices.
25 460 E. Marschner. Mercury arc rectifiers.
25 462 J. Vallerins. Electrical cutouts.
25 467 British Thomson-Houston Co. (General Electric Co., N.Y.). Dynamo-electric machines.
25 476 M. A. Codd. Electrolytic rectifiers.
25 490 A. R. Angus. Production and amplification of electrical oscillations for telegraphy, etc.
25 497 H. Konemann. Electric vacuum tubes.
25 503 P. Krout. Electric sign.

October 13th.

25 505 R. F. Hamilton. Apparatus for converting a.c. to d.c. (8/9/23, U.S.).
25 509 R. H. Smith. Headphone attachment for wireless receiving sets.
25 513 W. A. E. Tyers. Terminals for electric cables.
25 518 E. J. Bastock. Crystal detectors.
25 526 T. Rowlands. Electric furnaces, etc.
25 529 J. Smithies. Wireless receiving sets.
25 543 G. A. Goad and W. Scott. Electric signalling apparatus.
25 550 A. Miller. Electric-trigger release for bolts, locks, etc.
25 551 M. V. Pirie. Variable electric condensers.
25 565 P. N. Glending and R. E. Beswick. Induction coils.
25 571 Automatic Telephone Manufacturing Co., F. Tench, R. Mercer and W. H. Paulett. Automatic telephone systems, etc.
25 574 Automatic Telephone Manufacturing Co. Automatic telephone systems, etc. (12/10/21, U.S.).
25 584 A. V. Corgnard. Obtaining a deposition of chromium by electrolysis.
25 589 E. Taylor-Jones. Means for production of high electrical potentials.
25 598 T. N. Cole and R. P. Richardson. Rheostats.
25 599 Sterling Telephone Electrical Co. and M. R. Lawrence. Loud speaking telephones, etc.

October 15th.

25 604 F. W. Baker. Commutators for ignition systems of automobiles, etc.
25 605 C. A. and F. S. Miller, and F. Hoffman. Electric generators.
25 636 F. O. Casson and C. Edwardes. Diaphragms for telephones, etc.
25 644 J. B. Hopkinson. Clip to attach electric lamps to cycles.
25 649 M. M. Houghton. Rheostats and potentiometers.
25 668 Akt.-Ges. Brauм, Boveri et Cie. Apparatus for operation of vacuum pumps in rectifier installations. (14/10/22, Germany.)
25 677 General Electric Co., Ltd. Closed arc lamps. (23/6/23, Germany.)
25 678 General Electric Co., Ltd. Tungsten arc lamps. (5/5/23, Germany.)
25 679 S. P. Storey. Thermionic valve holder and adaptor.
25 689 W. H. Horsfield. Application of liniments, etc., by electric massage.
25 697 British Thomson-Houston Co. and R. D. Given. Braking mechanism for electric hoisting gear, etc.
25 699 Radio Communication Co. and J. Scott-Taggart. Wireless receiving apparatus.
25 707 A. Pouchain. Electrolyte for accumulators. (14/10/22, Italy.)
25 715 M. M. Melinsky. Variable electric condensers.
25 716 Oldham and Son and W. D. Wilde. Galvanic batteries.
25 718 D. Mottura. Electric heating system for steam locomotives.
25 722 Automatic Telephone Manufacturing Co., and C. Gillings. Impulse circuit arrangements for telephone systems.
25 724 Automatic Telephone Manufacturing Co. Telephone systems. (18/10/22, U.S.)

October 16th.

25 730 G. H. Fletcher. Telephony.
25 743 A. G. P. M. Poirault de la Porte. Devices for automatic connection of conductors. (16/5/23, France.)
25 749 H. Isherwood. Power relay apparatus.
25 763 R. Christie. Electric motors for hoisting, etc.
25 764 S. S. Bird. Crystal detectors.
25 765 A. Mousley. Electric terminal connection.
25 788 M. H. Tate. Method of generating electrical energy.
25 793 W. F. Hurndall. Electric switch for wireless apparatus.
25 801 F. G. Cooke. Operating handles for electrical apparatus.
25 803 E. H. Millington and M. M. Melinsky. Crystal rectifiers.
25 804 Western Electric Co. and W. L. McPherson. Vacuum tube circuits.
25 813 Metropolitan-Vickers Electrical Co. and N. P. Hinton. Telephone receiving apparatus.
25 818 Philips' Gloeilampenfabrieken. Apparatus for exhausting lamp bulbs, etc. (27/10/22, Holland.)
25 832 W. Dubilier. Apparatus for generating alternating currents.
25 852 J. Bethenod. Telephone receiving apparatus. (28/10/22, France.)
25 857 H. L. Down. Vacuum apparatus for electric discharges through gases, etc.
25 858 G. Campos. Electrical measuring instruments.
25 859 A. Reyrolle and Co. and B. H. Leeson. Balanced electric protective arrangements for a.c. systems, etc.

October 17th.

25 860 F. Creedy. Starting alternating current motors.
25 865 C. Kralt. Variable condenser.
25 867 E. Hope. Electric fuses.
25 869 S. Leech. Reflectors for electric lighting, etc.
25 870 S. Leech. Area lighting lanterns.
25 871 R. Springer. Radiant heat or electric light baths.
25 874 A. Stephens. Wireless telegraph circuits, etc.
25 890 A. M. Taylor. Supplying charging currents for underground cables.
25 891 C. H. Verity. Synchronised clocks.
25 913 A. T. Pooley. Detachable accumulator case.
25 916 R. E. H. Carpenter. Supports and connections for dry cells, etc.
25 917 R. E. H. Carpenter and H. R. Rivers-Moore. Anti-distortion device for radio-telephone receivers.
25 919 Coventry Automatic Telephones, Ltd., and A. R. Kahl. Electro-magnetic step-by-step mechanism.
25 921 Western Electric Co. Balancing signalling conductors with artificial lines. (16/12/22, U.S.)
25 931 R. T. Wallace. Filament resistance for wireless telegraphy, etc.
25 944, 25 945 and 25 946 H. Baron (Aldendorff). Automatic telephone systems and switching apparatus.
25 955 A. C. W. and C. J. W. Hansan. Sound amplifier for wireless telephony, etc.

October 18th.

25 987 A. H. Colley. Aerials for wave signalling systems.
26 000 W. E. Millward. Transmission gear for rotary electric furnaces, etc.
26 002 P. Krault. Mechanical electric sign.
26 019 Metropolitan-Vickers Electrical Co. Electromagnetic switches. (24/10/22, U.S.)
26 030 S. Calamatianos. Static transformers.
26 032 Marrec, Ltd., and Y. Marrec. Duplex radio-telegraphy.
26 033 Marrec, Ltd., and Y. Marrec. Telegraphy.
26 041 G. Zambra. Electric motors. (18/10/22, Belgium.)
26 056 R. V. Langbart. Crystal cup for wireless sets.

ARRANGEMENTS FOR THE WEEK.

FRIDAY, NOVEMBER 2nd. (To-day).

The Institution of Mechanical Engineers.

6 *p.m.* At the Institution, Storey's Gate, St. James's Park, London. Thomas Hawksley Lecture by Sir Westcott S. Abell on "The Mechanical Problems of the Safety of Life at Sea."

Electrical Power Engineers' Association (Southern Division).

7 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, W.C.2. Lecture by Mr. Jas. E. Lea on "Volumetric Measurement of Coal in Relation to Power Station Problems."

Junior Institution of Engineers.

7.30 *p.m.* At 39, Victoria Street, Westminster, S.W. Lecturette by Mr. D. V. Hotchkiss on "Hydraulic Propulsion."

North-East Coast Institution of Engineers and Shipbuilders.

7.30 *p.m.* Lecture by Mr. H. W. Curchin on "Development of Ships, Structural Design."

MONDAY, NOVEMBER 5th.

Royal Institution of Great Britain.

5 *p.m.* At the Institution, 21, Albemarle Street, London, W.1. General Monthly Meeting.

The Society of Engineers.

5.30 *p.m.* In the Apartments of the Geological Society, Burlington House, London, W. Paper by Mr. W. Lee on "Lubrication."

The Institution of Electrical Engineers (Western Centre).

6 *p.m.* At the Merchant Venturers' College, Bristol. Lecture by Prof. D. Robertson on "The Mariners' Compass."

The Institution of Electrical Engineers.

7 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.2. Discussion on "Engineering Training." Opened by Dr. A. Russell.

The Institution of Electrical Engineers (Mersey and North Wales (Liverpool) Centre).

7 *p.m.* In the Lecture Theatre of the Laboratories of Applied Electricity, The University, Brownlow Street, Liverpool. Chairman's Address by Mr. E. M. Hollingsworth.

TUESDAY, NOVEMBER 6th.

The Institution of Civil Engineers.

6 *p.m.* At the Institution, Great George Street, Westminster, S.W.1. Opening Meeting. Address by Sir Charles Langbridge Morgan.

Paisley Association of Electrical Engineers.

7.30 *p.m.* In the Board Room, Y.M.C.A. Buildings, 39, High Street, Paisley. Paper by Mr. James Orr on "Lesser Known Electric Utilities."

The Institution of Electrical Engineers (North-Western Centre).

7.30 *p.m.* At the Midland Hotel, Manchester. Chairman's Address, followed by a Smoking Concert.

The Röntgen Society.

8.15 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2. General Meeting.

WEDNESDAY, NOVEMBER 7th.

The Institution of Electrical Engineers.

6 *p.m.* In the Lecture Theatre of the Institution, Savoy Place, Victoria Embankment, London, W.C.2. Wireless Section Meeting. Inaugural Address by the Chairman, Mr. E. H. Shaughnessy.

Institution of Railway Signal Engineers.

6.30 *p.m* At the Institution of Electrical Engineers, Victoria Embankment, London, W.C.2. Paper by Mr. F. R. Lankshear and Mr. A. F. Bound on "Signalling Colours."

The Institution of Heating and Ventilating Engineers.

7 *p.m.* At the Engineers' Club, Coventry Street, London, W.1. Mr. F. G. Whipp on "Some Common Faults in Fan Design and Application."

The Industrial League and Council.

7.30 *p.m.* At Caxton Hall, Caxton Street, Westminster, S.W.1. Lecture by Sir George Paish.

The Institute of Metals.

8 *p.m.* At the Royal School of Mines, South Kensington, S.W.7. Lecture by Dr. W. Rosenhain on "Some Impressions of American Non-Ferrous Metallurgy."

FRIDAY, NOVEMBER 9th.

The Physical Society of London.

5 *p.m.* At the Imperial College of Science, South Kensington. Papers by Dr. Allan Ferguson and Prof. A. L. Narayan.

Institute of Metals (Sheffield Local Section).

7.30 *p.m.* In the Non-Ferrous Lecture Room of the University, St. George's Square, Sheffield. Lecture by Mr. E. A. Smith on "Substitutes for Platinum."

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THE ELECTRICIAN

VOL. XCI.—No. 2373. FRIDAY, NOVEMBER 9, 1923. SIXPENCE

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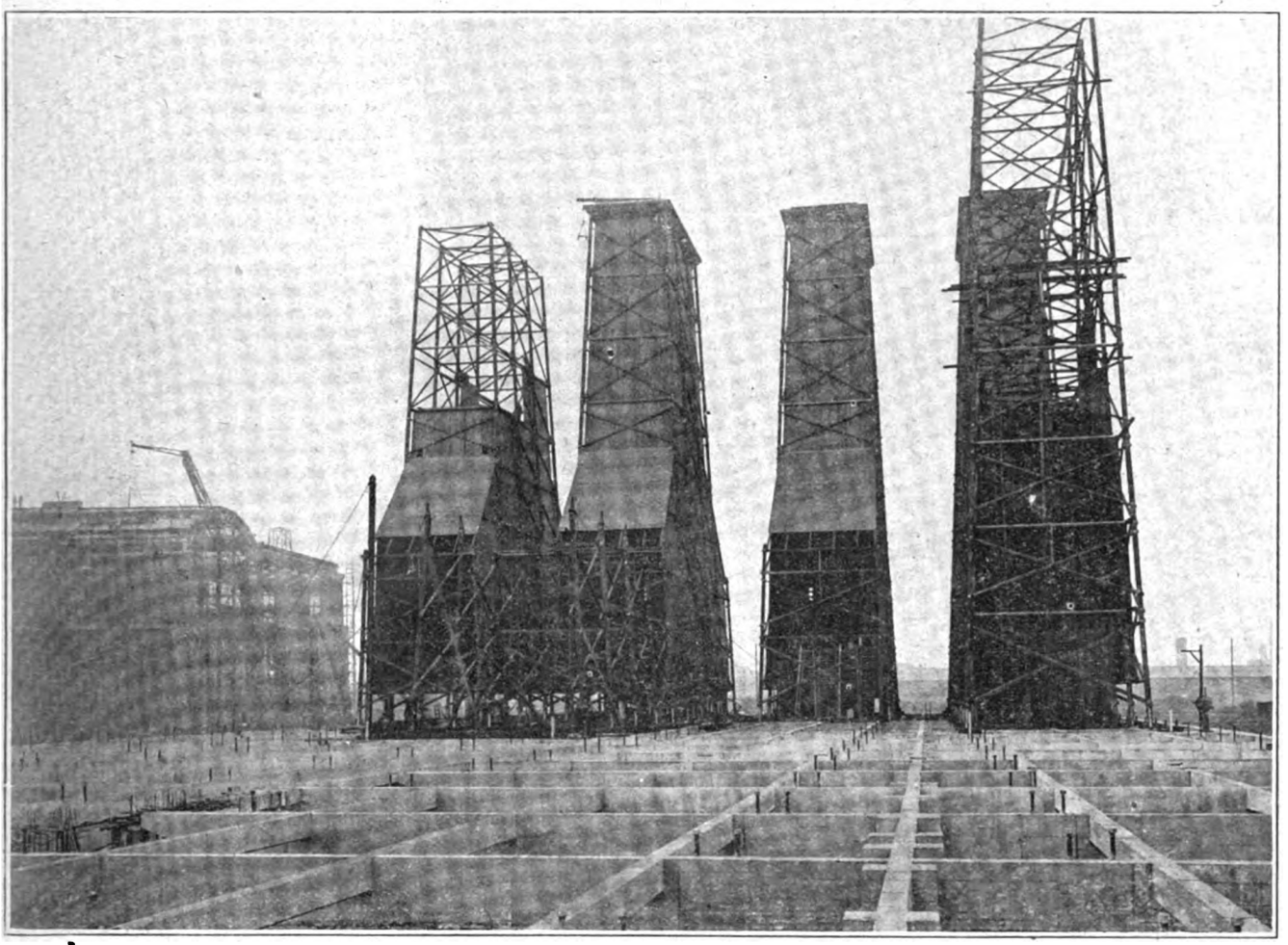

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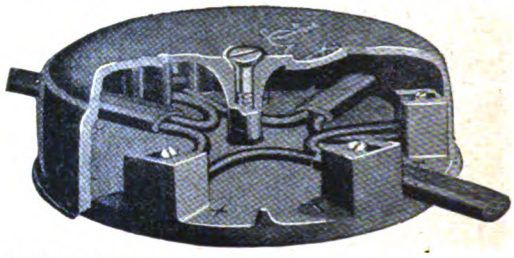

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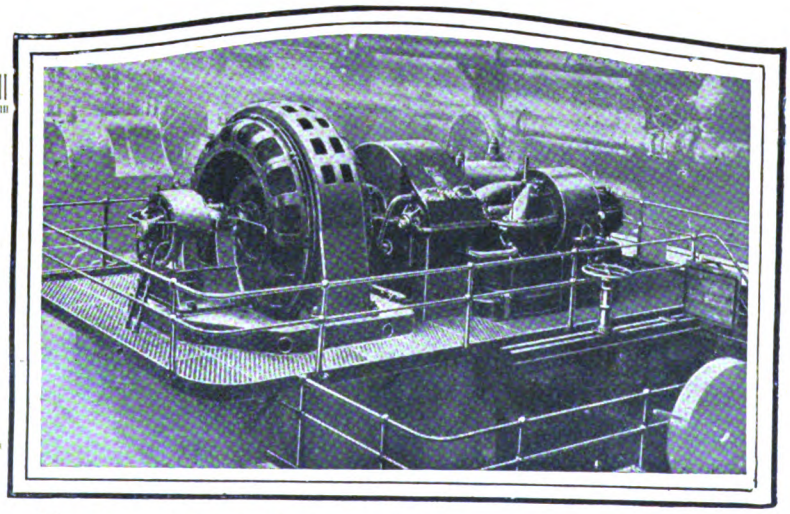

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INDUSTRIAL RESEARCH.

That much-abused term, research, may connote one of three general ideas. A purely scientific examination of certain phenomena undertaken solely with a view to increasing the sum of human knowledge. An investigation into the properties of materials undertaken with a view to increasing the efficiency of their application in industrial work. A constant supervision of the methods employed in manufacture, with a view to their improvement and the ultimate cheapening of the product. The first of these naturally finds its home in the laboratories of universities and technical colleges. The second's proper place is on the premises of the various industrial research associations and in the laboratories, which we are glad to see are becoming increasingly a part of electrical factories. But the field of the last is in the shops themselves, and its contact with the work-a-day world is rightly more close than is that of either of the other two. Strictly speaking it is not research at all in the sense that research means the discovery of something fundamentally new. Its important object is a continuous inquiry into what is being done in the factory and workshop, and its endeavour is to improve methods of production and of output, and so directly to reduce cost and selling price. The term research as applied to this work is something of a misnomer, and we should prefer to call it development. The only reason that we have put the word research in the title of this article is that development is in the electrical industry employed to describe the means used to increase the sale of electricity. What is wanted is a third term which shall more particularly define this intermediate phase between pure science and pure commerce. It may be added that all these species of endeavour are equally necessary for true engineering progress, and we have no intention of decrying or exalting one at the expense of the others.

In recent leading articles we have discussed the scope of the first two branches of research which we have mentioned above, and have shown their importance for the electrical industry. It is now necessary to say something about the third. According to Mr. W. WILSON, who read a paper on this subject before the Institution of Electrical Engineers last week, the broad function of this type of research, technical research or development, is to evolve new types of product for manufacture, to improve existing equipment, and to give technical advice to any department of the factory requiring it. In other words, this research department shoulders all the technical burden of the staff and works, and so absolves the designing staff from risk of failure, and removes all work of a non-standard nature from the shops. This allows the routine of production to run more smoothly and once again helps to cut down cost. Mr. WILSON illustrates his thesis by two examples. The first is a factory employing several thousand hands all engaged on mass production. Such a factory may seem to require no research department, but even in it there are problems connected with jigs and gauges which require scientific knowledge if the best reuslts are to be obtained, while matters such as illumination and heat treatment fall into the same catagory. The second example is a department of an electrical factory which is entirely self-contained. In such a factory the duties of the development staff are to produce new designs and to keep a close touch with electrical practice so as to be able to initiate proposals as to future activities. No changes in design or performance and no experiments are permitted without reference to this department, and no "private enterprise" is allowed in the shops. A most important part of the duties of such a department is the keeping of records, so that information on what has been done, however apparently useless it may appear to be at the time of its doing, may be available for reference should occasion arise. The result of this is the removal of a considerable burden from the works and drawing office, and consequent smoother working, economy of labour, and greater certainty of results.

It is not likely that these proposals will meet with universal acceptance. To keep down overhead charges is the aim of all managements, and to many it will appear that a department of the kind suggested will mean increased cost without correspondingly beneficial results. In the shops themselves the foremen and the best class of workers will feel that their enterprise is being unduly limited and their daily life reduced more than ever to a dead level of monotony. The first objection can only be counteracted by an examination of the balance sheet, and we feel sure that a trial given under generous conditions will soon show that in that respect the results are wholly good. The second objection can be overcome by tact, and as Mr. WILSON proposes, by encouraging suggestions, not only from the staff but from the workpeople. The points of

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view of these two classes of employees are essentially different, but as regards economic production they are equally useful. The former have a wider outlook, while the latter are mainly concerned with detail. And while the former may start an idea or design which contains the elements of success it is extraordinary how often the latter will provide just that improvement in method or alteration in detail which makes the apparatus marketable.

Mr. WILSON rightly pays great attention to the important questions of staff selection, buildings and equipment, procedure and records and to the necessity of indexing literature and information. Without desiring to grind an axe, a word may be said about the last of these. The field of electrical engineering is so wide that everyone working in it is perforce more or less a specialist. Specialism inevitably tends to a narrowness of outlook, a tendency which must be counteracted. Mr. WILSON describes a method of indexing current technical literature which enables the research worker to discover with the least possible trouble what is being written about his own particular subject. Not less important is it that the specialist should know what is being done in other fields than his own. Such a knowledge helps to broaden his outlook, and to give him information which, sooner or later, he will be able to turn to advantage. He should, therefore, be encouraged to study the technical journals as they appear, and one of the best ways of doing this is for firms to show rather more generosity in making copies available.

Current Topics.

The Dehydration of Insulating Oil.

The effect of moisture on the insulating properties of transformer oil is by now well known. About six years ago we published an article by Messrs. HIROBE, OSWAGA AND KUBO in which it was pointed out that the breakdown voltage of an oil depended to a very large extent not only on the presence of water but on the presence of cotton fibre or other matter which might absorb moisture. This opinion was confirmed and proved quantitatively in an article by Prof. T. A. MCLAUGHLIN which appeared in THE ELECTRICIAN of March 18th, 1921. As will be seen from the information which is given on another page of this present issue, the matter has been carried from the laboratory into the practical stage, and apparatus has now been devised by the De Laval Chadburn Co. for removing moisture from insulating oils such as are used in transformers, and so increasing the standard disruptive strength. It may be recalled that the presence of water in the oil only adversely affects its insulating properties when it produces "water strings," and that water absorbed by the oil has little deleterious effect. The presence of cotton fibres in the oil, however, "crystallises" the moisture, with the result that the dielectric strength of the oil is considerably reduced. This has the important practical result of ruling out the use of the blotter press for drying the oil, as if it is used deleterious fibre is often introduced. The De Laval Chadburn Co. have overcome this difficulty by the employment of centrifugal equipment which removes both dust and fibre, and so have raised the disruptive voltage of a particular sample of oil from 5 000 to 50 000 V. The aeration of the oil is avoided by special arrangements, and a further advantage is that oil can be cleaned and dehydrated in the transformers. If the increase in disruptive strength just mentioned can be sustained in practice there seems no good reason why the present B.E.S.A. standard voltage should not be raised from 22 000 to 50 000 V. Whether this is possible or not should be proved by the tests which are now being undertaken, of which we hope to give particulars in an early issue.

The Market for Wireless Apparatus.

IN an article which we publish on another page of this issue Mr. L. MCMICHAEL remarks that the market for wireless apparatus may be divided into three parts:—Complete sets, semi-complete sets, which can easily be finished by the amateur, and components. For the first class of apparatus there is a very small demand, and for the second and third a very large one. Mr. MCMICHAEL has had a wide experience in selling wireless apparatus and therefore should know what he is talking about. Nevertheless, we are surprised to hear this opinion, especially as it does not seem altogether to be confirmed by an inspection of the stands at the All-British Wireless Exhibition, which opened at the White City yesterday. Accessories and components we admit there are in plenty, but their number is at least equalled by the number of complete sets. As Mr. ALEXANDER pointed out in these columns a week or two ago, a large number of broadcasters are more interested in the results of wireless than in wireless itself, and are therefore demanding an apparatus that can be as simply and easily operated as the gramophone. The number of these people is likely to grow rather than to diminish and so Mr. MCMICHAEL'S opinion will be still further controverted. However, the matter is of more or less academic interest, as the result of selling both sets and components will be equally beneficial to the electrical industry. Mr. MCMICHAEL lays down certain lines upon which the wireless selling campaign should be conducted, and coming from a man of his experience, these are well worthy of study.

Valve Developments.

The results of the large amount of work that has been undertaken in recent years in research laboratories to improve the wireless valve are now beginning to assume a practical importance. To the expert, and especially to the amateur, the great disadvantage of the valve is the necessity for using a separate source of energy for its excitation. This, in its turn, means either charging apparatus or loss of time and money in getting the service performed. Anything, therefore, which tends to reduce the power used in the valve is to be welcomed. And we have no doubt that this welcome will be extended to the small valves which, under various arresting names, are now being put on the market. These valves all have as their object the reduction of power consumption. For instance, the "Wecovalve" of the Western Electric Co. consumes only 0·25 A at 0·8 to 1 V, while the British Thomson-Houston Co. are now placing on the market a valve with a filament current of 0·06 A at 2·5 to 3 V, and an anode voltage of 50 to 80 V, and the General Electric one with similar characteristics. This movement is having an interesting reflex among battery makers. Those who produce secondary batteries are turning their attention to accumulators which shall be capable of running for months without recharging, while those who make primary batteries are manufacturing cells which will be capable of providing the energy required over long periods without replacing. The choice that has to be made between these two sources of current depends on the connected factors of price and convenience. But, in any event, all these developments should greatly help wireless progress, while the generator which we described in our last issue suggests another method of attacking the problem.

Electricity Supply in Country Districts.

Among the tasks which are imposed by the Electricity Commissioners on the new Joint Authorities is that of developing electricity supply in those parts of their district which has not yet been tapped. For financial reasons this is a task which must be undertaken with some caution, but the immediate and ultimate results make it desirable that the work should be carried out with an eye on the future. This is particularly necessary when routes are being chosen through areas that may become more or less industrialised.

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A route which prevents the electrical capacity of the line or cable being increased should obviously not be chosen. On the other hand, a route which avoids villages to make a short cut to a farm or other large consumer may require deflection at some expense as the general demand for electricity increases. Electrically, it is comparatively easy and economical to lay out a transmission line which will supply farms and other consumers through pole transformers. But to do so at once introduces the problem of regulation. If the transformer is designed for the average load, which is economically sound, then it will give bad service at times of peak. If it is designed for peak load the losses during the greater parts of its working life will be uneconomically high. The use of two transformers with an automatic change-over switch has, we believe, been suggested for this purpose, but a better solution seems to lie in the employment of some form of automatic regulator connected to tappings from the transformers so that a proportion of the windings can be switched in and out as the load changes. A wide field for the development of electrical energy exists in such rural districts. We hope, therefore, that technical problems such as these will be tackled and solved without delay in order that progress may not be retarded.

Engineers and Publicity.

THAT the engineer does not receive full credit for the work he does in advancing civilisation is axiomatic. It is a condition of things which some are inclined to grin and bear and others to grumble at without troubling to analyse its causes. But we hope in the near future some examination will take place and means be found for not only obtaining a status for the engineer (a real status rather than a paper status), but for increasing the amount of recognition which his services obtain from the public. The point has been raised in more than one way just recently. In proposing a vote of thanks to Sir JOHN DEWRANCE for his presidential address to the Institution of Mechanical Engineers, Sir JOHN ASPINALL complained of the small attention given by the daily Press to such pronouncements. Yet what is said on these occasions is of general interest and calls attention to what engineers are doing. Mr. C. T. ALLAN, in his address as chairman of the Western Centre of the Institution of Electrical Engineers, made the same point. The work of the engineer, he said, was generally unrecognised and that lack of recognition mattered very much. The engineer was wrong in despising publicity, and the progress of engineering had suffered because engineers were so uncommunicative. But even when they do say what they are doing, engineers, in stage parlance, generally fail to "get it over." As Mr. CECIL BENTHAM pointed out in his Presidential address to the Manchester Association of Engineers, the engineer lacks lucid verbal expression—he cannot tell an interesting story. As everyone who attends a meeting of an engineering Institution knows, the speaker is generally either armed with a typewritten document from which he gabbles at express speed in a low voice, or he becomes involved in a prolix and badly constructed statement from which it is difficult to extract any meaning. The exceptions are few. If engineers would recognise the need of publicity and make themselves more interesting the causes of complaint we have just analysed would soon be removed.

Institution Meeting Procedure.

After we had written this paragraph a glaring example of the inability of engineers to discuss an interesting subject interestingly was brought to our notice, and we sincerely hope that the proceedings at the meeting of the Institution of Electrical Engineers last week will not be taken as a pattern for the remainder of the session. The author was allowed forty minutes to expound his Paper, and in spite of a request from the President to be brief, the subsequent speakers were so diffuse that time could only be found for five contributions to the discussion. The result was that several of those present who wished to speak were unable to do so. This state of affairs would be bad enough if the discussion had brought out anything particularly new. But, in fact, it did not, and a great deal of time was taken up with corroborative detail which did nothing to strengthen the argument. The author was left with a number of direct questions to answer, but failed to do so owing to the lapse of time. The charge of dullness is often levelled against Institution meetings; but the remedy is in members' own hands. The author must remember that most of his audience have already studied the Paper, and the subsequent speakers that what is required from them is succinct, direct criticism, not autobiography.

Col. R. E. B. Crompton.

AT the meeting on Thursday in last week it was announced that Col. R. E. B. CROMPTON had been elected an honorary member of the Institution of Electrical Engineers. This honour is richly deserved, and we hope that the recipient will live long to enjoy it. It is hardly necessary to remind readers of THE ELECTRICIAN what Col. CROMPTON has done for the advancement of the electrical profession and industry. But it is interesting to note in these materialistic days that among the select list of honorary members he and Sir CHARLES PARSONS alone represent what may be termed the manufacturing element. There is, however, a fundamental distinction between the work of these two men. Sir CHARLES PARSONS has specialised, and the result of his specialisation is world-wide renown in a particular field. Col. CROMPTON'S work has been much more distributed and, perhaps, as a natural result its importance is not so evident. But it has had a great influence on the design and manufacture of electrical machinery, on electricity supply, on units and standards, on motor transport, on measuring machines, and in more than one branch of military science. The famous Dr. JOHNSON earned a place in literature not so much for what he himself wrote, but for his effect on the writings of others. From this point of view Col. CROMPTON may be called, in no unworthy way, the JOHNSON of the electrical industry.

Corrosion and Taxation.

Speaking at the opening of the new chemical laboratories at the Birmingham Municipal Technical School, Sir ROBERT HADFIELD said that to the chemist a subject like "The Conquest of Corrosion" was of far more interest than that of "Back to Methuselah," because one represented progress and the other retrogression. Iron would always be liable to corrosion so long as oxygen was present, but if oxygen were eliminated we should not be here. This statement provides an interesting simile of the state of things wrought in industrial and commercial circles by that allotrope of oxygen—taxation. But for taxation our national life would be impossible, but unfortunately taxation is responsible for the corrosion of a certain percentage of the profit-margin produced by industry. This corrosion becomes burdensome when it hampers trade and is excessive in its incidence. Under such conditions—and they prevail now—the principle of taxation as a necessity of national life is dominated by the corrosive influence of wasteful expenditure. The remedy, as Sir ROBERT aptly said, is "the careful watching of something that is vanishing from our view." This is exactly the business man's position to-day; the fruits of his labours are vanishing, and he must therefore give the spending departments of the Government and the Chancellor no rest until the rate of "corrosion" is by some means checked. Metallurgists, like Sir ROBERT HADFIELD, are searching for alloys which shall resist the corrosive attacks of oxygen, but it is even more important that the Government and the business men of the country should search for an alloy of economy powerful enough to counteract the wasteful influence of excessive taxation.

D.

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NOTES ON WIRELESS MATTERS.

Receiving Circuits with Intermittent Instability—Review of some of the Devices—Methods that will find a Wide Field of Application.

By PROF. G. W. O. HOWE.

If an alternating e.m.f. acts upon a circuit, it sets up an alternating current of the same frequency and of an amplitude depending upon the e.m.f. and on the inductance, capacity, and resistance of the circuit. If the circuit is tuned to the frequency of the inducing e.m.f. the inductance and capacity effects are mutually neutralised, and the current is equal to E/R where E is the e.m.f., and R the effective resistance of the circuit to alternating currents of the given frequency. This effective resistance includes not only the a.c. resistance of the conductors, but also the effect of all losses whether in dielectrics or neighbouring conductors. If the inducing e.m.f. ceases to act on the circuit the oscillation will die away at a rate depending on this same resistance. If the total effective resistance of the circuit could be made zero, any induced e.m.f., however small, if of the correct frequency, would build up a current of ever increasing amplitude, and on the cessation of the e.m.f. the oscillation would continue with unchanged amplitude. If the total effective resistance could be made negative, not only would any e.m.f., however small, build up a current of increasing amplitude, but the amplitude would go on increasing after the cessation of the e.m.f.

Negative Resistance.

To obtain this condition it is not essential that the circuit should have a negative resistance to steady current, but merely to alternating currents of the resonant frequency. For example, if a direct current arc takes 2 A at 50 V, on increasing the current to 2·1 A the P.D. may fall to 49 V, whilst on decreasing the current to 1·9 A the P.D. may increase to 51 V. Now the resistance in the usual sense is positive in all these cases and about 25 O, but if we regard the changes as due to an alternating current with an amplitude of 0·1 A, superposed upon the steady current of 2 A at 50 V, we see that *a P.D. of 1 V in one direction causes a current of 0·1 A in the opposite direction.* In mathematical language, although V/I is positive, $\delta V/\delta I$ is negative, and, therefore, to a superposed oscillatory current the arc appears to have a negative resistance. This is the explanation of the Duddell musical arc, in which an alternating current is obtained in a circuit containing no impressed alternating e.m.f.

In other cases this negative resistance is not inherent in the apparatus, but can be produced by causing the alternating current to react upon the apparatus, either magnetically as in the Vreeland oscillator or electrostatically as in the ordinary three-electrode valve oscillator. If in the latter case the circuits are so arranged that an increase in the anode current produces such an increased positive grid potential that the increased anode current is obtained with a decreased anode potential, the valve from anode to filament has the same characteristics as the arc.

An oscillatory circuit with negative resistance is unstable; if it is not subjected to any disturbing e.m.f. it should, like a cone balanced on its apex, remain unaffected, but the slightest variation will upset the balance and cause an oscillation to build up. It would continue to build up indefinitely were it not that the conditions on which the negative resistance depends are only fulfilled over a limited range.

The Turner Trigger Device.

In the heterodyne method of receiving radio signals a steady oscillation is maintained in the receiving circuit at a frequency differing slightly from that of the signals to be received. The signals are detected by the modification they produce in this steady oscillation. Another method has recently come into use in which no steady oscillation is maintained in the receiving circuit and in which the circuits are tuned exactly to the received signal frequency. In this method the receiving circuit is made to have a negative resistance, so that, if free to do so, it would build up an oscillation, but this is prevented by periodically quenching the incipient oscillation. During the interval between two successive quenchings there is a slight building up even in the absence of any signal, but the circuit is in an extremely sensitive condition to an impressed e.m.f. of the resonant frequency and a very weak signal is therefore able to build up large oscillations during the intervals.

The first to use an unstable valve circuit with a quenching device was Mr. L. B. Turner, who described his "Thermionic Trigger Device" before the Institution in 1919. Two points should be noticed in this connection: the first is that Turner adjusted his receiver so that it was just unable to start oscillating unless it was given a slight impulse, so that in the absence of a signal it was quiescent, and it only responded to signals exceeding a certain minimum strength. Once started, however, it built up, and in the absence of the quenching device would continue to oscillate even after the signal ceased. The second point is that Turner employed a mechanical quenching device somewhat analogous to the tapper used to decohere the filings-coherer in the early days of wireless. The increased anode current caused by the oscillation operated a Post Office relay, the tongue of which moved over and short-circuited the back-coupling coil, thus stopping the oscillation and releasing the relay tongue; the oscillation would again build up and the tongue again move, as long as the signal lasted.

In the same year, 1919, Bolitho took out a patent for a somewhat similar device, but replaced the mechanical quenching relay by a valve. In this arrangement the grid circuits of the main valve and quenching valve have a common oscillatory circuit. The anode circuits are quite separate; that of the main valve contains a h.t. battery and a reaction coil coupled to the common grid circuit coil in the usual way, and adjusted so that the valve is on the threshold of self-oscillation. The anode circuit of the quenching valve contains in place of the ordinary h.t. battery, some source of alternating e.m.f., adjusted to a frequency considerably lower than that of the signal wave, but preferably above the audible range. It also contains a reaction coil coupled to the common grid coil, but with the connections reversed so that the e.m.f. induced in the grid coil tends to prevent any oscillation. During a portion of the cycle of the a.c. generator in the quenching valve anode circuit the plate voltage will not be positive enough to cause any appreciable current to flow in its anode circuit, although its grid being connected to the grid of the main valve will oscillate if the main valve is oscillating, as it will be if a signal is being received. During the other portion of the cycle, however, the anode voltage of the quenching valve will be sufficiently positive for the grid fluctuations to cause considerable currents to flow in the anode circuit and the reversed coupling coil, which will neutralise the e.m.f. induced by the coupling coil of the main valve and thus stop the oscillations. Hence during a portion of each cycle the system is free to oscillate, and will do so, if there is a signal to start it, or in the absence of a signal if the adjustment is sufficiently unstable.

The Armstrong Circuits.

This method was then studied and further developed by E. H. Armstrong, the well-known American expert, who also gave it the name of the super-regenerative method. He devised several circuital arrangements for causing one valve—the quenching valve—to oscillate at a frequency almost if not quite beyond audibility, and then causing the anode current of this valve to act upon either the grid or anode circuit of the main receiving valve in such a way as to quench the incipient radio-frequency oscillation of this main valve once in every cycle of the quenching valve oscillation. Armstrong has described many ways of doing this. He favours adjusting the main valve so that it is actually unstable and builds up a slight oscillation during the intervals between successive quenchings even in the absence of a signal. When a signal is received the building-up is enhanced, being no longer due to fortuitous disturbance, but to a definite e.m.f. of the exact resonant frequency, assuming the tuning to be correct.

Another American worker, Mr. E. T. Flewelling, has devised a very simple way of causing intermittent quenching of the unstable oscillatory valve circuit, without introducing a second valve, and without any further coupling coils. By adding a condenser and a single additional connection, the oscillation causes a charge to accumulate on the grid until oscillation ceases, the charge then leaks away and oscillation starts up again. In the absence of a signal the adjustment is made so that the valve is only just unstable; any received signal of the correct frequency will then cause a greatly enhanced oscillation to be built up. All these so-called super-circuits are not only sensitive but selective—that is to say, their excessive sensitiveness is limited to waves of a definite frequency. Such methods will undoubtedly find a wide field of application.

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RETAILING WIRELESS APPARATUS.

How the Business has Developed—The Demand for Broadcasting—A Salesman's Job—Points to Bear in Mind.

By L. McMICHAEL.

In the days before broadcasting was thought of, the experimenter, after passing through the initial stages where he made the whole of his apparatus, demanded that he should be supplied with certain components, and a very comfortable business developed along these lines. There were not very many experimenters, but trade was quite good and such items as filament resistances, transformers, valve holders and kindred appliances were already in demand. Good prices could be got for these. There were no booms or slumps, the summer season made a little difference, but nothing comparable with that which we experience nowadays.

Gradually the interest in wireless grew, and trade developed accordingly. Better and cheaper accessories were produced and a very steady sale grew up. Then came the War, and with it the prohibition from using any wireless apparatus. After the War, the ban put upon the use of wireless apparatus was rescinded and experimental licenses were again issued. A small trade developed, but this was greatly handicapped by the enormous stocks of war goods on the market.

The popular aspect of wireless was extended by the introduction of wireless telephony and amateurs transmitted experimentally gramophone records, vocal selections, and speeches for the benefit of fellow enthusiasts. This, briefly, was the beginning of broadcasting, and it whetted the public appetite for this new type of amusement. The desire once created rapidly developed, and The Marconi Scientific Instrument Co. provided occasional programmes from their Writtle Station, which we may look upon as the real beginning of broadcasting in this country.

Very soon the public demanded broadcasting, and finally it came. Many of those who were already in the wireless business had been making apparatus against a day when it could be sold, and so prepared themselves to meet the unavoidable rush that would ensue. The results, however, of the introduction of broadcasting were such as to take completely by surprise the whole of the manufacturing community who could handle wireless, and they were immediately swamped with orders. Every Tom, Dick, and Harry started to make and sell wireless, and before very long, in spite of the boom, an enormous quantity of wireless apparatus had accumulated in the country; then came the slump.

The How-to-Make-It Movement.

There is no need to go into the reasons of the slump, occasioned partly by Government interference and partly by adverse newspaper propaganda. Suffice it to say that since that time there has been no resumption in the sale of wireless receiving sets on a large scale. All this time the "how-to-make-it-movement" had been progressing, and the sale of components and accessories for home construction grew, until, by the time the slump was at its worst, the demand for components had saved the situation in most cases.

Selling wireless now became a saleman's job and not that of a mere hander-out of goods. To sell a complete wireless receiving set of about £50 during this slump period required a super-salesman, and so, by the survival of the fittest, salesmen rose to the occasion, and we now have our wireless super-salesmen. Their opportunities, however, have been few and far between, but the situation to-day, shews a marked improvement in all respects. The licensing question is now settled, and the daily newspaper propaganda which originally, for some unknown reason, aimed at smashing the wireless industry, now tends to foster it, whilst the approaching winter months are helping to increase the demand for wireless apparatus. There is no boom—nobody wants a boom—steady business is always very much better.

Selling wireless to-day falls under three main headings. In the first place there are the sets, which have only a very small clientèle. There are special sets so made up that they can be wired up and finished at home; these have a very ready sale. And then again there are components and accessories for the entire home construction set, which are in great demand. The constructor's licence has legitimised this kind of set, and the wireless salesman has now to size up his man when he enters the shop. Is he a constructor; if so, is he also an experimenter? Does he want to construct the whole thing, or does he just want to put it together and get it cheaply, or is he, on the other hand, going to buy a wireless set as he would a gramophone?

Another point to be borne in mind is the doubt that may be felt in the minds of some, even now, as to whether it is worth while, and whether broadcasting will continue. One obvious answer to this is that broadcasting is now a national necessity, and that under no circumstances can broadcasting be stopped. The wireless salesman will have to advise his customers. A large number know what they want, but an equally large number do not, and must be told.

The shop itself is an important factor in influencing a successful sale. As an education it is instructive to go into the establishments of half a dozen wireless retailers and take a look round. How does the atmosphere of the place strike you? Is it tidy or untidy? Can you see what you want or is it mixed up with a miscellaneous collection of all sorts of bits. Does it actually appear to you as a nice clean, comfortable and tidy place? Is there a demonstration going on, and, if so, what does it sound like? As the result of these visits and self-imposed questions the ideal shop can readily be visualised.

Tranquility of Tidiness.

In the first place there should be an air of tranquility and tidiness. A demonstration should most decidedly not be going on in the shop. The complete sets and accessories should be entirely separated from components and similar goods. The man who has come in to buy a 50-guinea set does not want to be jostled by the purchaser of a small grid-leak. The arrangement of the service and the displays should be orderly and progressive. If it is at all possible, separate departments should be provided for the home constructor and experimenter and for the purchaser of the complete set. If this is not possible, the shop should be arranged with the sets on one side and the bits on the other.

Now as regards demonstrations, this is most important from the point of view of the whole trade. A demonstration which is not perfect is a sin and a crime against the whole wireless industry. No demonstration should ever be made unless it is made under the best possible conditions. For this reason a demonstration room should, wherever possible, be so arranged that it is away from the movements of the customers in the shop. Suitable accommodation should be provided and every instrument used for demonstration purposes should have been tried previously; no chances should be taken over the demonstration. The size of room, its shape, the hangings and furniture, the number of people in the room—all have so important a bearing on the tone, volume and quality of the sound produced by the loud-speaker that no trouble should be spared to provide suitable surroundings. Too much stress cannot be laid on this important point, and it is not too much to say that a successful and comfortable demonstration will do more to effect a sale than any amount of explanation. The ordinary customer does not care how the set works as long as it does work: it is the result that he wants.

Knowing How to Sell.

Finally, the salesmen themselves. They must, in the first place, of course, know how to sell. They must be students of human nature and know more about the requirements of the other man, soon after he has entered the shop, than he knows about himself. They must be able immediately to classify him and go all out on the classification he suggests. At the present moment it is very necessary for the wireless salesman to know a lot about wireless, but as the industry settles down, as trade progresses, as people get educated into the necessity of having wireless in their home, the internals so much discussed and digressed upon by the various wireless publications at the present time will sink into the background and the results only be counted for merit.

The wireless salesman must be able to discuss his subject intelligently; but, more than this, he must be able to make his customer need the instrument in question. It is the salesman's job to find the line of least resistance, and work upon it. Of course, he must be just and must not beguile any customer into purchasing what is obviously no use to him or what is all too obviously beyond his means. Honesty in wireless salesmanship is the best policy.

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INDUSTRIAL RESEARCH.*

Its Place in Electrical Engineering Development—Its Organisation, Staff and Equipment Considered.

By W. WILSON, B.E., M.Sc.

The past forty years have witnessed a gradual, but far-reaching change in the manufacturing system. The increasing application of science to industry, and the growing complexity of the various products have in general made it impossible for a single mind to carry on complete administrative and technical direction. Also the standardisation of the newest products has opened the way for quantity production, and specialisation in output. The scientific staff has found a place in manufacture. Their work, generally termed "industrial" research, is divisible into two well-defined orders (*a*) general and theoretical, and (*b*) particular and practical, usually termed "development." Three stages can be seen in the development of almost all industrial apparatus. First there is scientific discovery, next the recognition of its application in practice, finally the industrial development of the idea.

Many industrial developments have been the outcome of research in this country, but have unfortunately been discontinued at the end of the second stage. Thus industries involving the fixation of atmospheric nitrogen, many electrochemical developments and much of the exploitation of knowledge in electrical engineering is based on the work of Priestly and Cavendish, Davy and Faraday, Maxwell, Kelvin and others. By allowing foreign nations to act in this way we have conceded them the initiative, an error in tactics which has led to loss of prestige. The chief reason for this state of affairs is the national tendency against co-operation, evident in our art, politics and industries. Unfortunately the present industrial era is one in which association of effort and ideas is all important. Modern progress depends essentially on the union of scientific knowledge with practical experience, which is displayed in development and industrial research.

Functions of a Development Department.

The broad function of a development department is to evolve new types of product for manufacture, including new parts for existing models. Designing and drawing offices can effect the desired change if theoretical or experimental information is afforded. Problems involved in the examination of finished products are then dealt with by the routine testing or inspection department. Such a department removes all technical burdens from the shoulders of the staff and works, and avoids the interruption of regular routine work. In order to illustrate the working of the system, the author considers a factory employing several thousand hands, all engaged in mass production, and producing articles on lines desired by customers. He shows how the efficiency of the works can be improved by the institution of a small band of scientific workers, who should be aided by a technical library. As another example of more advanced work he takes a self-contained electrical factory, where the department would also evolve new designs. The department should be the repository of all technical data relating to articles made. The department must be aware of all developments, even though originating in other sections of the works, and any unusual occurrence bearing upon design should at once be reported to them. They would also act as adjudicators in the case of complaints from customers, examining the apparatus and determining the conditions leading to failure. Examination of materials and the calibration of instruments may be dealt with by the department, though, generally speaking, the introduction of purely routine work should be avoided.

Great importance attaches to the systematic examination by the department of suggestions from all quarters, though the benefits derived from sources outside its walls are less than is commonly supposed. Valuable discoveries can only be made by those who are constantly searching for them. There is much popular misconception, especially among business men, as to the simplicity of arriving at valuable results. It is practically impossible for an investigator to produce a novel apparatus unless he has certain qualifications, including sound theoretical training, intimate knowledge of he conditions under which the apparatus is to operate, and familiarity with the work of others in this field Suggestions may also emanate from those outside the factory —e.g., customers and patentees. The former, as users of apparatus, may afford useful data for design; the latter will usually present a specification that requires detailed study. But even a sound suggestion cannot always be adopted at once, as the modification of a standard design may not be commercially justified.

Staff Qualifications.

The segregation of men engaged upon development enables their qualifications to be "pooled," with advantageous results. The senior workers should, however, be "all-round" men, and the head should have wide experience. A research man must have an analytical mind, capable of isolating the various components of a problem and separating the vital from the secondary. This qualification can be greatly stimulated by training. The author outlines the general and special training desirable. The former includes training in clear and logical thinking, the tactics of research, and the art of lucid expression; training of hand and eye through the study of mechanical drawing, and in the practical application of theory afforded by works' experience. Special training includes the study of the pure and applied sciences with which the industry is concerned, the professional subject (e.g., electrical engineering), and design. Works' experience after graduation should be obtained as a regular employee, and the inspection of works concerned with collateral industries has a valuable widening influence. A research staff is not only engaged entirely on brain work but an inherently "high pressure" effort. It should be relieved of ordinary worries, such as "chasing" materials and plant, and "rush jobs" should be avoided as far as possible, as they are very exhausting. Thirdly, data supplied should be accurate and first hand. Juniors may include two types of men who do not need the above qualifications. Some are not ambitious and are content to continue performing the same duties. Such men are useful, but, generally speaking, it is better that juniors should be keen to improve their position. The other type is the improver who spends a time in the laboratory prior to going out as a branch engineer or salesman.

Buildings and Equipment.

The subject of buildings and equipment has already been very fully treated by Mr. A. P. M. Fleming. The chief impression to be avoided is that the development section, which does not produce output, can take second place to the part of the factory that does. It must be recognised that the development staff are going to exercise a great and beneficial effect on production and that anything that impedes their work will impede output. The principal requirement in the site is absence of noise, especially "spasmodic" noise which is most distracting and prejudicial to mental effort. Adequate heating and absence of vibration are also important points; Mr. Fleming's recommendation of ferro-concrete is not supported by the author, owing to the transmission of sound through this material. Brick construction is to be preferred. Special care is needed in the design and equipment of the testing laboratories; in an appendix the author illustrates some apparatus designed by him for use in switchgear development.

Procedure in Development.

No invariable course as to the procedure in the development of every model can be prescribed, but the division of a problem into constituent parts is an important principle. It is a mistake to expect a model to demonstrate too much at one stage. The quickest progress is often made by constructing a series of models, each achieving some definite result or overcoming some difficulty in design. The first model should be designed to show whether an idea is practicable or workable: some fundamental failing may be revealed that renders further steps unnecessary and the matter can be dropped before much time or expense has been devoted to it. One of the simplest examples of development work is the electrical operation of some process or apparatus formerly actuated by some other

* Abstract of a Paper read before the Institution of Electrical Engineers.

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means. In the original paper this is illustrated by the conversion to electrical operation of a belt-driven machine tool. In the first stage the device consists merely in the original apparatus, with motors and starters applied to it. Next the whole apparatus is reviewed in order to effect simplification and unification of the various elements. The process is analogous to the life history of any fully developed apparatus. The first electric trams were simply horse cars with motors and controllers attached to them—but the first rough models were soon supplanted by more perfect types.

The development of an entirely new design differs from the above in that the starting point has first to be decided upon, and it is here that the personality and originality of the designer plays a leading part. In general the knowledge of how other designers have solved the same problem should not be too readily invoked, for the imagination is at its best when it has a blank page to draw upon. As an example, the author takes the case of a firm which decides to make contactor gear for the first time. The rough model made up from the first designs probably bears little resemblance to the final product. It is passed to the testing department, where experiments will ascertain whether it functions as expected and is good mechanically. Full details of electrical characteristics are then obtained and all defects are reported and corrected in the next model, full working drawings of which are then got out. One model is made in the development workshop to serve for a final test. The same process is carried out with regard to master controller, relays, interlocks, etc., and finally a complete set is assembled. Here any remaining defects are revealed and tests are continued until they are eliminated. The shops and drawing office are then notified that manufacture may go forward.

Recording and Filing Results.

An organised system of recording results is essential. The most valuable information is obtained from tests and these often involve the destruction of costly material. Hence special care should be taken in the preservation of test data. The system favoured by the writer makes use of a small number of loose leaf binders, in which blank pages are clipped. Every detail of possible interest in the future is entered on these sheets, no reliance being placed on the memory of any participant, and from these notes official reports are compiled. The original notes are then removed from the binder, clipped into a folder, labelled and filed away. Preservation of notes is desirable, as they often contain detailed information not included in the reports.

It is important that in these notes not only successful results, but also failures should be recorded. It is often necessary to know both what is possible and what cannot be done.

In the original paper the author describes in some detail the index system for rendering information quickly available. This is so designed that all but 5 per cent. of the work can be done by a junior. No attempt is made to reproduce any part of the text. The index cards merely contain a short title and serve to indicate the whereabouts of the abstract. Matter is classified both by subject and author. Test-results, patents, verbal criticisms, interviews, etc., may also be dealt with by means of a card index.

Industrial Research Organisations.

Industrial research is conducted by some private individuals, firms of consultants, universities and colleges, manufacturing firms and research associations. The private worker to-day is at a disadvantage. Difficulties attending tests and experiments are now greater than in the past. Moreover, it is difficult for any except those attached to firms or other associations to keep in touch with modern rapid advances. Private workers now find it more difficult to sell the results of their work as firms expect their own research department to produce their new models.

Some authorities maintain that universities and colleges should confine themselves to the purely philosophic research for which they are primarily intended. If they are tempted to take up industrial work, effort is withdrawn from research in pure science. However, a certain amount of industrial research can be performed at such institutions, and this is beneficial in promoting closer contact between universities and industry. The author refers with approval to work of this kind undertaken at Sheffield University.

Many items of industrial research benefit every firm engaged in a certain industry and are best carried out by co-operative associations. The Committee of the Privy Council for Scientific and Industrial Research constitutes one of the most welcome items in industrial history within recent years. By 1918, some 30 industries were in process of forming research associations. The British Electrical and Allied Industries Research Association began operations shortly after this date. The Council has also been the medium for subsidising research by the Government. The important fact has been recognised that "research work like other forms of creative activity, will not flourish under committee rule." A scheme was proposed about four years ago in a paper by Mr. H. R. Constantine whereby every worker would work to the instructions of a controlling staff appointed by the Government. Such a scheme would certainly induce an atmosphere that would stifle research. The form of co-ordination required is such as to enable the results of researches to be available to every worker especially in his own vicinity. In electrical research this need is being largely supplied by the work of the Institution, by sister societies, and by the technical press. Any useful advance in co-ordination can be effected only by a development along the above lines.

REVIEWS.

Popular Fallacies Explained and Corrected.

By A. S. E. Ackermann. Third Edition. (London: The Old Westminster Press.) Pp. 984. 12s. 6d. net.

To read this book produces disillusionment. We had always thought, for instance, that rooms warmed by gas stoves were unhealthy, yet Mr. Ackermann to the extent of three pages and much wise saw and noble instance tells us they are not. He quotes Sir Henry Thompson to prove that it is not a good thing to take a glass of sherry before dinner; yet it is very pleasant and a great many electrical engineers, depressed as the industry is, do it without apparent ill-effect. In fact he is very prone to show the futility of many customs and ideas connected with spirituous refreshment. He also is of opinion that George Washington when a boy did not cut down the famous cherry tree. *Sic transit gloria mundi.*

In the engineering section he calls attention to the fact that the technical terms stress and strain are not synonymous, that power and energy are not synonyms, that sparrows are not killed by sitting on telegraph wires, that steel and iron are not the same, that the sensitiveness of moving coil electrical instruments does not necessarily increase proportionately with the strength of the magnetic field used, that electricity is not generated by the friction of the brushes on the commutator, that there is water power of some value in Great Britain, and that gas engines do not make gas.

The book is amusing and informative and its compilation must have meant a great deal of work. But the author gives no definition of what he means by a fallacy, and we should regard some of his illustrations as examples of error pure and simple rather than wrong conclusions reached from insufficient or incorrect premises. He devotes some space to proving that cocoa is not made from cocoanuts, and he might equally well have shown that monkeys are not made from monkey nuts. Neither are fallacies; they are simply errors. Again, Mr. Ackerman explodes such legends as King Alfred and the cakes, that Napoleon coined the phrase, a "nation of shopkeepers," and that Galileo on a certain famous occasion uttered the words, "e pur si muove." But if these people did not say and do these things it is quite consistent with what we know of their characters that they might have. And no one is the worse for supposing that they did.

The book can be recommended as worth perusal. Since its first publication in 1908 the number of fallacies in the Ackermannian sense dealt with has been increased from 430 to 1 350. There are still some omissions. One important one is: "That all fires are not caused by the fusing of an electric wire." We notice that the "Daily Mail" is quoted many times and The Electrician but a few. We take this as a compliment.

Wireless Telegraphy and Telephony. By E. Redpath.

(London: Cassell and Co.). Pp. 150. 1s. 6d.

The Amateur Wireless enthusiast is well served by "Wireless Telegraphy and Telephony," in which fairly full particulars for making up both crystal and valve receiving sets are given. Dimensioned drawings are given and a large number of useful working hints. This book should be a great help to those wishing to build up their own sets from the beginning and also to the dealer who wishes to prepare for the big demand that will shortly arise for wireless components.

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THE PARIS RADIO CENTRE.*

Some Details of an Important Foreign Wireless Station.

Previous to the construction of the new wireless stations in the neighbourhood of Paris, the radio resources of France were quite inadequate for the liberation of the country from an embarrassing and even dangerous dependence on foreign cable services. They consisted of the Eiffel Tower station of 50 antenna kilowatts capacity (confined almost entirely to the transmission of time signals, meteorological bulletins, etc., and military communications with colonial and foreign stations), the station at Lyons with a maximum capacity of 150 antenna kilowatts (which served as an auxiliary for Franco-American commercial traffic), the station at Bordeaux (Croix d'Hins) furnished with two arcs each of 400 to 500 antenna kilowatts capacity and a high-frequency alternator of 500 antenna kilowatts capacity, and, finally, the station at Nantes of even smaller power than that at Lyons and confined exclusively to naval service.

All these stations, with the exception of the Eiffel Tower, are remote from Paris, a fact inherently disadvantageous and a serious limitation on their traffic capacity. They are moreover, dependent on external sources of power and thus on the maintenance of the transmission line systems involved.

There was clearly, therefore, a necessity for the construction of a large central transmission station in the neighbourhood of the capital, capable of regular and rapid transcontinental communication. This requirement has been met by the establishment of a radio-electric centre at Paris, of which the following is a detailed description.

The radio-electric centre at Paris (Fig. 1) consists of :—

1.—Three transmitting stations at Sainte-Assise, near Melun :

(*a*) A transcontinental transmitting station whose antenna power can be varied from 125 to 1 500 kW according to requirements.

(*b*) A continental transmitting station with a maximum antenna power of 100 kW.

(*c*) A valve station for short distance transmission, e.g., Paris-London. Antenna power, 2 kW.

2.—A receiving centre at Villecresnes (Seine-et-Oise) comprising six receiving groups.

3.—A central office at Paris which controls the transmitting stations, and where messages are received. This office also ensures rapid liaison with the administrative centres of the postal and telegraphic services.

The whole system is the property of the Radio-France Co., which exploits the stations without guaranteeing interest, and without subsidies. The state receives a part of the profits, and becomes the owner of the installations in 1953.

The transmission centre, situated on the right bank of the Seine, between Corbeil and Melun, at a distance of about 24 miles from Paris, is served by the Paris-Melun railway. The site is open and practically level, and the subsoil consists of a water-retaining clay bed which has proved of great value for the earthing system.

Transcontinental Station.

This station, intended for long distance transmission to North and South America, Asia, etc., is furnished with four high-frequency alternators—two of 500 antenna kilowatts capacity, two of 250 antenna kilowatts capacity. These are driven by direct current motors and can operate separately or together. They can be coupled to the antenna in such a way as to provide simultaneous transmissions of 1 000 and 500 antenna kilowatts respectively. The power required by the station is supplied by the local distribution network or, alternatively, by an auxiliary Diesel engine installation consisting of two 1 500 to 1 800 H.P. engines, each directly coupled to a 900 kW, 500 V d.c. generator, and two 90 H.P. Diesel engines, each directly coupled to a 60 kW, 110 V dynamo for the supply of the auxiliary services and the excitations.

The transmitting hall contains the high-frequency generators, the antenna inductances, the control gear, and the rotary converters, etc., for the transformation of the three-phase supply from the distribution network.

The wave-lengths utilised by the station are :—

a. 19 400–22 600 m. for the 500 kW groups.

b. 13 800–16 200 m. for the 250 kW groups.

Two desks, one for the 500 kW and one for the 250 kW groups, carry the controlling and regulating apparatus, also the mechanism for automatic transmission from a distance. A special set of tables known as the manipulation tables carry main and auxiliary manipulation gear. A system of tubes terminates under these tables, the tubes carrying compressed air for the quenching of the contact sparks of the relays. The normal speed of manipulation is up to 100 words a minute.

The Antenna.

The antenna (Fig. 2) is supported by 16 stayed metallic pylons 250 m. high, separated from each other by a distance of 400 m. It is in the form of a double sheet of a total length of 2 800 m., and covering an area of about 910 000 sq. m., each half of the sheet consisting of 20 wires whose transverse spacing increases uniformly from the edges toward the centre.

Each pylon is calculated to withstand a horizontal traction of 10 tons at the summit and a vertical load of 16 tons, together with a wind pressure of 250 kg. per sq. m. (i.e., about 51 lb. per sq. ft.).

The two halves of the antenna can be used separately for two different transmissions or can be coupled together for

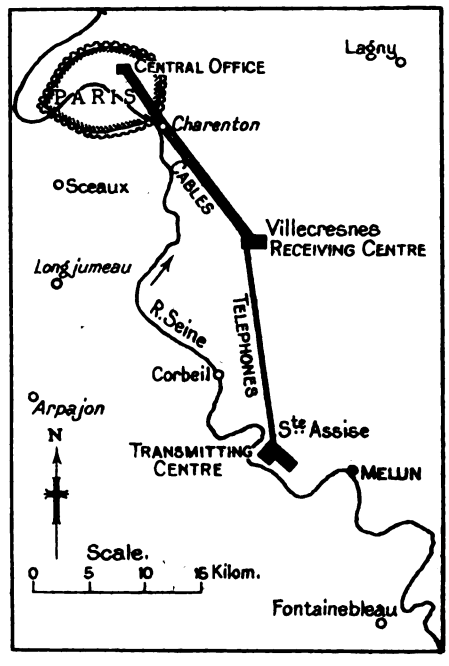

FIG. 1.

work at full power. The descent of each half converges to the head of a stayed pylon 50 m. high, from which two collectors lead in to the station.

The earthing system is of the type known as " the multiple earth." It consists of a network of copper wires of 1·5 mm. diameter, spaced 10 m., and disposed under the antenna sheets in a direction perpendicular to that of the antenna wires. These earth wires are interconnected by means of bands of copper buried at the same depth (20 to 30 cm.).

On the basis of a theoretical calculation, the space under each antenna sheet has been divided into three sections, each of which carries approximately the same number of lines of force. The centres of these regions are each connected to the base of the antenna by means of lines of equal impedance. (Each of these earth current distribution lines consists of four wires, spread over a breadth of 160 m. in the case of the extreme connections, and 120 m. for the intermediate connection.) The results obtained with this system are as follows: Before its adoption the total resistance of the antenna was 1·9 Ω at a wave-length of 14 300 m. This has been reduced to 0·54 Ω. Of this figure the radiation resistance is 0·19 Ω, giving an efficiency of 35 per cent., a figure which will probably be even further improved when the final form of the earthing system has been installed.

* From " Le Genie Civil."

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The continental station is situated in the immediate vicinity of the transcontinental station, but is quite independent of it. It has a range of about 3000 km. It is furnished with four high-frequency alternators of 25 kW, which can be so coupled as to supply either a single transmission of from 25 to 100 antenna kilowatts or two simultaneous transmissions of from 12 to 50 antenna kilowatts.

The antenna is of the umbrella type, and consists of two symmetrical independent sheets each covering a sector of 180 degs. It is supported by a metal pylon 250 m. high, similar to those of the transcontinental station. Each sheet includes a descent which terminates in a sort of separate antenna. The natural wave-length of the whole is about 4 800 m., and the capacity 0·015 microfarad.

The earthing system consists of a counter-balance or "earth screen," and a buried earth. The earth screen, which is well insulated from the ground, is supported partly by the pylon and partly by 6 m. wooden poles placed on two concentric circumferences of 135 and 235 m. radius respectively. The rays of the earth screen are 72 in number from the pylon to the first circle and 144 from the first circle to the second. The whole is divided into two equal sectors which are separately connected to the station by means of insulated aerial wires.

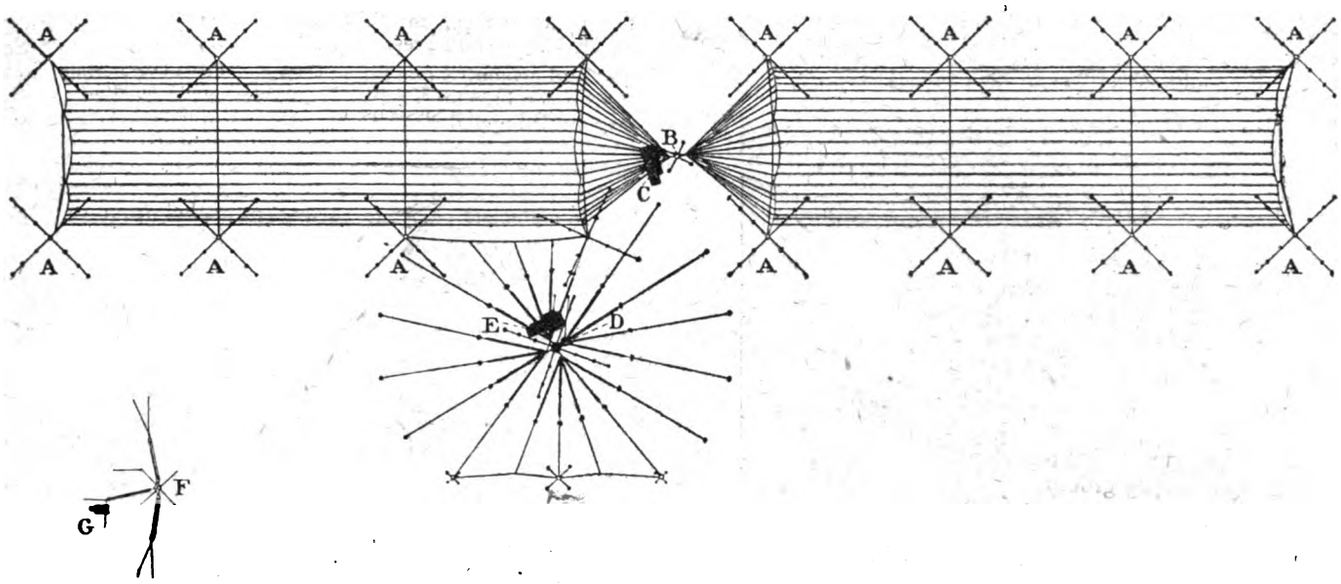

FIG. 2.

The buried earth is composed of 36 copper wires buried at a depth of 20 cm. It covers a circle of about 700 m. diameter, and is divided into four groups of nine wires each, each group being connected separately to the station by means of four insulated cables carried in conduits.

The Valve Station.

The valve station has been erected in some of the outbuildings of the old château of Sainte-Assise, and is intended primarily for communication between London and Paris. The station contains two transmitting sets of which one acts as a reserve. The wave-length range is from 1 800 to 4 800 m. The power supply is either from the local distribution network or from a petrol engine dynamo set of 25 kW capacity.

Each transmission set comprises the transmitting apparatus proper, an antenna inductance, and the control and manipulating gear. The latter permits a normal speed of 120 words a minute.

The antenna of this station consists of three prisms of six wires, each wire being 120 m. in length, supported by a central pylon 100 m. high. The natural wave-length of the antenna is 13 000 m. and its capacity 0·003 microfarad.

The earthing system is composed of a zinc plate 300 m. square buried in the neighbourhood of the station, and two networks of wires buried under the antenna. The three parts of the system are connected independently to the station by means which assure the most economical distribution of the earth currents.

The Reception Centre at Villecresnes.

The reception centre at Villecresnes comprises six receiving stations with combined coil and antenna reception. Each of these is provided with the selective anti-parasitic apparatus of the Société Française Radioélectrique. (One of the stations is devoted to experimental work and to the training of personnel.) The six receiving sets are housed in six small single-floored buildings about 100 m. apart from each other.

The received signals are recorded directly in Paris, the audible frequency currents from the receiving sets being rectified on the spot and transmitted as continuous telegraphic currents over the land lines.

The central office at Paris is installed at 166 Rue Montmartre, at the heart of the business centre. It is connected by direct lines to the transmitting and receiving stations and constitutes the brain centre of the whole system, being the seat of both the automatic high speed transmission and of the automatic reception.

The transmission is effected by automatic paper band machines, with a maximum speed of 200 words a minute.

The recording of the signals is carried out by the most recent and highly perfected systems: (*a*) Siphon recorder. This consists essentially of a very sensitive relay which controls the displacement of a siphon which traces a continuous line on a moving band of paper. (*b*) Direct printer. The telegraph currents received from the reception centres operate a special apparatus which perforates a band. The latter is then passed through a second apparatus which reproduces the message in ordinary printed characters. (*c*) Photographic recorder. This method of reception, ultimately intended for the reception of very high speed signals, is principally employed as a control on the other systems.

Interconnection Arrangements.

The liaisons between the different parts of the radio-electric centre are maintained by means of two lead-covered cables each of forty pairs. Both of these terminate at the central office at Paris, the other ends being at Sainte-Assise in the one case and Villecresnes in the other. Emergency lines are also in existence for the maintenance of communications in case of a breakdown of the main lines. At each terminating point the cables are brought out on to general distribution boards to enable them to be used to the best advantage in accordance with the requirements of the traffic.

AN ELECTRIC LOCOMOTIVE EXPLOSION.

The "Elektrotechnische Zeitschrift" gives an account of a peculiar accident which recently occurred on one of the single phase locomotives on the St. Gothard railway. It appears that the core and coils of the main transformer were taken out for inspection, and it is assumed that in replacing them the winding became damaged or that some foreign metal was dropped into the tank. In any event a day or two afterwards a heavy internal short circuit occurred which generated hydrogen and methane. These escaped from the tank, and finding their way on to the contactors were ignited. This type of accident is to be avoided in future by the use of a relief pipe, which will carry all the gases on to the roof, while an airtight seal is to be provided between the transformer and contactor compartments.

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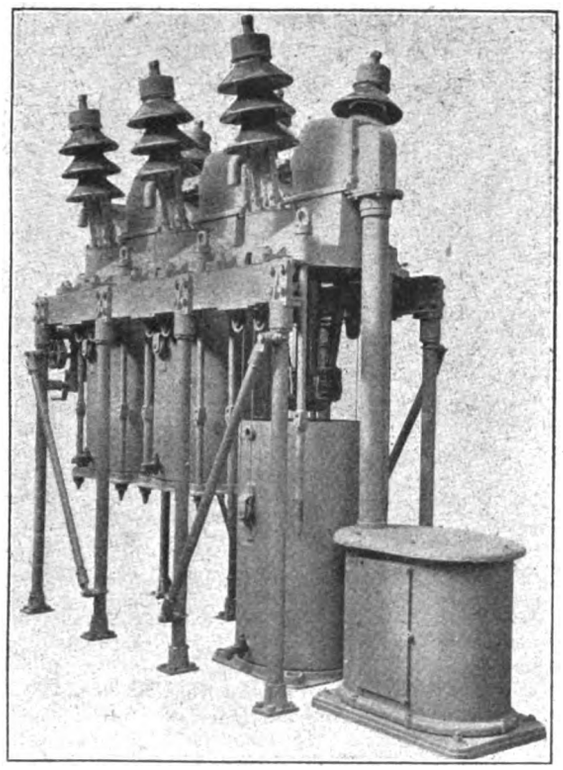
44 000 V OUTDOOR OIL BREAKERS.

Ferguson Pailin's Latest Design—Solving the Problem of Reducing Capital Cost of Sub-Station Equipments.

As is well known, considerable attention is being devoted at the present time to the problem of reducing the capital cost of sub-station equipments necessary for taking supplies from e.h.t. transmission lines. One solution that has been extensively used abroad, is to build the transformers and oil circuit breakers suitable for mounting outdoors, thus eliminating building costs, and in this article we give some details of the oil circuit breaker which has been designed by FERGUSON PAILIN with this end in view.

The unit has been symmetrically shaped to facilitate the running off of rain, and to prevent it gathering. All the joints are weather proof and the operating mechanism is mounted under cover. The design of the bushing insulators ensures that a sufficient surface is protected from rain, or snow, to give an ample insulating creepage surface to the breaker when entirely exposed to the weather.

These breakers are made in sizes suitable for currents up to 800 A, and for voltages reaching 44 000 V. They are of massive construction, each three-phase unit complete with oil weighing 2¾ tons. The provision of a 21·5 in. head of oil above the point of rupture, a high breaking speed, and large



VIEW OF 44 000 V OUTDOOR CIRCUIT BREAKER (FERGUSON PAILIN).

air cushion, strong tanks holding 144 galls. of oil, and a thorough venting system, have been instrumental in giving a large rupturing capacity. They can be arranged for either manual or electrical operation, and automatic or non-automatic tripping as desired.

Whilst primarily intended for outdoor service, these breakers are also suitable for mounting indoors, no protecting enclosure or cell work being required as the lowest live metal is above 8 ft. from the ground, which complies with the Home Office Regulations for indoor switchgear of this country.

To form a three-phase unit, three single pole units are coupled together, and are mounted on cross channels which are supported from the ground by a strutted pipe frame work, at such a height that the oil tanks can easily be lowered and withdrawn.

The circuit breaker base frame, comprises a heavily ribbed steel casting which supports the terminals, fixed and moving contacts and operating gear. Terminals of hard drawn high conductivity copper rod are brought right through the base frame, and carry the fixed finger type contacts at their lower end. Steel stiffeners ensure good contact, and easily renewable arcing contacts of large thermal capacity are provided designed so that the final break occurs when a high operating speed is attained. The moving blades are firmly screwed and pinned into stout bakelite connecting rods, which operate in tubular bakelite guides. These guides are fitted with *lignum vitæ* bearings to keep the moving system steady in operation.

Steel tubes of rectangular cross section form a link between the connecting rods and the main operating mechanism; being comparatively small in area, these tubes introduce but a small displacement of air on entering the tank whilst the breaker is operating, i.e., when internal pressures are being developed. The provision of accelerating springs enables a high breaking speed for the breaker to be obtained, and suitable devices retard the breaker at the end of its stroke.

The tank lowering device is of windlass type and is so arranged that any single tank, or all three tanks can be lowered when required by one man.

The terminal bushings are of the well-known condenser type, designed so that the dielectric stress is uniformly shared throughout the radial depth of insulation. The insulating material used is bakelite, around which porcelain sheds are fitted and cemented one into another. The intervening space between the bakelite and the porcelain sheds is filled in with compound of high dielectric strength. A metal cap is cemented on to the top porcelain shed. This seals the end of the bushing and incorporates a cone grip socket for the external connections. Special attention is given to the porcelain sheds to ensure that there is sufficient creepage surface protected from rain and sleet, to give security under the worst weather conditions.

A heavily ribbed magnetic casting clamped on to the bakelite bushing and cemented into the lower porcelain shed forms the fixing to the base of the breaker and provision is made for the mounting of current transformers on the bushing. The lower portion of the earthed bushing clamp extends downwards below the oil level, preventing static effects.

The main operating mechanism is mounted under cover, and is shielded from weather effects; it is arranged outside the breaker, eliminating the risk of semi-conducting gases passing from one tank to another, or the breaker being blown into the closed position. The mechanism is connected up to the solenoid, or hand operating gear, through driving rods working in projecting tubes, mounted under cover outside the breaker, avoiding any communication between the tanks on the different phases. When hand operation is desired this is effected by means of a cantilever which allows the breaker to be closed by an easy movement, the electrical operation is carried out by a simple solenoid device.

EXTINGUISHING ELECTRICAL FIRES.

Tests made at the Pittsburgh experimental station of the U.S.A. Bureau of Mines relative to the hazards to fire fighters from gases and smoke resulting from the application of carbon tetrachloride extinguisher to electric arcs, burning insulation, or fires such as may occur in electrical apparatus and machinery, are summarised in a report just issued by the Department. It was found that the application of 1 cu. ft. of carbon tetrachloride fire extinguisher to electric arcs and burning insulation in a chamber of 1 000 cu. ft. capacity, developed phosgene, chlorine and hydrogen chloride in quite dangerous concentrations. Carbon tetrachloride vapours, sulphur dioxide and carbon monoxide were also formed in less dangerous concentrations. Rats exposed for 15-minute periods to the gases evolved from the use of carbon tetrachloride on the arcs died or were seriously affected. These tests confirm conclusions drawn from previous tests by the Bureau of Mines that it is dangerous to breathe the gases that may be generated from one quart of carbon tetrachloride extinguisher applied to a fire in a confined space from which escape is difficult or impossible, and from which the gases would not be removed by ventilation.

So far as is known, carbon tetrachloride extinguishers are the most effective and satisfactory of any that can be applied to electrical fires with safety from shock to the operator. Arcs of 60 A d.c. and 220 V, and 35 A and 500 V, were easily extinguished with a one-quart carbon tetrachloride fire extinguisher. The purpose of these experiments of the Bureau of Mines was to determine the extent of the danger from poisonous gases arising from use of carbon tetrachloride extinguisher on electrical fires, and to promote safety of fire-fighters through their knowledge of those conditions. It is not the purpose to discourage the use of carbon tetrachloride extinguishers, which are safe under all conditions, excepting those of close confinement of fire gases in absence of ventilation, and lack of ready escape for the operator from the gases.

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THE INSTITUTION MEETING.

Industrial Research Discussed from Many Angles—Development and its Need of an Incentive—What They Do in the Navy.

At the meeting of the Institution of Electrical Engineers on Thursday, November 1st, the PRESIDENT began by referring to the death of M. Maurice Leblanc, an honorary member, and said that the Council proposed to send the following telegram to the French Institution of Electrical Engineers :—

The Institution of Electrical Engineers, London, send their deepest sympathy to all French engineers on the death of Maurice Leblanc, one of the most esteemed of their honorary members. When President of the International Electrotechnical Commission he won golden opinions from everyone. His achievements in engineering science have been of the greatest help to his brother electricians all over the world.

The PRESIDENT also referred to the death of Mr. C. P. Steinmetz and read a cablegram which had been sent to the American Institute of Electrical Engineers :—

The Institution of Electrical Engineers, London, send their sincere condolences to their American *confreres* on the death of C. P. Steinmetz, one of the early pioneers, and one of the greatest exponents of the science of electrical engineering. His fame is world wide, his work lives and will continue to live.

The meeting having expressed its approval of these messages those present, on the invitation of the President, rose in their places for a few seconds.

A New Honorary Member.

The PRESIDENT then announced that the Council had that afternoon elected Col. R. E. Crompton an honorary member.

A Paper by Mr. W. WILSON on "Industrial Research with Reference to Engineering Development," of which an abstract will be found on p. 510 of this issue, was then read.

Discussion.

Mr. A. P. M. FLEMING (Metropolitan-Vickers Electrical Co.) foresaw a little trouble in transferring all experimental work to the development department as suggested by the author. The production and other departments liked to do a little experimenting and would have a natural disinclination to see it handed over in this manner. He did not think the author's methods would be found easily applicable to all classes of electrical manufacture. The requirements laid down for the staff were severe. A high standard was, of course, necessary but care must be taken not to make it too high. It would be interesting to know what amount of money the author would devote to a development department. A reasonable sum was from 3 to 5 per cent. of the turnover, to cover the whole of the research, and if manufacturing firms would definitely set aside a sum, it would make for consistent, rather than spasmodic, attempts at development.

Mr. E. B. WEDMORE (British Electrical Research Association) suggested that the author had not laid sufficient stress upon the engineering training of development department staffs. Development department men should have ample opportunities for studying works processes, and a good plan would be to give the men cost sheets of the particular article they were dealing with. A vital part of development work was experiment. There was need for greater co-operation between competitors and many more problems of a general character could be dealt with co-operatively between competing firms than were actually being handled in that way.

Mr. W. B. WOODHOUSE (Yorkshire Electric Power Co.) spoke of the need for an incentive in all research and development work, and suggested that in the case of the latter the incentive was the possible reward to the manufacturer. If manufacturers carried out development work on co-operative lines, it might result in them controlling the market, and if they could control the home market, they might be able then to attempt to control the foreign market. Many improvements in electrical plant and machinery were due to the customer, and there were some problems of development in which the user could be most usefully taken into consideration. The universities ought to be brought in. Such a course would have the advantage of keeping teachers up to date.

Mr. C. C. PATERSON (General Electric Co.) thought the problem of development research was one more of human nature than system. The author had sought to prove rather too much for the development department as such, and it would be interesting to know more about its relations with the works drawing office and the production department. No universal rule could be followed to determine which was the right system to adopt in any particular works. Every section of manufacture must decide for itself. For instance, the manufacture of the thermionic valve was an operation which called for the supervision of the development man right up to the last stage of manufacture, owing to the fact that the slightest deviation unknown to the production man seriously affected the final product. There were other cases in which the development department, having got out the model, could safely leave the rest to the works. There was a distinct difference between research and development research, in that the former was a search for knowledge whilst the latter was the application of knowledge to a commercial object. The industry would have produced but very mediocre results if it had depended upon the universities solely for its ideas. We should never have had the gasfilled lamp or the dull emitting valve. He agreed with the author as to the advantages of segregating this sort of development work and research work from the production department itself. It would have been useful, however, had the author discriminated a little more between the functions of the research department and the functions of the development department. Even the research department must be carried along the lines of producing new ideas and the workers in that department should have the opportunity of seeing their products in the commercial state and be given an inducement to proceed on these lines.

Mr. E. T. WILLIAMS said in the electrical department of the Navy research and development were treated as three separate things—viz., research, experimental work, and development. It was possible to get men to work together in team work without losing their individuality. If development work were mixed up with routine work, one or other suffered, usually the development work. In selecting a staff for a development department, special care should be paid to administrative qualities, because they did not want men with only scientific or mechanical attainments; the best man was one with all three. In the naval dockyard workshops men were encouraged to make suggestions for improvements, and awards were made for those which were used. Since the war the Admiralty Electrical Department had endeavoured to co-operate with manufacturers and was always glad to discuss matters with them.

Admirable Crichtons Required.

Mr. S. W. MELSOM (National Physical Laboratory) suggested that something more than academic attainments were necessary for the development staff. Research workers should no longer be wrapped in cotton wool. One of the qualifications that an applicant for a post should have was that he should be a sportsman, if, indeed he should not have some form of dissipation as an offset to the work he had to do. According to the Paper, workers in the development department should not have any rush work, but no man in engineering was worth his salt unless he were capable of responding to pressure with a greater amount of work.

Two Aspects.

Mr. F. CREEDY said that assuming a development department was continuously at work, there were two aspects to be considered. First, who decided what new apparatus was to be made, and, secondly, having developed the apparatus, who decided that it would not prove disappointing commercially? In the ordinary way, the former would be settled by the business heads of the firm, and his experience had not been that these heads were disinclined to encourage research and development. The development department should work in the closest touch with the sales department, and the development engineer should be constantly investigating the operation of all sorts of plant and studying their defects. Having carried through the development to a production basis, the question then arose whether it would be a commercial success. In this respect the development engineer was often handicapped by the sales department because the salesmen at first would not be the best men to explain it to the customers. It would really require that the development man himself should do this for a while and this placed a very heavy burden on him.

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ALL BRITISH WIRELESS EXHIBITION.

THE ALL BRITISH WIRELESS EXHIBITION, which opened at the White City, London, yesterday, and will remain open until Wednesday, November 21st, is by its size and scope an excellent example of the way that "wireless" has attracted the public imagination and of the way that manufacturers have seized the opportunity for business which the consequent demand for their products has caused. It is not too much to say that it is a "broadcasters'" or amateurs' exhibition—even their paradise. From the point of view of a technical journal it is therefore a little disappointing; variations in design and construction are few and new ideas are limited. For the field which it is designed to serve this is, however, no disadvantage, and we hope that much business will result from the enterprise of the organisers and the exhibitors.

Metropolitan-Vickers Electrical Co.

The chief features of the METROPOLITAN-VICKERS ELECTRICAL CO.'s exhibit are their latest improved types of two-valve and four-valve sets with dual amplification circuits, and the "Cosmos" Radiobrix. They are also exhibiting a new six-valve set with a frame aerial, and in addition the "Cosmos" Radiophone crystal set, with single valve and two-valve "crystal set amplifiers," which are specially designed to fit into the crystal set. A comprehensive assortment of radio accessories, components, and parts are also to be found.

The special dual amplification circuit now employed causes the performance obtained with two valves to be fully equal to that hitherto obtained with three. This is due to the fact that the same valve is used both for high and low frequency amplification. A non-radiating reaction coupling is also fitted.

FIG. 1.—COSMOS RADIOPHONE 2-VALVE SET.

It will be remembered that the "Cosmos" valve sets are designed on the "unit" principle. For instance, the "Cosmos" radiophone two-valve set (Fig. 1) consists of a two-valve tuner unit, with the necessary batteries and telephones; the addition of a two-valve note amplifier unit converts this into a four-valve set. Each unit is connected up to the next by a single plug which cannot be inserted wrongly. The units are arranged to fit into handsome cabinets of various designs, or they may be used by themselves. Thus it is possible to start with a comparatively inexpensive form of valve set, which may be added to afterwards, and so by degrees an elaborate set built up.

The "Cosmos" radiophone six-valve set is a super-sensitive self-contained set, which is fitted with a frame aerial in the cabinet; it is also arranged so that it can be connected up to an outside aerial if desired. It is particularly adapted for use in flats where an aerial cannot be used. With a frame aerial loud speaker reception can be obtained up to a distance of 25 miles. Detection is by a crystal and the set is highly selective. A non-radiating adjustable reaction coupling is fitted. The frame aerial fits inside the containing case when not in use. The cabinet is a handsome piece of apparatus, and can be supplied in various styles.

The "Cosmos" Radiobrix (Fig. 2) comprise a comprehensive range of units, by various combinations of which the radio experimenter or amateur can build up any type of

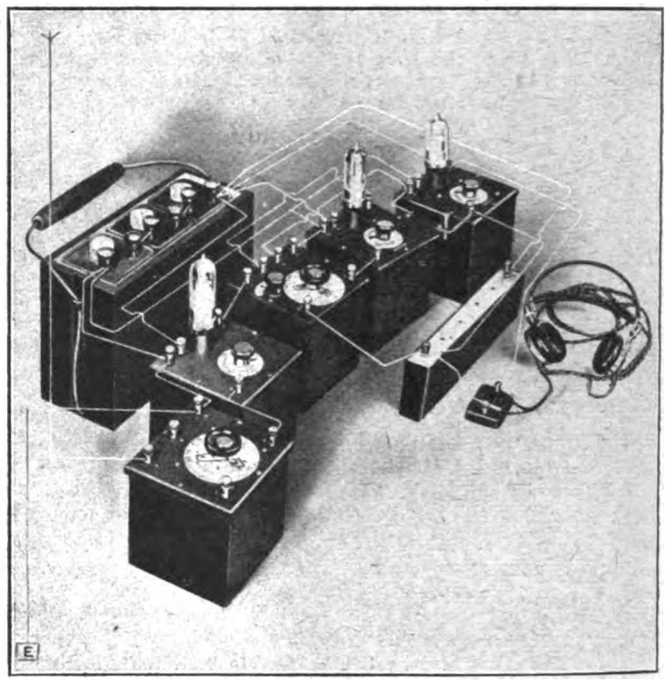

FIG. 2.—METROPOLITAN-VICKERS "RADIOBRIX."

receiving set, and by connecting up the standard "Radiobrix" in various ways an immense variety of circuits can be tested and used.

Falk, Stadelmann & Co.

The range of receiving sets shown by FALK, STADELMANN AND CO. comprises simple crystal receivers, including a popular type known as the "Benbow." This is priced at £3 10s., complete with headphones and accessories, plus B.B.C. tariff. There is also a cheaper model retailing at £2 17s. 6d., as well as valve sets of various sizes.

Special attention may be drawn to the "Nelson" valve set (Fig. 3), which is novel both in its exterior design and, in its general layout. It is constructed with a roll shutter, which may be closed down over the face of the instrument when it is not in use. The valves are contained in an enclosed compart-

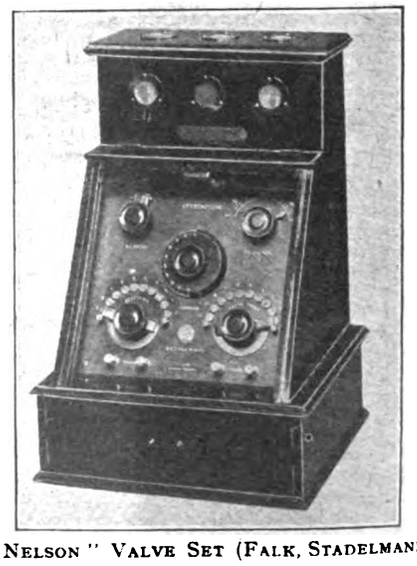

FIG. 3.—"NELSON" VALVE SET (FALK, STADELMANN AND CO.).

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ment at the top of the cabinet, with a lift-up top and fall front for access when necessary. Gauze covered port holes are provided to allow of filament inspection and ventilation. Terminals are fitted at the back of the instrument for the battery, aerials and earth connections, so that all wires not material to the actual handling of the set are out of the way and out of sight. The only terminals on the face of the instrument are those for connecting up the headphones or loud speaker.

A new Efescaphone set, which combines a crystal and valve, is the "St. Vincent." This embodies a specially sensitive reflex circuit, comprising high frequency amplification, crystal detection and note magnifying stages, although employing only one valve. It is arranged to give maximum signal strength over the whole band of broadcasting wave lengths. This set develops sufficient power to work a loud speaker within 10 to 15 miles from a broadcasting station with only one valve.

Alfred Graham and Co.

ALFRED GRAHAM AND CO. are giving a comprehensive display of Amplion loud speakers, covering the entire field of loud speaker application. The loud speakers shown include the Amplion Junior, which is not merely a loud speaker in miniature or head-gear receiver adaptation, but an equipment of real efficiency designed for economical production upon a quantity basis. It is now made in a de luxe model. Two other types of loud speakers are arranged for alternative table or wall use. In them the "tone arm" is pivoted on an arm which is secured to a weighted base in such a manner that the trumpet can be placed in any convenient position. A number of other models are exhibited.

The technical improvements embodied in the 1924 Amplions include modifications in the electro-magnetic system, such as the mass of the magnets, the section of the laminated pole-pieces, and the coil windings. The diaphragm, instead of being rigidly clamped as heretofore, is simply retained in position without the imposition of any stress or strain other than that due to magnetic effort, so that it is rendered less periodic than ordinarily is the case.

Trumpet resonance of undesirable character, which has been one of the main faults of loud speakers generally, has been overcome by the construction now adopted. The tone-arm is made of pressed metal, and between the arm and the wooden bell-mouth trumpet, with which all new models are finished, a substantial rubber bush is interposed. This bush closely embraces the small end of the trumpet on the outside and expands into the bore of the conduit, so exercising sufficient pressure on both sections to damp out the vibrations which would otherwise develop.

Siemens Brothers & Co.

SIEMENS BROS. & CO. are showing two types of wireless broadcasting receiver. One of these is a three-valve set which was designed with a view to minimising interference from other stations so that London broadcasters could enjoy the programmes at Birmingham, Newcastle, or Glasgow. This is effected by using the ordinary arrangements for tuning the aerial, in conjunction with a loosely coupled closed circuit. This circuit can be cut out for finding distant stations, or

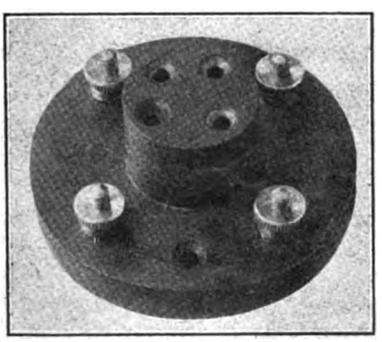

FIG. 4.—A USEFUL WIRELESS ACCESSORY (SIEMENS BROS. & CO.

where no interference is taking place, while the low-frequency amplifier can also be cut out when it is not required. The set is self-contained except for the filament accumulator battery and for the aerial and earth connections. Its range of wavelength is from 300 to 2 800 metres. The apparatus provides for the use of a tuned closed circuit coupled to the aerial circuit, thus making the set highly selective, while the adjustment of the two circuits is effected from the condenser by circular switches of ten studs each.

The other set has a much shorter range, but as the number of broadcasting stations is increasing this is no obstacle to its employment, while its simplicity in operation will be a great attraction to many amateurs. A special two-valve low-frequency amplifier has been designed for use with this set. It is contained in a compact mahogany box in which all the necessary apparatus except the filament battery and the telephone headgear is placed. The high tension battery has a life of about six months, and a switch is provided by means of which either one or two valves may be used.

The switches provided allow a number of combinations of apparatus to be used. It may be pointed out that for use in country districts and for other places where there are no facilities for re-charging accumulators, Siemens are manufacturing a special dry cell unit. This unit has a sufficiently large output to permit the set being worked for one hour a day for about six months. The firm are also showing a loud speaking receiver which is made in three types, with resistances of 120, 2 000 and 4 000 O respectively. A typical Siemens accessory is the valve holder illustrated in Fig. 4.

The products of the DUBILIER CONDENSER CO. at Stands Nos. 106 and 107 serve to emphasise the prime importance of the condenser in all phases of radio work. The "amateur" will be most interested in the four patterns of fixed condenser which are fitted with grid leak attachment. These condensers (Fig. 5) are all constructed with carefully selected mica dielectric, and are built up on the same principle as that adopted for the

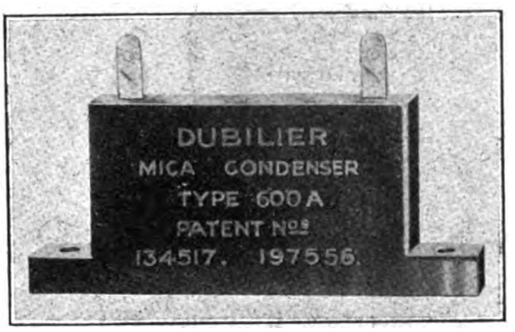

FIG. 5.—MICA CONDENSER (DUBILIER CONDENSER CO.)

larger power condensers, the design being arranged to reduce all losses to a minimum. One type of condenser has a clip into which grid leakage resistances can be pushed, while the feature of another, which is of special interest to amateurs is that extreme constancy of capacity has been obtained. Variable air condensers of the moving vane type are shown in three patterns, while examples are also to be found of special screened variable condensers for use as standard or precision instruments, and for experimental work on short wavelengths where electrostatic screening is desirable. The Ducon apparatus, which enables the ordinary house electric lighting wires to be used as receiving aerials, is also in evidence, while a number of other useful accessories are to be found.

General Electric Co.

The GENERAL ELECTRIC CO.'S exhibit comprises a complete range of "Gecophone" broadcasting receivers, among which may be mentioned two crystal models, and the well-known two-valve "Gecophone" set. Among new models are a two-valve panel set which is being sold not only as a complete unit but also as a constructor's set of components for home assembly. Other novelties are a four-valve cabinet-de-luxe with self-contained loud speaker and batteries embodying many new features. A range of loud speakers includes a new "Gecophone" speaker produced at the Company's Peel-Conner Works at Coventry, while other exhibits are a complete range of components and aerial equipment, a rejector unit, and various models of power amplifiers. Another section of the exhibit consists of Marconi broadcasting valves made at the Osram-G.E.C. Lamp Works. These include the latest types of dull emitter valves.

The name of S. G. BROWN is one to conjure with in the wireless world, and visitors to the exhibition will have an excellent opportunity of seeing this firm's well-known products in telephone receivers, loud speakers and amplifiers. The telephone receivers are provided with a milled-head adjusting screw, and are mounted on light aluminium head

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bands with a double swivel motion to fit the ears. Another receiver is of the flat disc type which has the same adjustment, while in a third type attention has been paid to reducing the weight, so that these sets weigh 6 oz. only. An exhibit is also made of the "Frenophone," details of which have already appeared in THE ELECTRICIAN. It may be recalled that its chief features are the amplification of weak signals to great loudness without loss of purity in the rendering, and that it depends for its operation on the high degree of friction existing between a moving surface of optical glass and a pad of cork or such substance. The coefficient of friction is so high that very slight changes in a constantly applied pressure between the pad and glass produce enormous fluctuations in the tangential drag. The glass surface is revolved slowly by a gramophone clock, and the pad which rests on it is fixed to a light flexible pin which is fastened to the reed of a Brown telephone receiver. The pad is linked by reins to the diaphragm, which is of the usual loud speaker type. Speech currents cause the reed to be set in vibration, and these vibrations appear as oscillatory changes of the steady pressure of the pad on the glass disc, causing great amplification of speech.

FIG. 6.—LOUD SPEAKER FOR ATTACHMENT TO GRAMOPHONE.

The loud speakers shown on the BRITISH THOMSON-HOUSTON Co.'s stand are characterised by their sound mechanical construction and electrical efficiency. They are usually wound for 2 000 O. and high grade moulded insulating compound is alone used in their construction, while to ensure permanency the magnets are made of cobalt steel and are fitted with an easily adjustable air gap.

These loud speakers are made in four types, one of which is designed for use with the tone arm of a gramophone (Fig. 6), and the other is of the electro-dynamic type, which is provided with a permanent magnetic field generated by a battery of cobalt steel magnets, so that the use of a field exciting accumulator is avoided. The secondary winding of the transformer is connected to a moving coil, which floats freely in the permanent magnetic field. Any variation of current in the coil causes a corresponding movement, which is transmitted to the diaphragm. A large amplifier which has been designed for loud speaker work, is also shown. Valves which have been specially designed for power amplification and reproduction so as to be free from all noise are employed. Their current consumption is very low, being only 0·25 A at 6 V. The intensity of reproduction is adjusted by means of a rotary switch.

On Stand No. 100, the WESTERN ELECTRIC Co. are, of course making a special exhibition of the Wecovalve (the new peanut type valve which operates off a single dry cell), and the new Weconomy sets which incorporate these valves. The stand has been cleverly designed to contain five compact compartments, in which visitors will be able to test the apparatus by the use of head receivers in comfort and without interference. A complete line of new loud speakers and cabinet sets will also be exhibited. The Weconomy sets have compactness as their keynote, as will be gathered from the illustration of the two-valve set (Fig. 7), which we give herewith. This set is arranged for high frequency amplification and detection, and is complete with tuning inductance, filament resistance and other acces-

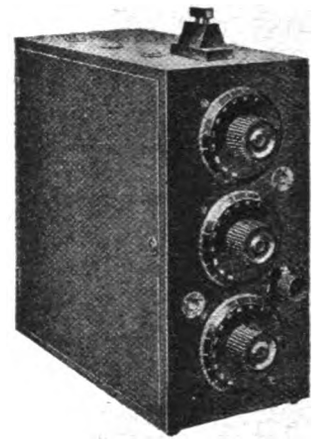

FIG. 7.—COMPACT TWO VALVE SET (WESTERN ELECTRIC Co.).

sories to cover the broadcast wavelength band of 300 to 500 metres. By adding Igranic coils, for which two holders are provided, tuning can be increased up to 3 000 metres. This company, have of course, given special attention to the design and manufacture of loud speakers, a small pattern of which we illustrate herewith (Fig 8). This loud speaker has an accurately fixed air-gap, and operates on the ordinary magnetic diaphragm principle. We understand it gives excellent results when it is connected to a detector set through a good two-stage low frequency amplifier.

FIG. 8.—WESTERN ELECTRIC LOUD SPEAKER.

L. McMichael, Ltd.

As is well-known, L. McMichael, Ltd., specialise in "M.H." wireless receiving sets, which are entirely British made, and of high standard both in manufacture and performance. Their stand (No. 83) at the exhibition contains a selection of some of the more important of their products, and these can roughly be divided into experimental receiving sets and units for the experimenter; broadcast sets for the listener-in; home assembly sets, and components for the constructor; and components and accessories for the experimenter and constructor.

The M.H. unit system is designed for the experimenter and general user who has a preference for some system of units which can be added to, or subtracted from, to make

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a composite set, and to enable the various combinations to be easily altered. It is claimed to be the only unit system wherein each unit conforms in size and exterior appearance to each other unit.

The system comprises a tuner unit, high frequency amplifier units, valve rectifier unit, note magnifier units, and accessories such as links, plug-in link adaptors, supply plugs, and connecting straps which enable units to be quickly assembled and dissembled with the smallest possible number of connections.

An ideal complete unit five-valve receiver comprises the following: A tuner unit, two high frequency amplifier units, a valve rectifier unit, two note magnifier units, ten interconnecting links, five plug-in adaptor links, one supply plug. There is also provided a crystal tuner unit, which makes another inter-changeable unit for experimental purposes.

Igranic Electric Co.

Everyone who has had experience in the practical working of a high frequency amplifier has at least a hazy notion that a combined control comprising a grid potentiometer and the usual form of filament rheostat has its limitations. In the region around the critical adjustment, where small sounds at a slight touch become large noises, some means of making much more minute moves is much to be desired. It is clear that anything that will permit this to be done will raise the probable number of potentiometer and rheostat adjustment combinations very considerably. Something, in fact, is needed to act in regard to these combinations as a vernier condenser does to those of larger values. This "something" is to be found on the stand (No. 43) of the Igranic Electric Co. in the shape of the vernier rheostat (Fig. 9). This rheostat consists of a resistance rotatable by means of a knurled flat knob within a hollow spindle. On this is mounted an insulating drum carrying a single strand of resistance wire. This smaller spindle is controlled by a knob which is smaller than the one previously mentioned, and which is mounted at the extreme front. The wiring and contacts are such that any desired value of the single strip of resistance can be added to that given by the flat knob by turning the smaller one. The same type of filament rheostat is obtainable without the vernier addition. Both are suitable for panel mounting, possess a pointer and give very gradual and smooth operation. The maximum resistance of both is approximately 4 O, and they are suitable for both ordinary and dull emitter valves.

A good deal of discussion has of late turned upon the utilisation of a.c. mains for filament heating. The Igranic Co. have brought forward a device which, while effecting step-down transformation, embraces certain circuit arrangements which effectively prevent noise. It is known as the Igranic a.c. valve-to-plug set.

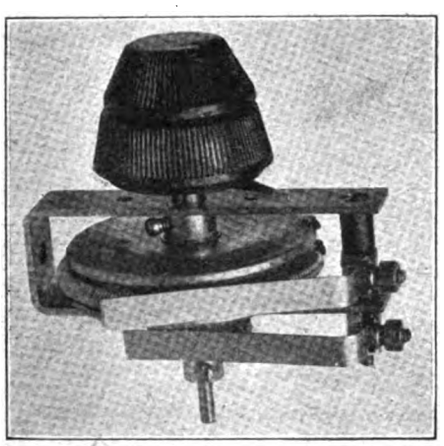

FIG. 9.—VERNIER RHEOSTAT (IGRANIC ELECTRIC CO.).

The RADIO COMMUNICATION Co. are showing a seven-valve cabinet set, which is fitted with remote control and is used in conjunction with highly artistic cabinets in either the Chippendale, Adam or Jacobean styles. The remote control enables the set to be operated from an armchair at some distance away. Other types of this firm's well known receiving sets are also to be seen. The constructor will be interested in the "Polar Blok" apparatus, which is a cleverly designed system of set construction somewhat on the lines of the well known meccano, by which a complete receiving set may be constructed in a short space of time without undue knowledge or ability being necessary.

The BURNDEPT exhibits, which are found on two stands, may be divided into four classes: amateur and experimental, Ethophone broadcast receivers, home constructional apparatus and components and accessories. In the new Ultra IV Mark II set for amateurs the last stage of audio-frequency is a power stage, so that a much greater volume of speech is

FIG. 10.—TWO-VALVE SET (EAGLE ENGINEERING CO.).

obtained without the quality being impaired. In the Ethophone apparatus, which is especially designed for listening-in, accessibility is the keynote, and the instruments are designed to give the highest efficiency combined with simplicity of control. Loud-speakers, giving excellent reproduction, can be fitted on the larger sets. The ethophone selector, which can be used with the larger sets to get rid of trouble from ship or unwanted land station interference may also be mentioned. The home constructor's apparatus is designed with the utmost simplicity, so that assembly is easy by the aid of a booklet.

The EAGLE ENGINEERING Co. are showing a wide selection of their Chakophone crystal and valve receiving sets, together with a complete series of parts for home constructors. Our illustration (Fig. 10) shows a two-valve cabinet model receiver. Everything is compact and easily accessible, and all the apparatus is contained in a handsome polished walnut case. Dull emitter or peanut valves can be used with this set to great advantage, thus effecting an economy in current consumption which is so necessary to broadcasters living in the country.

W. G. Pye & Co.

W. G. PYE AND CO.'s exhibit includes patent tuning coils of the plug-in type. These are of extremely low self-capacity and of very robust character. The tuning coil holders for two and three coils shown are fitted with vernier adjustments giving very fine reaction adjustment. Another interesting exhibit is a system of unit valve panels from which an efficient multi-valve set can be built up, while complete receiving sets of two, three, and four valves, covering ranges from 300 to 3 400 metres, are also to be seen. These sets are mounted in various designs including a simple sloping cabinet, a table with a hinged lid covering the valves, etc., and a pedestal with self-contained loud-speaker. We may also mention two low frequency transformers which have been designed to give a uniform amplification over the whole range of music frequencies. One is particularly efficient on weak signals, and this should be used after the detector valve. The other is for subsequent stages and power amplification and is suitable for the loudest loud-speaker work.

The MULLARD RADIO VALVE Co. are showing on their stand, No. 90, their latest production, the New Mullard Wecovalves, and in addition the Ora R, L.F. Ora, P.A., small transmitting valves, large glass transmitting valves, and a Mullard silica valve. Apart from this comprehensive range of valves, they are making a display with Mullard resistances, grid leaks, condensers and headphones.

THE BRITISH L. M. ERICSSON MANUFACTURING Co. are showing a selection of their headphones, which need no introduction to readers of THE ELECTRICIAN. The loud-speakers exhibited are also of high quality and have a purity of tone which is exceptional. Complete sets of both the valve and crystal types and accessories are also on view.

(To be concluded.)

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THE DEHYDRATION OF INSULATING OIL.

The tentative British standard specification for insulating oils for use in transformers, switches and circuit breakers, dated April, 1923, and drawn up by the British Engineering Standards Association, provides that the standard disruptive strength of oil shall not be less than 22 000 effective voltage (R.M.S.). A dielectric strength of this value has been difficult to obtain in the past, and to obtain it resort has had to be taken to boiling the oil for a considerable time to get rid of all trace of moisture. To assist in the extraction of moisture out of the oil a vacuum is applied to the top of the vessel in which the oil is heated, but such an arrangement has proved

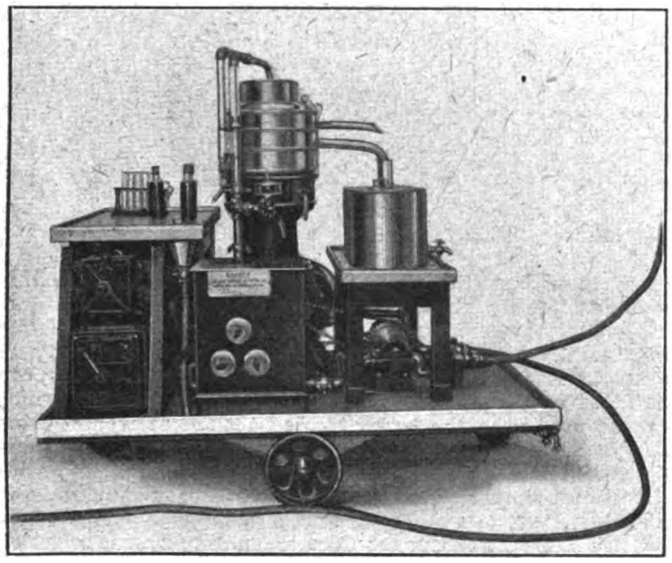

FIG. 1.—GENERAL VIEW OF DE LAVAL DEHYDRATOR.

unsatisfactory and impracticable. It has been more usual in recent years to pass the oil through a blotter press. But such treatment is slow and costly and is liable to introduce fibres from the blotting paper.

Moisture Not so Deleterious as Supposed.

The commonly accepted belief that the dielectric strength is primarily due to the absence of moisture is only partly true. Experiments have shown that although it is very difficult so to guard the insulating oil that it will not absorb moisture, yet it is almost impossible for the oil to absorb moisture to an extent of more than 0·05 per cent. in volume. A fair indication of the presence of moisture is the fact that the oil will become slightly opaque. Water in oil does not materially effect its insulating property unless there is some hydroscopic material like fibre also present. When, however, fibrous matter is present in conjunction with a small quantity of water a rapid deterioration of the insulating qualities of the oil takes place. This fact has been established by exhaustive experiment. More than 50 tests were made on various samples of insulating oil. Briefly stated, the tests consisted of adding water to a quantity of oil, which was then mixed by the electrostatic action of a high voltage. This mixture was allowed to stand for several days, after which there was noticed a distinct layer of water at the bottom of the oil and exceedingly fine globules of water in the body of the oil, which globules were so minute as to be visible only with the aid of a microscope. Great care was taken to keep the oil entirely free from fibre or dust. A part of the oil was taken, whilst a little dust and fibre were allowed to mix with other samples. The difference in dielectric strength between the oil containing fibrous matter and that which was free from such matter was remarkable.

The lowering of the breakdown voltage was found to be entirely due to the fibres bridging between the electrodes. It was also found that the particles of water in the oil only influence the insulating power of the oil when they produced "water strings" so as to shorten the gap. The water in suspension is so finely divided that its cohesive pressure is too great to deform itself into a string by electrical force alone. The water particles move round in the oil, when the electrodes are changed, always keeping their original granular formation. In addition to this, that part of the water which may be actually absorbed by the oil is believed to have little effect on the dielectric strength.

However, when any substances, such as cotton fibres, which readily absorb moisture, are present, then they make bridges between the electrodes, and, having absorbed moisture, produce the same state of affairs as when "water strings" are made. Thus the dielectric strength of the oil will be considerably reduced. As already stated, the blotter press will not remove all fibres, but is likely to introduce them. The only known method of removing any particles of dust and fibre from the oil is by subjecting the oil to centrifugal force.

How Dust and Fibre Can be Removed.

Very interesting tests have been conducted by the DE LAVAL CHADBURN Co., of Wellington House, Buckingham Gate, with one of their De Laval centrifugal machines. They have found that not only can all dust and fibre be removed from the oil, but that the moisture can be extracted at the same time. On account of the peculiar construction of the De Laval centrifugal bowl the speed of rotation is kept comparatively low, and complete dehydration of the oil is obtained at about 6 000 revs. per min.

Samples of oil which broke down at 5 000 V have withstood a pressure of 50 000 V after passing through one of their machines. This is a remarkable achievement, and has supplied a long-felt want to the electrical engineer. There seems no reason, therefore, why the British standard for insulating oil should not be raised to that figure and so establish an important preference in favour of British insulating oils.

Another important point is that it will be possible in future to clean and dehydrate the insulating oil in transformers, switches, etc., without having to face all the cumbersome process of the past. The practice of leaving oil in transformers for several years is not unknown, although it is realised that a risk is being taken, not so much on account of moisture, which may become absorbed in the oil in that time, but on account of the sediment which settles upon the horizontal surfaces of the windings and leads. This risk has been

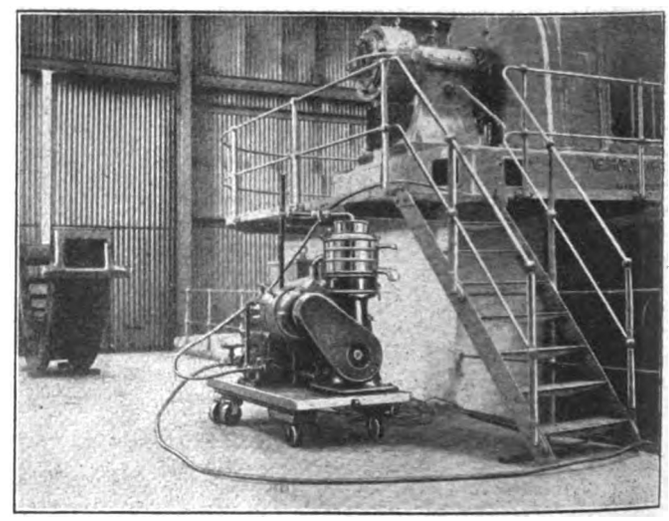

FIG. 2.—DE LAVAL PORTABLE UNIT IN USE AT CROYDON POWER STATION.

rightly accepted on account of the difficulties and labour involved in handling such large quantities of oil at a station or within a transformer house.

Cleaning and Dehydrating a Simple Operation.

If a centrifugal machine is to be used in the future for periodically cleaning and dehydrating the insulating oil, then treating the oil becomes a very simple operation requiring negligible labour. Therefore the standard of maintenance can be raised without increased cost, both of which are all-important in these days. We give an illustration (Fig. 2) of an ingenious adoption of the De Laval centrifugal machine which has been installed at Croydon for treating insulating oils. The whole unit is portable, and by being arranged on wheels

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suitably disposed at the centres of each side the whole unit can be turned on its centre and so manœuvred about in the smallest possible space. One machine can now do the work of several, and can easily be taken to outlying transformers, etc. Besides the centrifugal machine, there are mounted on the platform two rotary pumps for taking and delivering the oil, an electric motor and starter for driving the pumps and the centrifugal machine.

Aeration Need Not be Feared.

An objection to the use of centrifugal machines for treating insulating oil is sometimes put forward on the grounds that the oil becomes aerated. This difficulty has been overcome by providing a large container mounted on a stand into which the oil pours after leaving the centrifugal machine. The container is fitted with bafel plates and a special float valve. By this arrangement the oil is confined in the container sufficiently long to allow what air there may be in the oil to escape. Two 20 ft. lengths of flexible hose are provided with which to connect the unit for taking and returning the oil. An electric heater which is capable of accurate control is fitted in the oil system for heating the oil before it reaches the centrifugal machine. By heating the oil as much as possible, without damaging it, better results are obtained, whilst the speed at which the oil can be treated is increased considerably.

Insulating oil can be dehydrated at a speed of about 300 gallons per hour, so it will be seen that the largest transformer can be cleaned and dehydrated in a few hours, whilst all waste and leakage of oil are avoided.

It will be further realised that by employing this portable apparatus on a transformer which has had its insulation lowered by the presence of water, to circulate hot oil over a long period until the windings have been completely dried. During the circulation any moisture that is taken up by the oil would be extracted by the purifier. This operation has already been done in several cases with complete success, while at the same time the cost and the ease with which the operation was performed is remarkable. The whole process is, we understand, absolutely mechanical and requires little attention.

There is no reason why transformers, switches, etc., which employ insulating oil should not be kept free from any form of sludge. At one large power station a drain is taken from the bottom of every oil switch and led into a common pipe. The oil is drained from a switch at any moment after one or more overloads have thrown the switch out, the switch being refilled from a tap immediately over it; the fresh oil running down from a gravity tank. The used oil is passed through a De Laval combined purifier and dehydrator, which removes all dirt and moisture, rendering the oil as good as new again. It is then pumped back to the gravity tank for future use.

It is interesting to know that the same machine that is used for the treatment of insulating oils can also be used for the cleaning of lubricating oils, and especially for some turbine plants where circulating oils are likely to emulsify.

BOOKS RECEIVED.

"The Law of the Car." (London: Percival Marshall & Co.). Pp. xvii+169. 2s. 6d. net.

"Elektronen-und Ionen-Strome." By Dr. J. Zenneck. (Berlin: Julius Springer.) Pp. 48. 1s. 6d. net.

"Modern Electro-Plating." By W. E. Hughes. (London: Oxford University Press.) Pp. 160. 16s. net.

"Mechanical Road Transport." By C. G. Conradi. (London: Macdonald and Evans.) Pp. xviii+394. 21s. net.

"Universal Directory of Railway Officials." 1923 Ed. (London: The Directory Publishing Co., Ltd.) Pp. 400. 20s. net.

"Science Abstracts. (Sections A and B, No. 310.) Vol. 26, Part 10. (London: E. and F. N. Spon.) 3s. per section.

"Die Materialprüfung der Isolierstoffe der Elektrotechnik." By Walter Demuth. (Berlin: Julius Springer.) Pp. 254. 13s. 6d. net.

"The Inspection and Testing of Materials, Apparatus and Lines." By F. L. Henley. (London: Longmans, Green & Co.) Pp. x+355. 21s. net.

"An Introduction to Wireless Telegraphy and Telephony." By J. A. Fleming. (London: Sir Isaac Pitman & Sons.) Pp. 109. 3s. 6d. net.

"Working of Steam Boilers." Sixth Edition. By Edward G. Hiller. (Manchester: The National Boiler and General Insurance Co.) Pp. 166. 3s. 6d. net. Full cloth, 5s. net.

"The Wireless Amateur's Diary." 1s. net; "The Wireless Experimenter's Diary," 2s. 6d. net.; "Wireless Telephony—A Simplified Explanation," by R. D. Bangay. Pp. 129. 2s. 6d. net. "Time and Weather by Wireless." By W. Mitchell. Pp. x+125. 3s. 6d. net. (London: The Wireless Press.)

CORRESPONDENCE.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

THE QUESTION OF IMPROVING THE SHAPE OF ALTERNATOR WAVES.

[To the Editor.]

Sir,—I have read with interest the letter by Mr. Clinker, describing the device that has been used by the British Thomson-Houston Co. to reduce the effect of harmonics in some of their three-phase generators. The principle of the device is, of course, entirely different from the one which Mr. Turney and I described recently before the meeting of the British Association. As Mr. Clinker says, the chief advantage that the B.T.H. method possesses is that the condensers used do not have to withstand the full pressure of the supply circuit. On the other hand, the inductances have to carry the full load current of the alternators, so that they will have to be designed for this current and will, therefore, be correspondingly expensive. In the arrangement proposed by Mr. Turney and myself the shunts will only carry a fraction of the full load current of the alternator, and the inductance coils in the shunt circuits need only be of small size. The only inductance which carries the main current is the limiting inductance and, as was pointed out in the description of the apparatus at the meeting of the British Association, where it is desired to eliminate triple frequency components of the pressure wave, the limiting inductance can be placed in the neutral of the three-phase supply, in which case it only carries any out of balance currents there may be between the three phases of the system. The cost of the necessary circuits, therefore, in our arrangement, is quite small. Where the device is used on high pressures it is not necessary that the condensers should be designed to stand up to the full supply pressure, as the circuits can be applied through transformers of quite small rating, if necessary.

In the arrangement described by Mr. Clinker, if the reactance of the inductive coil ($L\omega$) is large compared with the effective resistance r, the rejector circuit will offer an impedance to currents of the frequency for which it is tuned of

$$\frac{(L\omega)^2}{r} \text{ or since } L\omega = \frac{1}{C\omega} = \frac{L}{Cr}$$

$L\omega$ cannot be made too large, or the regulation of the alternator will be adversely affected, since the greater part of the load current at normal frequency has to pass through the inductive branch of the rejector circuit. Where the alternator is connected to a network of cables through which triple frequency capacity currents will flow, the impedance of the rejector circuit may, therefore, be of the same order of magnitude as that of the cable network. Under these circumstances the reduction in the triple frequency currents brought about by the use of rejector circuits will be relatively small. On the other hand, in the arrangement described by Mr. Turney and myself, the voltage wave of the alternator has the triple frequency component reduced to a small fraction of its original value, and the capacity current through the cable network is reduced to correspondingly small proportions, whatever the external reactance may be. The filter device described by Mr. Clinker would, I think, be difficult to apply in a case where triple frequency or other low harmonics of the pressure wave have to be eliminated. In cases where the harmonic to be eliminated is of high frequency, as in the case quoted by Mr. Clinker, the filter circuit should be more effective. There are, I believe, a number of cases where telephone interference is due to low harmonics of triple frequency or some multiple of triple frequency. In one case with which we have had to deal the insertion of a shunt for 6 times the main frequency and another for 12 times the main frequency, together with a suitable limiting inductance, completely got rid of telephone disturbance.

The case referred to by Mr. Clinker in which trouble was found to be due to the 35th and 37th harmonics is, of course, a simple one to deal with by means of either device, since the condensers and inductances required are relatively small.—

I am, etc.,

E. W. Marchant.

Liverpool.
November 3rd.

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HIGH STARTING TORQUE SQUIRREL CAGE MOTOR.

[To the Editor.]

Sir,—There is a vital difference between the composite conductor described by Prof. Elihu Thomson and the composite conductor described in my recent British Association Paper, an abstract of which appeared in The Electrician on October 5th.

The distinctive feature of my composite conductor is the outer sheath of copper foil coextensive with the main central conductor and with the magnetic sheath. A complete discussion of the significance of this outer copper foil sheath is hardly possible in the correspondence columns of your journal,

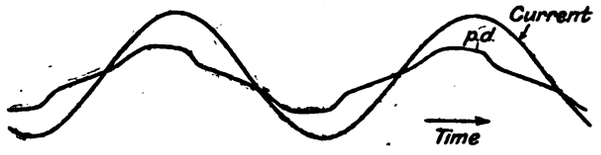

Fig. 1.

but I hope to be able to publish such a discussion at an early date, together with the test data obtained from motors which are now being constructed in accordance with this design.

As a matter of fact, before evolving the composite conductor described in my recent paper, I carried out a prolonged series of tests to ascertain whether the required results could be obtained by using a composite conductor comprising simply a central copper rod encased in a magnetic sheath. The results of these tests convinced me that this arrangement was not a practicable means for obtaining the required high starting resistance of a squirrel-cage motor for the following reasons :—

1. At the high current densities—25 to 30 A per sq. mm.—corresponding to the starting conditions, the increase of resistance obtainable at starting was too small.
2. The low power factor of the composite conductor would largely wipe out the effect of what increase of resistance was obtained.

The use of an outer copper foil sheath eliminates both these objections. Further, when composite conductors having an outer copper foil sheath are used for the rotor, the characteristics of the motor under normal running conditions will be practi-

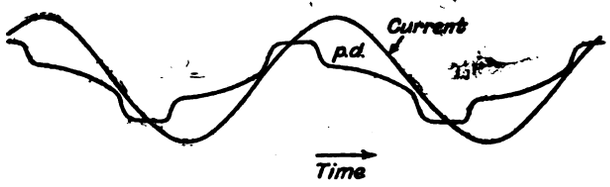

Fig. 2.

cally the same as those of a standard squirrel-cage motor. This, however, will not be the case if the outer copper foil sheath is dispensed with.

The attached oscillograms are of interest in this connection. Fig. 1 shows the wave forms of current and p.d. espectively, at 50 frequency, for a composite conductor having an outer copper foil sheath. Fig. 2 shows the wave forms of current and p.d. respectively, at 50 frequency, for the same composite conductor from which the outer copper foil sheath has been removed. The current density for both oscillograms is approximately the same.

An inspection of these oscillograms shows the very distinct advantage obtained, as regards power factor, when the composite conductor is provided with an outer copper foil sheath.—I am, etc.,

T. F. Wall.

Sheffield.
November 3rd.

THUNDERSTORMS.

[To the Editor.]

Sir,—I have read Mr. C. F. Elwell's interesting letter in your last issue.

I did not know Prof. Ryan's formula, the limitations of which Mr. Elwell does not give. The ordinary everyday formula gives the sparking pressure up to a million volts within the limits of experimental error. It would be possible, but very curious, if the law of discharge suddenly alters at voltages greater than a million. It is, of course, a rough guess to say that so many kilovolts produce a spark in the atmosphere one mile long, as it depends on the shape of the electrodes and whether they are clouds or earth or sea or sky. What I wanted to lay stress on was that the electric strength of air diminishes as we go upwards according to laws known to physicists and electricians and that the potential difference between the ends of lightning flashes is sometimes measured in thousands of millions of volts.—I am, etc.,

Alexander Russell.

London.
November 2nd.

SALE OR RETURN.

[To the Editor.]

Sir,—I believe that electrical contractors generally would welcome the complete abolition of the system adopted by many fittings manufacturers of supplying goods upon "sale or return": but any step in this direction to be effective should be taken jointly by the whole of the fittings manufacturers acting together, because so long as some firms continue the practice, contractors having showrooms will accept the goods. No showroom owner can be so independent as to allow to others the privilege of showing goods obtained upon sale or return when he is paying cash and buying outright himself.

What would satisfy the contractor best in dealing with manufacturers of electric light fittings may be summarised as follows :—

(1) Abolition of the "sale or return" system.
(2) A reasonable discount, less than is often offered at present, but reserved absolutely for the trade and unobtainable by any other persons outside the trade.
(3) A substantial extra discount to contractors who have showrooms and do actually purchase for demonstration purposes.
(4) A small extra discount on a quantity basis.

I am, etc.,

H. Marryat.

London,
November 5th.

[To the Editor.]

Sir,—It isn't possible to stop the "Sale or return" policy. So long as one manufacturer is "in possession," and the customer refuses to change, some competitor will always be found who is not willing to resign himself to that state of affairs. Something, however, can be done to mitigate the nuisance; even without an agreement among manufacturers, individual firms can put a limiting period after which goods must be paid for or returned. And, after all, in slack times it may be preferable to have the stock spread about instead of being stuck in the manufacturers' stores. It only means a little extension of credit.

An agreement on the limiting period would go a long way to stop the people who stock their showrooms right through on "sale or return" terms, as they would find it too much trouble to be continually packing up stuff to send back. If they sell it, of course there's no grumble.—I am, etc.,

Ernest E. Sharp.

London,
November 3rd.

TURBO-ALTERNATOR SPEEDS.

[To the Editor.]

Sir,—In your issue of October 26th appears a description of a new 10 000 kW generating unit installed at Halifax, and it is stated that it has the distinction of being the first set built for so large a capacity at a speed of 3 000 revs. per min.

It may be of interest to your readers to know that there are at least a dozen sets of 10 000 kW capacity and above operating in this country, the largest generating unit at 3 000 revs. per min, having a maximum capacity of 15 000 kW.—We are, etc.,

Metropolitan-Vickers Electrical Co., Ltd.
Arthur Edward du Pasquier, Manager,
Publicity Department.

Trafford Park,
November 3rd.

The fifty-seventh ordinary general meeting of the Western Centre of the Institution of Electrical Engineers was held at Bristol on Monday, Mr. C. T. Allan presiding. The hon. treasurer (Mr. A. J. Newman) presented the statement of accounts for the previous session, which showed a credit balance of £70 8s. 2d. After routine business had been transacted, Professor David Robertson gave a lecture on "The Mariner's Compass."

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NEWS IN A NUTSHELL.

An exhibition of electrical cooking apparatus was held at the Rochdale Corporation's Electricity Showrooms last week.

We are informed by Mr. W. M. Rogerson, the borough electrical engineer, that it is hoped to open the Halifax municipal electrical showrooms on Monday.

A "lightning" strike of some 300 tramway employees as a protest against the removal of a traffic regulator to another centre resulted on Tuesday in a considerable dislocation of traffic on the Metropolitan Electric Tramway system in North-West London. The strike, however, was settled the same evening. About eighty cars on five routes were involved.

The "Punch" Almanack for 1924 was published on Monday, and is, as usual, well worth reading. To those connected with journalism it will probably appear principally as a wonderful typographical production in which full use has been made of modern colour printing methods. To the ordinary reader it will be welcome as a fund of jokes and good stories for successful "re-sale," if the other people have not heard them first. When "Punch" begins to jest about anything it has arrived. We are therefore glad to see several quips about broadcasting.

A verdict of "Accidental death" was recorded at Manchester on Tuesday at an inquiry into the death of Thomas Sutton, a workman who was killed by receiving an electric shock at the Corporation's Stuart Street power station last Sunday. While cleaning the switchboard he apparently opened a live cubicle without authority under the impression that it was dead. The Coroner was satisfied that the workmen were aware that they should not open any cubicle without express instructions, and that there was nothing wrong with the apparatus.

In a letter published in our last issue Mr. C. F. Elwell pointed out that Prof. Ryan's recent researches on electric discharges through air seem to indicate that the distances covered by these discharges vary according to a logarithmic rather than a straight line law. With three million volts, therefore, a spark could be projected 18 miles, and this has given a San Francisco newspaper a horrible vision of a new and terrible kind of warfare fought at long distances with thunderbolts. We hope that this prophecy will never be fulfilled, but the new law, if it is established, should certainly render possible the transmission of power at higher pressures than the present limit of 220 kV.

The Electricity Commissioners' scheme for effecting an improvement in the existing organisation for the supply of electricity in the West Riding (Aire and Calder) electricity district, and providing for the establishment of a Joint Electricity Authority, comes to hand as we go to press, and will be dealt with at greater length in our next issue. The Commissioners will hold an inquiry in the Council Chamber, Town Hall, Bradford, on Tuesday, December 4th, at 10.30 a.m., and following days, if necessary. Copies of the Scheme may be obtained from the Secretary, Electricity Commission, Gwydyr House, Whitehall, London, S.W.1. November 26th is the latest date for receiving objections.

"Where do envelopes go?" asks the E. D. A. Either into the waste-paper basket or on to the mantelpiece is the answer, depending on whether they are sent to business or private addresses. And as a great deal of electrical publicity goes to the latter class, it is worth while to use the envelopes for advertising as the recipients, their servants, and even the postmen are "potentials." It is therefore suggested that envelopes should be embellished with such slogans as "Just touch that switch," "Electrify and troubles fly," and "The right way the electric way"—set out in an artistic way. Electros for the purpose can be obtained from the Electrical Development Association at 5s. each.

A bronze tablet perpetuating the memory of the Callender men who fell in the Great War was unveiled at the Anchor Works, Leigh, last Friday, in the presence of a large gathering of the firm's employees and relatives of the fallen. The directors and management of the company were well represented, amongst those present being: Sir J. Fortescue Flannery, Sir Tom Callender, Sir Ernest William Moir, Sir John Malcolm Fraser, Messrs. Th. Petersen, C. Pipkin, H. Foulds, and J. Bowyer. Referring to Leigh's part in the war, Sir J. Fortescue Flannery said that of field telephone cables alone, no fewer than 117 000 miles were turned out from the Anchor Works, and in addition 260 men went into the fighting line.

By the will of Mr. A. F. Moore, of Philadelphia, his estate was to be used for founding a school of electrical engineering as a memorial to his parents. It was decided, however, that the best use could be made of the money, some $1 500 000, by extending an existing school of electrical engineering, and the Department of Electrical Engineering of the University of Pennsylvania was selected for the purpose. The present laboratories will continue to be used and extensions will be built. Primarily the income from the fund will be employed to develop undergraduate instruction in engineering, but a portion will be used for graduate and research work. The engineer who by his munificence has made this development possible was the owner of the A. F. Moore Wire Manufacturing Co., of Philadelphia. The firm was the first in the United States to manufacture covered wire, and under Mr. Moore's management the electrical end of the business was largely extended.

The strike of electrical workers employed by Mann, Egerton and Co. on work in Government offices, has ended, and the men returned to work on Monday.

Proposals have been laid before the Imperial Economic Conference by the British Electrical and Allied Manufacturers' Association for the substitution of a new tariff basis for the present *ad valorem* duties in our trade with the Dominions.

Arrangements have been made for an Electrical Engineers' Dance, to be held at the Midland Hotel, Manchester, on December 7th. Tickets, inclusive of supper, at one guinea each, may be obtained from Mr. C. D. Taite, 196, Deansgate, Manchester.

The issue of the Metropolitan-Vickers "Gazette" which has just come to hand is made up almost entirely of photographs of the firm's products. This has been done because it is found that a number of individuals who do business with the company are completely unaware of their staple lines of manufacture. The result is worth studying.

The new Staff Institute for employees of the Derby municipal electricity undertaking was formally handed over by Ald. W. G. Wilkins, chairman of the Electricity Committee last week. In accepting the gift on behalf of the staff, Mr. T. P. Wilmshurst, the borough electrical engineer, emphasised the spirit of equality upon which all ranks would meet in the Institute.

In his inaugural address to the Institution of Civil Engineers on Tuesday, Sir Charles Langbridge said the task of the twentieth century was to bring back to life some of that leisure and spaciousness which was submerged in the tide of Victorian prosperity, and engineers would be called upon to undertake the great task of simplification, organisation and reconstruction.

Lecturing before the Barnsley Mining and Engineering Society last week, Mr. T. Bryson mentioned that the incidence of nystagmus in collieries where electric hand-lamps were in use showed a steady reduction on the figure recorded when flame safety lamps were in use. He thought the development of a system in which lamps of higher candle-power were carried on the cap was bound to help in reducing the incidence of the disease.

A concert arranged by the Social Society of the County of London Electric Supply Co. was held at the Cripplegate Theatre last Saturday. Owing to indisposition, Sir Harry Renwick, president of the Society, was unable to be present. An enjoyable evening's entertainment was provided by Messrs. W. E. Dossett, T. Price, W. C. Wallis, P. R. Garland, J. V. Whittenbury, A. True, J. Musgrove, F. E. Jones, L. J. Adams, H. Howell, A. E. Russell, and G. L. Morlock, and Misses M. Coalter, L. Worsfold, G. Pink, M. Keeble, D. Edwards, D. Revers, D. Madgin, and W. Carter.

The advantages of suitable reflectors for lighting are visibly demonstrated in the London showrooms of Francis Polden and Co. We show on page 527 a self-explanatory window demonstration, fitted with a flasher which lights each bulb alternately

Protests were made in Sheffield papers against a reported proposal of the Electricity Supply Department to use the old Sheaf Street power station for new electricity show rooms, it being urged that to place beautiful electric fittings next to a forge was highly improper. It transpires, however, that the site, shown in our picture page this week, is to be utilised for offices and store-rooms.

"Faults in Fan Design" were discussed by Mr. F. G. Whipp in a paper read before the Institution of Heating and Ventilating Engineers on Wednesday, when the author dealt at considerable length with the question of fan bearings and methods of arranging fan-drives, and discussed the various designs of bearings, metals used in their construction, and methods of lubrication. The fan engineer, he concluded, was not always to blame for the bad behaviour of his apparatus, and he was of opinion that a list of "don'ts" for fan-users could with advantage be included in makers' catalogues.

The Russian Telegraph Agency has received the following cable from Moscow, dated October 30th:—"Sergeiev, President of the Electrical Machine Trust, returning to Petrograd after a visit to Sweden, Germany and Holland, announced the conclusion of important contracts with foreign firms, which are granting large credits. In particular, the German A.E.G. will participate in the development and reconstruction of the electrical engineering industry of the U.S.S.R. The contracts concluded permit of the introduction of the latest inventions in the Soviet factories and of the invitation of foreign assistants."

"Winter's Pie" is to be published next Monday, and having been furnished with an advance copy we can assure our readers it is as good as ever. The cover has been designed by Mr. Frank Newbould, and inside will be found a number of full-page drawings in colour and in black and white by well-known artists, and bright stories by the best authors. Incidentally we notice that broadcasting comes in for its fair share of attention, and that Mr. Heath Robinson has designed an electric tea stirrer which bears an unpleasant resemblance to the fearsome instruments used in a dentist's parlour. The proceeds of the sale of this excellent number go, of course, to various charitable institutions connected with the printing and newspaper industries.

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MERCHANDISE TO SELL & PROFIT BY.

A "Besa" Ceiling Rose.

We do not think we shall be very far wrong if we make the statement that very few in the trade know that there is a wiring device which can be classified as a "Besa" ceiling rose. Though the specification covering these ceiling roses was issued as far back as 1914, it is unfortunately a fact that very little progress has been made towards the universal adoption of ceiling roses made to it. The number of manufacturers offering these ceiling roses is very small, and it is of interest therefore for us to illustrate the ceiling rose which J. H. Tucker and Co. show in section 1 of their new list. The main characteristics of the rose will be seen in our illustration on page 525. But as regards one feature it is of interest to quote the following note from the B.E.S.A. specification:—"The colour of the covering of wires attached to a ceiling rose when once it is fixed in position cannot usually be seen, and in consequence the various terminal plates cannot be identified unless marked in some distinctive manner. The need of such identification is often of considerable importance, e.g., when one pole of an installation is earthed, in which case all switches, including key sockets, must be on the insulated pole . . ." This condition is complied with in this rose.

The B.T-H. "Tungar."

The fact that we have commented in these columns so many times on the market for reliable battery charging apparatus, both for a.c. and d.c. circuits, does not in any way detract from the importance of the subject. We feel, and we would stress this point strongly, that there is a large market at present untapped for a device at a reasonable price, or to put it another way, an attractive price. We have referred previously to the constructional and technical details of the "Tungar" battery charger manufactured by The British Thomson-Houston Co., and these details need not therefore be enlarged upon. The B. T-H. Company have, however, just taken a step which is of much importance to the trade, and only emphasises still more the turnover which retailers can reap by the sale of this class of apparatus. Prices have been reduced considerably, because it is realised that the new prices must result in an increased turnover for all concerned. We have not the space at our disposal in this column to detail the price reductions on all sizes. Sufficient for us to say, that the 2A size, in both high and low voltage, is now listed at £7 10s., and the 5 A size at £10. Further, the list prices of spare replacement valves have been reduced, which is an effective answer to those who have in the past suggested that the comparatively high price for the valves would always hamper the really large development of the "Tungar" battery charger. The B. T-H. Co. have arranged a large programme of advertising in all wireless and automobile papers, and similar journals which are popular with the public, and have printed a large issue of folder L288. We understand that quantities of these folders can be supplied overprinted with the retailer's name and address.

Benjamin Elliptical Reflectors.

The several manufacturers of metal reflectors and other apparatus, are rendering the trade every service in their efforts to teach the public, and more particularly the bill-poster, that good illumination of a good sign keeps the investment alive and working day and night. This may sound obvious, but nothing will be gained if attempts are made to secure this business without paying any attention to the type and size of reflector required in accordance with the site and size of the poster to be illuminated. The development of the elliptical angle reflector marks the progress which is continually being made in the knowledge of lighting equipment. We illustrate a side elevation of the Benjamin elliptical reflector. The unit consists of a heavy gauge steel reflector, vitreous enamelled green outside and white inside, each being equipped with a B.C., E.S. or G.E.S. lampholder, according to the diameter of the reflector and the size of the lamp used.

ELLIPTICAL REFLECTOR. BY BENJAMIN ELECTRIC LTD.

The Walsall Cell Tester.

It is usually merchandise or apparatus which is not in every day demand whose source the buyer has great difficulty in locating quickly. To reduce this difficulty to a minimum is the principal object of the notes in these columns, and it is therefore appropriate that we should comment on the Walsall cell tester. The instrument is of the moving coil type and is supplied with a 4 in. scale. Spears are fitted both to the case connection and loose flexible connection, or alternatively a spear and terminal arrangement can be supplied if so required. The instrument is supplied in two voltmeter readings, namely 2 V and 15 V.

A Wireless Protective Device.

AERIAL SWITCH AND LIGHTNING ARRESTER. BY C. F. ELWELL, LTD.

There is no doubt that the heavy storms which we experienced this year caused much misgiving among the wireless public. Whether these fears are laughable or not does not matter; the fact is that the fear was, and still is, a very real one, and will recur next year. There is no reason why this "fear and trembling" should not be turned to good account by the retailer, and much more business done in sets which consist of an aerial switch and a lightning arrester. We have described several such devices in these columns. We illustrate this week a very compact set manufactured by C. F. Elwell. Apart from its use as a lightning arrester, it is a very useful arrangement for permanently connecting the aerial and the earth wire. The complete apparatus as illustrated is listed at 25s.

D.K. and S. Patent Fitments.

It is probably all to the good that there are so many different wiring systems. It is a sign of progress; and of a determination to probe out the most efficient and economical system. In the meantime the contractor is faced with difficulty because these many and varied systems mean a stock of fittings to instal with them. We have to-day (*a*) what might be called "patent" systems by various manufacturers; (*b*) what has come to be known as the cab tyre system; (*c*) the conduit system; (*d*) the cleated system; and (*e*) the wood casing system, which is now little used. In view of this state of affairs all contractors will be interested in the patent fitments which are manufactured by Davies, Kent and Stewart. Briefly stated, the series of fitments consist of a bonding block, a connecting base, a ceiling rose cover, a connector box cover, and separate terminals. From these five parts a number of accessories can be made up suitable for the various systems which we have mentioned. For instance, with the cab tyre system the bonding block can be used, and this forms the base which grips the cab tyre sheathing and can then carry a ceiling rose, connector box or other accessory. The fittings are suitable for the conduit system because the standard connector base will fit inside any standard 3 in. junction box with ordinary cover. When so fitted the complete box will form a connection box, or if used without the cover the connection box for use with fittings. The whole system is described in much detail in the manufacturers' list No. 53.

A Solution to a Problem.

An electrical buyer has all manner of apparatus and devices from which to buy, and it requires comprehensive knowledge of all the details and snags which he will undoubtedly meet if he is to make a success of the job. Particularly is this so with regard to rubber insulating gloves. Very few of us are able to judge whether rubber has real lasting qualities, such as is required for gloves, and therefore the safest course to follow is to buy gloves from a manufacturer with an established reputation for this class of material. We should recommend this course to all buyers; and one manufacturer who will relieve him of a lot of trouble and worry in this direction is the St. Helen's Cable Co. In the new catalogue which they have just issued (and which, we believe is the first complete catalogue issued from their new works at Slough), the company illustrate a range of gloves which will cover all nominal requirements. It is the common practice of many manufacturers, particularly so far as cheaper grades of gloves are concerned, to sell them under a warranty that they have been tested in water under a high voltage a.c. circuit. This test, however, is not of much use if the gloves are tested in batches, and on this score it is useful for us to mention that the St. Helen's gloves are each tested separately in water at 10 000 V a.c. for five minutes.

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An Exide for a Peanut.

It is typical of The Chloride Electrical Storage Co. that they should have ready so quickly a battery for use with what is now popularly known as the pea-nut valve. We illustrate below the "Exide" type H.Z. battery which the manufacturers have specially designed for this work. It has those two cardinal points, namely, compactness and low weight, which make for success in a line of this kind. The battery is made in three sizes, each having a 2 V rating. The first size has a normal charging current of 1½ A, the second size 2 A, and the third size 3 A. The Chloride Co. advise us that this battery has been particularly designed for use where very long slow discharges are required. Owing to the special characteristics which are embodied in their manufacture, the cells will only need, it is claimed, to be re-charged every six months, if the working conditions are normal.

"Highlow" Radiators.

The great appeal which electric heating with the popular type of radiant fire makes to the domestic market on the score of cleanliness need not be elaborated upon here. We have referred previously in these columns to the outlook there is for development with the low pressure electrically heated steam radiators. Archibald Low and Sons advise us that they have a complete range of apparatus available for this system of heating, and we have before us a copy of their catalogue No. 923, which describes these in detail. Elegance is not the failing of the average steam radiator, but in the pattern illustrated below the manufacturers have been successful to some extent in meeting this criticism. As will be seen from our illustration the design is plain and elegant. It can be supplied in four sizes with varying heating capacities, and can be finished in gilt, aluminium or black.

A Thief-proof Gallery.

We illustrate a patent locking gallery manufactured by the General Electric Co. It will be of interest to contractors and others because there are many situations where a device of this kind is badly needed. We think we are right in saying that the gallery which we illustrate is the only one of its kind on the English market. The complete unit as shown below consists of a standard 2¼ in. heavy gauge metal gallery which screws on to a standard B.C. lampholder. By means of a substantial brass tongue piece which enters the slot of the lampholder, the lamp is effectively locked, and the gallery is prevented from turning. The shade cannot be removed as it will not pass over the lamp. This fitting can be adapted to any pendant or bracket and is amply ventilated for use with gasfilled lamps.

TRADE PUBLICATIONS.

The Cambridge and Paul Instrument Co. have recently distributed to their customers a mailing list describing the Cambridge thermionic voltmeter.

The Chloride Electrical Storage Co. make an announcement of importance to "wireless" retailers. They have just published catalogue P describing "Exide" portable batteries, and on page 26 will be found the type HZ battery, which has been specially designed for use with "dull emitter" wireless valves.

"Our experience in the manufacture of pole line material and the design and erection of low and high pressure lines extends over the past 20 years." Thus the preface to a new catalogue, No. P. 179, issued by the British Insulated and Helsby Cables, Ltd. The whole list is devoted to pole line materials, and it is questionable whether any engineer can obtain a more comprehensive list covering this class of material.

The "Remca" portable electric rivetter, which is briefly described in a pamphlet recently published by the Mada Engineering Co., should have the attention of contractors and others who cater for the boot and shoe trade.

In the new catalogue just published by the St. Helen's Cable and Rubber Co. the buyer has presented to him a *vade mecum* on cables, flexibles, and other insulating material.

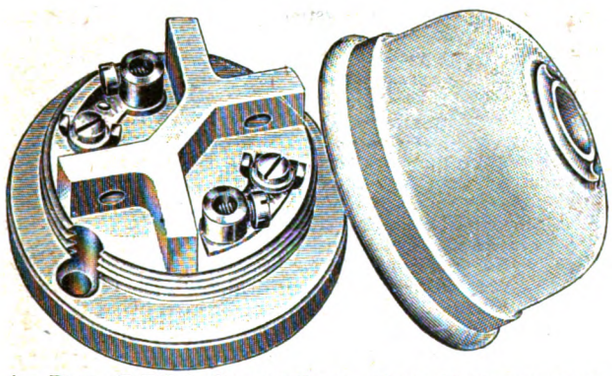
"Oil Break Switches for Medium Duty" is the title of a new publication just announced by the English Electric Co. The publication bears the number 453, and we are asked to advise readers of The Electrician that a copy of the list will be sent to all bona fide inquirers.

Two new publications are announced by the British Thomson-Houston Co.—(*a*) folder L.288, on Tungar battery chargers; and (*b*) leaflet L.273, on "spotlight" projectors.

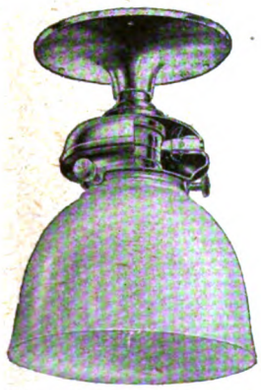
The Midland Electric Power Installation Co. in sending us a copy of their leaflet illustrating the "Mepic" electric shop window heater, ask us to announce that they have made a number of improvements on the previous design, and also introduced a heater with a higher capacity.

"Scalding hot water" is the title of a mailing folder just published by Bastian and Allen. It describes the Bastian geyser in a manner which will appeal to the domestic user, and the folder should be distributed very largely by the trade to "prospects." Bastian and Allen also announce the publication of a list describing their electric fires for the 1923–24 season.

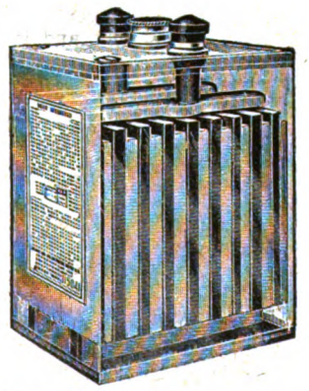
The Sun Electrical Co. continue to render a service to the trade in a manner which is peculiar to themselves by the publication of a most comprehensive catalogue of electric fires. The list includes Sunco, Belling, Cosmos, Jackson, Heatrae, Premier, Polar Cub and Flamingo fires.



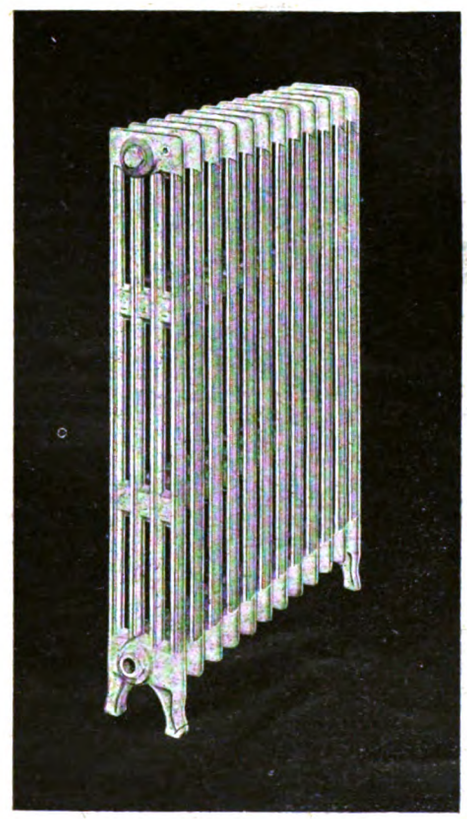
A 2-Plate B.E.S.A. Ceiling Rose. By J. H. Tucker & Co.



Thief-Proof Gallery. By The General Electric Co.



Type H.Z. Battery. By The Chloride Electrical Storage Co.



"Highlow" Hot Water Electric Radiator. By Archibald Low & Sons.

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PERSONAL GOSSIP.

Mr. C. J. Mackenzie-Grieve has been appointed a director of the Southern Brazil Electric Company.

Dr. Eric Bayley has succeeded the late Dr. Wingrave as Medical Officer to the Eastern Telegraph Co.

Alderman T. C. Newman, Chairman of the Borough Electricity Committee, is Mayor-elect of Swindon.

In the Blackburn municipal elections, Mr. John Walsh, electrical engineer, was elected to represent St. Mark's Ward.

Mr. W. Provost, electrical accessories manufacturer, has been re-elected a member of the Birmingham City Council.

Mr. John Bentham, consulting electrical engineer, was an unsuccessful candidate in the Wakefield municipal elections.

Mr. Samuel Insull, president of the Commonwealth Edison Co., Chicago, is understood to be paying a short visit to Europe.

Mr. J. A. Morton, electrical contractor, of Edinburgh, is a director of the newly formed British Towns Exhibition Association.

Mr. P. R. Jacklin, electrical engineer, of Sussex Square, Brighton, was an unsuccessful candidate in the municipal elections at Brighton.

Mr. Henry Annesley Coates, electrical engineer, of Cassiobury Park Avenue, Watford, has been re-elected unopposed as a member of the Town Council.

Professor R. A. Millikan has been awarded the Royal Society's Hughes Medal for his determination of the electronic charge and of other physical constants.

Dr. Charles C. Garrard, of the General Electric Co, Witton, Birmingham, has been appointed a member of the Council of the Birmingham Chamber of Commerce.

Mr. J. H. Cowell, manager of Blackburn Corporation Tramways, last week presented Mr. Richard Riley with a mahogany timepiece on the occasion of his retiring after 29 years' service.

Sir Robert Hadfield has been presented, on behalf of Birmingham University, with the Thomas Turner gold medal in recognition of his distinguished services to metallurgical science and education.

Mr. Norman Read, vice-president of the Colorado Power Co., who has been elected president of the Rocky Mountain Division of the National Electric Light Association, is a native of this country, although he received his education in Colorado.

We are informed that Sir George S. Gibb has joined the board of the Oriental Telephone and Electric Co. and of the China and Japan Telephone and Electric Co., and has been elected chairman in succession to the late Sir Henry Babington Smith.

Mr. H. Tomlinson Lee, formerly borough electrical engineer for Wimbledon, has been elected a member of Wimbledon Town Council with a majority of 473 over his opponent. Incidentally he obtained 307 more votes than any other candidate.

Col. R. W. Leonard, one of the donors of the house at No. 10 St. James's Square, London, to the British Institute of International Affairs, is a prominent Canadian railway engineer, and has been responsible for the erection of several hydro-electric plants in the Dominion.

The new Lord Mayor of Bristol is Alderman A. A. Senington, who for several years has been vice-chairman of the Bristol Electricity Committee. He is the Employers' Representative on the No. 6 District Joint Board, of which he has been chairman since its inception.

Last Saturday the staff of the Birmingham Electric Supply Department entertained Mr. R. A. Chattock (the city electrical engineer) to dinner at the Queen's Hotel, in commemoration of his 20 years' service with the Corporation, and of his association with the Nechells station.

Mr. Reginald Townsend, Adviser on Technical Costs to the Director-General of Factories, has been appointed Chief Superintendent of Ordnance Factories at Woolwich, in succession to Mr. John Bowden. Before joining the War Office, Mr. Townsend was with the British Westinghouse Co.

Mr. Frank H. Riddle, of the Champion Porcelain Co., Detroit, is paying a business visit to several European countries and is to read a paper on the "Relation between the Composition, Micro-structure and Physical Properties of Porcelain" at the Paris Conference on high tension transmission lines.

We are informed that Mr. C. S. Taylor has been appointed deputy engineer-in-chief and manager of the Shanghai Municipal Electricity Department in succession to Mr. A. H. Blagden, who resigned after twenty-one years' service. Mr. Taylor joined the Shanghai Municipal Electricity Department in 1913, and at the time of his promotion to deputy was power engineer.

Lt.-Col. Robertson, the recently appointed President of the Electrical Contractors' Association of Scotland, is a director of A. B. Robertson & Son, electrical engineers, of Union Street, Aberdeen, and has held the office of chairman of the Aberdeen branch of the E.C.A. of Scotland. After gaining the D.S.O. in France in 1916, he was responsible for the training of over 3 000 men for the various signal units. He is now Deputy-Chief Signal Officer for Scotland.

Col. Rookes Evelyn Bell Crompton, C.B., has been unanimously elected an honorary member of the Institution of Electrical Engineers. The founder of Crompton's of Chelmsford, he has been a full member of the institution, of which he has twice been president, since 1881. With a long and distinguished army career he organised the Corps of Electrical Engineers for service in the South African war, while in the Great War he was employed in designing the vehicles afterwards known as Tanks.

Mr. James Dalrymple, the general manager of Glasgow Corporation Tramways, who has just returned from a two months' tour in the United States and Canada, thinks that compared with some of the American centres we do not know what traffic congestion is in this country. He does not think the tramcar seating accommodation in the States is as good as ours, and fares for short distances are remarkably high. He was impressed by the success of the one-man car. On the Detroit trams he noticed that the conductors never left the rear platform.

OBITUARY.

Mr. W. A. Peare.

Mr. William Alfred Peare, who was for over 30 years on the electrical staff of the Cunard Steamship Co., Liverpool, has died at Litherland, aged 68 years.

Mr. W. Blenheim.

For many years head of the firm of William Blenheim and Co., electrical engineers, 3, Grange Road, Egham, Surrey, Mr. William Blenheim has died in the 75th year of his age.

M. Maurice Leblanc.

We regret to record the death of M. Maurice Leblanc, consulting engineer to the Société Anonyme Westinghouse, of Croissy (Seine-et-Oise). M. Leblanc devoted much attention in recent years to the development of mercury vapour converters and was a director of the Hewittic Electric Co., specialists in mercury vapour lamps. Numerous contributions on mercury vapour converters have been contributed by M. Leblanc to French and other technical journals.

Dr. C. Harries.

The Berlin correspondent of the "Times" reports the death of Dr. Carl Harries, a prominent industrial chemist, who married a daughter of Herr Werner von Siemens, and was scientific adviser to the Siemens' works in Berlin. His name was prominently before the public at one time in connection with his experiments in the manufacture of synthetic rubber. From 1904 to 1910 he occupied the Chair of Chemistry and the directorship of the Institute at Kiel University.

Dr. J. E. Stead.

We regret to record the death, at Redcar, last week, of Dr. J. E. Stead, the well-known scientist and metallurgist, in his 73rd year. As an analytical chemist he held important positions with the Tharsis Sulphur and Copper Co., and Bolckow, Vaughan and Co. In 1893 he devoted his attention to metallographic research, and in 1901 he was awarded the Bessemer Gold Medal of the Iron and Steel Institute. A past president of that Institute, Dr. Stead was elected a Fellow of the Royal Society in 1903.

Mr. G. W. Black.

The funeral took place recently at Worcester of Mr. George W. Black, aged 41 years, of "Bushcroft," Ombersley Road, Worcester, sales manager of Heenan and Froude, Ltd., with whom he had been associated for 13 years. After some experience in marine engineering, Mr. Black acted for a time as provincial engineering inspector on the staff of a boiler insurance company, and joined the sales staff of Heenan and Froude in 1910, as representative for the London district. Upon the reorganisation of the staff at the Worcester works just after the war, Mr. Black was appointed sales manager, a position which he held until his death. He is survived by his widow and three children.

Mr. Joseph Herbert Tritton, of Lyons Hall, Great Leighs, Chelmsford, and of 6, Sloane Court East, S.W., formerly chairman of the Indo-European Telegraph Co., Ltd., and of Galletti's Wireless Telegraph and Telephone Co., Ltd., who died on September 11th, aged 79 years, left £103 118 (net personalty £170 022).

Resources of the Empire.

"The Survey of the Resources of the Empire," which is being compiled by the Federation of British Industries, and which will be published by Ernest Benn, Ltd. (Benn Brothers), will be of particular service in the discussions which will take place following the Premier's new trade proposals, as people of all shades of politics will naturally turn to sources of information about our Empire trade which have no political bias. This great F.B.I. publication will not argue whether Free Trade, Imperial Preference or Prohibition is best for the country. It will merely supply the salient facts relating to the resources of different parts of the Empire, both actual and potential. As the nation will ultimately make up its mind on these great political questions after a study of the facts, the Empire Trade Survey is sure to be an important determining factor. The Survey will be published in twelve volumes, in each of which a limited amount of advertising space is still available.

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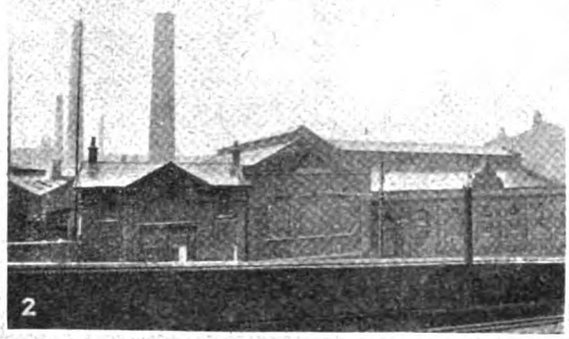

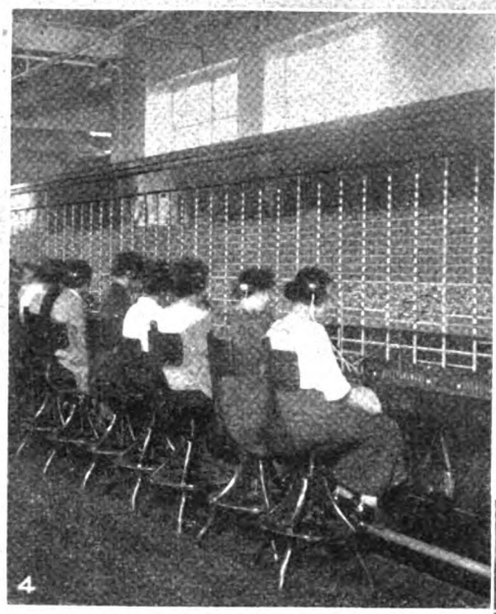

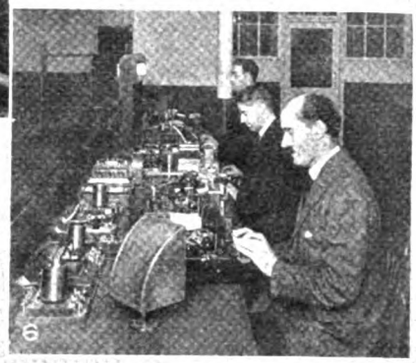

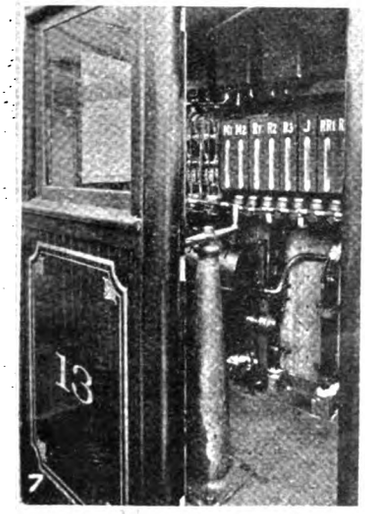

[2, 4, 6 and 8 "*Electrician*" Photos.

ELECTRICAL NEWS IN PICTURES.

1.—One of Wolverhampton's new fleet of electric trolley 'buses (p. 530).

2.—The old Sheaf Street power station at Sheffield, which is to be adapted for store and office accommodation is seen on the right of the picture (p. 523).

3.—The "Lumb" Bowling Trophy has been awarded this year to the Foundry team of the Blackpool Tramways Department.

4.—A corner of London's 101st telephone exchange, opened last Saturday (p. 523).

5.—Alderman W. Walker, appointed Chairman of the National Joint Industrial Council for the Electricity Supply Industry for five years in succession.

6.—Telegraph circuit table in Marconi's new Liverpool telegraph office (p. 523).

7.—Driver's compartment in the new rolling stock for the Mersey Railway (p. 523).

8.—Hackney Electricity Department's recognition of Mr. J. W. Beauchamp's activities.

9.—An object lesson in a Cannon Street (London) electrical show window (p. 523).

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BUSINESS OPPORTUNITIES AT HOME AND ABROAD.

Contracts Open.

SHADFORTH PARISH COUNCIL.—Electric lighting extension in Sherburn Hill area. Plans from the Clerk, South View, Ludworth, co. Durham.

CHORLEY REFORM CLUB, November 12th.—Electric light installation. Tenders to the Secretary, St. George's Street, Chorley.

HAWICK HIGH SCHOOL. November 12th.—Re-wiring electric light installation. Particulars from Mr. W. A. Edward, County of Roxburgh Education Offices, Newtown St., Boswells.

GREAT NORTHERN RAILWAY (IRELAND), November 12th.—Six months' stores, including electric fittings, lamps, cables, and wires. Forms (1s. each) from the Secretary, Amiens Street Station, Dublin.

HAZELL GROVE AND BRAMHALL URBAN COUNCIL. November 13th.—Construction of sub-stations at the Council Offices, Hazel Grove, and at Bramhall. Specification from the Clerk on £1 deposit.

GREAT WESTERN RAILWAY CO., November 13th.—Telegraph instruments, insulators, electric lamps, etc. November 23rd.—Cables and wires. Specifications, etc., from the Stores Superintendent, Swindon.

BRADFORD CORPORATION. November 17th.—Twelve months' stores, including lamp-holders and electrical fittings, insulating material, tapes, etc., insulated bolts and strains, controller contacts, etc. Schedule, etc., from the General Manager, Corporation Tramways, Hall Ings, Bradford.

HAVANT JOINT HOSPITAL DISTRICT BOARD, November 19th.—Electric light wiring and fitting of hospital. Particulars can be obtained at the Hospital.

CHESHIRE LINES COMMITTEE, November 20th.—Twelve months' supply of telegraph materials, etc. Specifications from the Stores Superintendent, Warrington.

BIRMINGHAM CORPORATION, November 21st.—Reconstruction of 700 yards solid double track and 3 000 yards wooden sleeper double track tramway. Specifications (£5 deposit) from the City Engineer.

MANCHESTER CORPORATION, November 21st.—Electrical plant for Elm Street cold stores. Specification from Superintendent Markets Dept., Town Hall, Manchester.

REIGATE CORPORATION, November 21st.—Electrically driven drainage pumps required in connection with electricity undertaking. Specifications from Mr. C. H. Wordingham, 7, Victoria Street, London, S.W.1, and 33, Brazennose Street, Manchester, on £1 1s. deposit.

PRESTON CORPORATION, November 26th.—Two 1 500 kW rotary converter equipments (specification R.P.S.6); h.t. and l.t. switchgear (R.P.S.7); and h.t. cables (R.P.S.8). Specifications, etc. (£2 2s. deposit each), from the Town Clerk. Additional copies of specifications, 10s. per copy (not returnable), from Mr. J. A. Robertson, 20, Brazennose Street, Manchester.

BELFAST GUARDIANS, December 18th.—Schemes for centralised heating and lighting plant in Institution buildings. Further information from the Clerk, Workhouse, Belfast, on £5 5s. deposit.

Overseas.

JOHANNESBURG CORPORATION, November 15th.*—Test transformer and other transformers.

JOHANNESBURG MUNICIPALITY, November 19th.*—Cables.

EAST INDIAN RAILWAY CO., November 21st.—Electric overhead travelling cranes. Specification from the Secretary, 73–76, King William Street, London, E.C.4, on £1 1s. deposit.

AUCKLAND ELECTRIC POWER BOARD, November 24th.*—Transformers and accessories.

CAPE TOWN MUNICIPALITY, November 29th.*—Transformers.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, November 20th.*—Protectors for telephone apparatus.

COMMONWEALTH OF AUSTRALIA, November 23rd (London).—Telephone and telegraph apparatus (V209). December 1st (Australia).—Telephone and telegraph apparatus (V.673). December 17th (London).—Cable terminal boxes (S.A. 674). January 3rd (London).—Telephone and telegraph apparatus (T. 415). Tender forms, etc., from the Supply Officer, Australia House, Strand, London, W.C.2.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS. November 28th.*—Motor generator.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS, December 5th.*—Transformers for White Bay power house. December 19th.*—Transformers for Meek's Road sub-station.

COMMONWEALTH OF AUSTRALIA, December 12th (in London), or December 15th (in Australia).—Cable terminal boxes (S.A. 676). Particulars, the Supply Officer, Australia House, Strand, London, W.C.2.

VICTORIAN ELECTRICITY COMMISSION, December 15th.—Four 1 000 kVA single phase transformers and spares. Specification (No. 23/145) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

VICTORIAN RAILWAY COMMISSIONERS. December 19th.*—Fibre for insulators.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO. December 27th.* Electrical supplies, including cable, wrenches, insulating compound, lamp shades, also rubber belting, ironmongery, etc.

* Particulars from the Department of Overseas Trade.

VICTORIAN ELECTRICITY COMMISSION, January 3rd.*—Aluminium steel cored cable and accessories.

SYDNEY CITY COUNCIL. January 7th (in Australia).*—Electrically driven coal unloading and conveying plant at Darling Island power houses.

SYDNEY CITY COUNCIL. January 14th (extended from November 19th.)—Stepdown transformers (Contract 758).

VICTORIAN ELECTRICITY COMMISSION, January 19th.—Transformers, switchgear and accessories for sub-station B. Specification (No. 24/2) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2, upon deposit of £2 2s.

Tenders Accepted.

HAWKINGTON.—B. E. Stoakes and Co. Electric light wiring at Village Hall.

CANTERBURY CORPORATION.—S. W. Bligh. Telephone apparatus between police and fire stations, £23 12s. 6d.

MELBOURNE (VICTORIA) CORPORATION.—W. T. Henley's Telegraph Works Co., insulated copper cables, £7 216.

ISLINGTON (LONDON) BOROUGH COUNCIL.—Chloride Electrical Storage Co., two lead batteries for 3½ ton Orwell and Edison dust-collecting vehicles.

GRIMSBY.—Metropolitan-Vickers Electrical Co., 3 000 kW alternator, turbine and condenser, £17 075; Berry's Electric, Ltd., switchgear, £174 2s. 6d.

SALFORD CORPORATION.—Premier Cooler and Engineering Co., four cooling towers and two pumping sets for the Agecroft power station (recommended), £11 452.

BATH CORPORATION.—Brush Electrical Engineering Co., No. 2 Brush-Ljungstrom turbo-generator and auxiliaries, £21 142; Mather and Platt, Ltd., rotary converter, etc., £1 477 4s.; Ferguson, Pailin, Ltd., switchgear, etc., £491.

LEEK URBAN COUNCIL.—National Gas Engine Co., 600 B.H.P. gas engine, £5 200; Crompton and Co., 435 kW dynamo, £1 000; General Electric Co,. extension of switchboard, £238; Premier Cooler and Engineering Co., water cooler, £100.

DUBLIN ELECTRICITY DEPARTMENT.—British Electric Transformer Co., twelve months' supply of transformers ranging from £287 for 300 kVA to £83 5s. for 50 kVA; also £175 5s. for 100 kVA three-phase and £115 15s. and £96 15s. for 50 kVA three-phase air and oil cooled respectively; £127 for 100 kVA 5 000/100 V and £216 15s. for 200 kVA three-phase (recommended). Serck Radiators, two air coolers, £153 10s. (recommended).

TELEGRAPH AND TELEPHONE.

A new Central battery exchange was opened at Rawtenstall last Saturday.

South Africa is said to be contemplating the expenditure of £600 000 on the extension of the telephone service in rural areas.

The "Toll" system of dealing with short-distance trunk calls which was introduced by the Post Office some time ago has resulted in a marked growth in the traffic.

Marconi's Wireless Telegraph Co. has opened a new telegraph office at 22, Chapel Street, Liverpool. A direct high-speed service is maintained with London, and thence with Spain, Switzerland, France, Canada, U.S.A., and other countries.

Writing from Sydney, a "Daily Telegraph" correspondent says the hope is expressed there that the vacant chairmanship of the Pacific Cable Board will be filled immediately, as the delay is apparently postponing decisions as to the reduction of rates and the duplication of the cable.

A new telephone exchange, to be known as the "Royal," was opened at Great Tower Street, London, last Saturday. It is the 101st in the London area, and will, it is hoped, be the last of any size in London to be worked on the manual system. The initial capacity is 7 500 lines with 2 600 junction lines, but the ultimate capacity will be 22 000 lines.

According to "Annales des Postes, Télégraphes et Téléphones," automatic telephony is developing rapidly in Germany. At Aix-la-Chapelle an exchange with 6 000 subscribers has been opened, while there are others in Leipzig (20 000 subscribers) and Dessau (2 000 subscribers). Leipzig has already six automatic exchanges, and the town is practically ready for conversion to entire automatic working.

According to a Central News message from New York, Mr. Carlton, of the Western Union Cable Co., stated last week that the company had been unable to start work on the projected cables to Italy owing to the fact that Britain, through influences in Portugal, had prevented any American company from obtaining permission to land cables at the Azores, despite the fact that the recent conference on communications agreed that the Azores should be regarded as neutral soil. It is thought highly probable, the message states, that the British attitude will be modified.

The half-yearly financial statement of the working of the Hull Corporation telephone system shows an income of £57 802 and expenditure of £36 897, leaving £20 905 to be carried to net revenue account. Deducting interest, loan instalments and income-tax, there is a surplus of £20 905. An interesting item in the account is £5 590 which is paid in royalty to the Post Office. The Deputy Chairman of the Telephone Committee (Mr. Locking) expressed the hope last week that the day was not far distant when they would be able to offer an independent line with a restricted number of calls per annum for £5.

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ELECTRICITY SUPPLY.

Extensions and Developments.

COLNE Electricity Committee proposes to acquire show-room premises for the electricity department.

TORQUAY Town Council has received sanction to loans of £3 500 for mains and services, and £1 000 for meters.

BURNLEY Electricity Committee has decided to extend the mains to Marsden Road district at an estimated cost of £1 350.

The new electricity undertaking of the NEW MILL (near Huddersfield) Urban Council was formally opened last Saturday.

BELFAST Corporation is applying to the Electricity Commissioners for sanction to a loan of £1 000 for the provision of electric cookers.

The Western Electric Distributing Corporation has applied to the Electricity Commissioners for permission to establish a generating station on a site in Church Street, WANTAGE.

Sanction has been received at BLACKPOOL for a loan of £22 000 for mains and transformers. Application is to be made for permission to borrow £5 000 for the purchase of electricity meters.

CANTERBURY Town Council has instructed May and Hawes, consulting engineers, to prepare a report as to the capabilities of the present plant at the electricity works and the need for its extension.

YORK Electricity Committee has received a report from the engineer, in which he states that it will be necessary to instal further boiler plant at the electricity generating station to meet the winter load of 1924-25, at an estimated cost of £32 650. The Committee recommends that the necessary steps be taken for extending the plant at Foss Islands.

BURNLEY Town Council has decided to apply to the Electricity Commissioners for authority to erect a proposed super-power station near Padiham. It is expected that three years will elapse before the station can be built, but the Council, the chairman stated last week, is anxious to expedite the scheme because a private company has already proposals on hand. The Council wants the two projects to be considered by the Commissioners at the same time, and has decided to prepare a scheme.

Tapping New Areas.

HOLT (Wilts) Parish Council has decided to have the parish lighted electrically.

LINLITHGOW Town Council is negotiating with the Scottish Central Electric Power Co. for a supply of electricity for the borough.

NEW QUAY (Cardiganshire) Urban Council is making a canvass in order to ascertain the probable number of consumers of electricity in the town.

Subject to the approval of the Electricity Commissioners, KEIGHLEY Electricity Committee recommends that consent be given to the Yorkshire Electric Power Co., under a clause of the agreement between the Corporation and the company, to use energy supplied under such agreement for supply to consumers in the parishes of Glusburn, Cross Hills, Kildwick, and Carleton, subject to the total amount supplied under the agreement not exceeding 250 kW. The Committee recommends that distribution cables for the Oakworth Urban District be provided at an estimated cost of £450.

Inquiries and Orders.

A public inquiry into the electricity supply of the MID-LANCASHIRE area will be held at Preston on February 20th next.

DEAL Town Council has decided not to object to the application of Sir Charles Bright and Partners for a special Order to supply electricity in the borough.

The Minister of Transport proposes to confirm the HAWARDEN Electricity (Extension) Special Order. Objections to Secretary, Ministry of Transport, Whitehall, London, by November 20th.

LEYLAND Council has decided to apply to the Electricity Commissioners for an Order for the supply of electricity in bulk to the district. Mr. J. A. Robertson has been appointed consulting engineer.

TOPSHAM Parish Council having decided to object to the application of the Topsham Electricity Supply Co. for an Order to supply electricity in the parish, the St. Thomas Rural Council has decided to oppose the application.

The Electricity Commissioners have made a Special Order authorising the Hawarden Rural Council to supply electricity in the parishes of East Saltney, Higher Kinnerton, Hope, Llanfyndd, Sealand and Tryddyn, and part of the parish of Hawarden.

The STRATHPEFFER AND DINGWALL Electric Co. has applied for an Order to supply electricity at Dingwall, Rosskeen, Alness, Kiltearn, Fodderty, Contin, Urquhart, Logie Wester, Urray, Kilmorack, Kirkhill, Inverness, and Bona.

The Electricity Commissioners have granted a special Order authorising the THAMES VALLEY Electric Supply Co. to supply electricity in the borough of Henley-on-Thames, and parishes in the area of the Henley and Wokingham Rural Councils.

The Order constituting the MID-LANCASHIRE Electricity District and establishing the MID-LANCASHIRE Electricity Advisory Board has been submitted to the Minister of Transport for confirmation. Any objections must be sent by November 30th to the Ministry of Transport, and also to the Secretary, Electricity Commission, Whitehall, London.

LEGAL INTELLIGENCE.

Electrical Inventor's Claim.

An action concerning an electrical invention, known as an earth and short circuit detector switch, was brought before Mr. Justice Bailhache in the King's Bench Division, on October 30th. The plaintiff was Mr. Randolf Harry Lane, 12, Mount Road, Wimbledon Park, who sued Indicator's, Ltd., 11, Southampton Row, claiming damages for alleged breach of contract to take over the invention.—Mr. Werninak, for the plaintiff, said that in October, 1920, it was arranged between the plaintiff and a Mr. Walter, of the defendant firm, that the defendants should take over and manufacture the apparatus which his client had invented. Plaintiff was to have a share of the profits and was to be appointed manager of a special department which the defendant company intended to open in order to deal with the article.—The defendant denied that there was ever a concluded contract between the parties.—His Lordship, in giving judgment, said he thought it would be a mistake to estimate the value of the invention at more than the money which the defendants had already paid in connection with the matter. He did not think there was a concluded agreement between the parties, but the plaintiff had undoubtedly presented to the defendants a joint share in a product which they both thought at one time might be a business success. In connection with the patent, the defendants had borne an expense of something like £40 and he had no means of knowing whether that was or was not a sufficient payment for their joint share. He thought the proper thing to do under the circumstances was to give judgment for the defendants and order that there should be no costs. Judgment was entered accordingly.

A Wireless Exhibition Contract.

Mr. Justice Swift, in the King's Bench Division, on November 1st, decided an action in which Mr. Arthur Budge Dale, of West Mersea, Essex, claimed £105 in respect of an alleged breach of agreement by the Igranic Electric Co., Ltd., of 147, Queen Victoria Street, London, in connection with the hiring of stall space at an exhibition of electrical products.—Mr. Cyril Atkinson, K.C., for plaintiff, said that he was claiming under an agreement made between him and the defendants, by which they were to take certain space at an electrical exhibition held last year at the Central Hall, Westminster, and they undertook to fill the space with exhibits. The rent for the space was to be ten guineas, of which five guineas was to be paid down. One of the terms of the agreement was that if defendants failed to fill the space they should pay £100 damages, and plaintiffs claimed that defendants, having failed to carry out the terms of agreement, were liable for the £100, in addition to the outstanding five guineas for rent. The defence set up was that the space available was not in accordance with the plan and description given in the prospectus, and not reasonably fit for the purpose for which it was required. On the question of registration of the plaintiff's business name application was made for relief, but when it came before Mr. Justice Rowlett, he adjourned it until the trial of the action.—Mr. J. B. Matthews, K.C., for the defendants, said that plaintiff was never in a position to give the space contracted for, and he was going to rely upon the want of registration.—Evidence having been given in support of plaintiff's case, His Lordship said the defendants ought to have known the conditions of the hiring, and if they did not read them it was their own fault. Having signed the contract they were bound by it, and were liable for the damages. In regard to the non-registration of the business name, his Lordship held that under the circumstances registration was not necessary, as there was nothing in any of the documents to indicate that Mr. Dale was carrying on the business under the name of the Wireless Radio Exhibition and Convention. The Business Names Act was never intended to apply to such cases as this. Under all the circumstances he came to the conclusion that Mr. Dale had made out his case, and there would be judgment for him for £105 5s., with costs, being £100 damages and five guineas outstanding rent.

A Wireless Engineer's Claim.

In the King's Bench Division on Tuesday, Mr. Justice Bailhache commenced the hearing of an action by Mr. Florence O'Driscoll, engineer of Bickenhall Mansions, London, W., against Marconi's Wireless Telegraph Co., claiming damages for alleged breach of a contract of employment. The plaintiff's case was presented by Sir Henry Maddocks, and the hearing was adjourned.

Electrical Fittings Dispute.

In the Shoreditch County Court, on Tuesday, before Judge Cluer, the Weston Electric Lamp Co., of 1-3, Sun Street, Finsbury, E.C., sued Mr. H. H. Parry, of 47, Coedoe Road, Abertridwr, near Cardiff, to recover £15 12s. 6d. for goods supplied.—The defendant had filed an affidavit to the effect that he was an agent of the plaintiffs, and was entrusted with samples of electrical fittings to the value of £25 1s. 10d. Then he was asked if he would return them for the purpose of an audit, and he duly despatched them with the exception of 5 astros and 5 shades, value £1 4s. 9d., which were brought into court.—Judgment was given for the plaintiffs for the amount claimed.

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ELECTRIC TRACTION.

Edinburgh Tramways Committee is to proceed with the building of eight tramcar bodies in its own workshops.

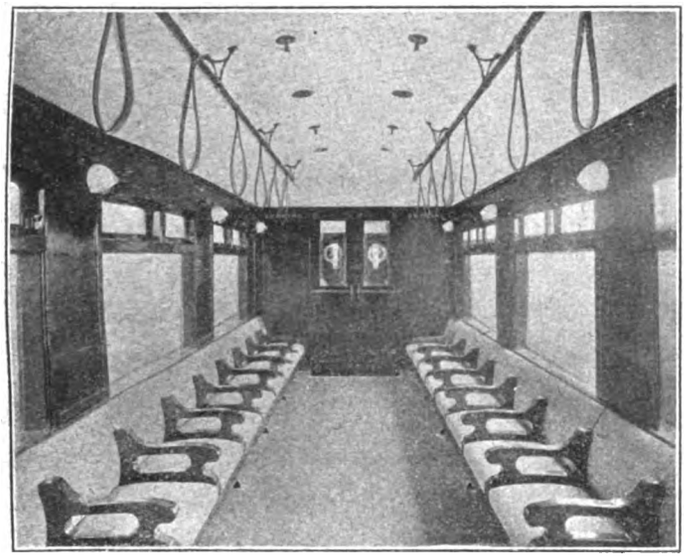
Northampton Corporation has recently placed into service a fleet of Thornycroft motor omnibuses to supplement the existing tramways.

Lambeth Council has approved an alternative route for the London County Council's proposed tramway extension from West Norwood to the Crystal Palace, via Auckland Hill and Gipsy Road.

The Minister of Transport has granted the Liverpool Corporation Light Railways Order, authorising the construction of light railways in the city of Liverpool in connection with the existing tramways.

Plymouth Tramways Committee has decided to apply for loans amounting to £20 000 for the reconstruction of the tramway track in Martin Terrace, Keyham, and part of St. Levan Road from North Gate to Rocky Hill.

Wolverhampton's new trackless tram system was officially inaugurated last week when the Chairman of the Tramways Committee said Wolverhampton had started with the most up-to-date trolley-bus system in the country.



INTERIOR OF ONE OF THE NEW COACHES ON THE MERSEY RAILWAY.

To avoid expense in relaying track between Ashton and Oldham, the Ashton-under-Lyne Tramways Committee proposes to introduce trackless trams at a cost of about £28 000. Track renewals would cost from £50 000 to £80 000.

A serious dispute has arisen between the East Ham and Barking Town Councils after seven years' satisfactory working of inter-tramways. Barking, who have leased their lines for £700 yearly, now want £1 071, threatening, in the event of non-compliance, to terminate the agreement at the end of November. East Ham refuses to pay more.

At Tuesday's meeting of the London County Council it was resolved to apply for powers to construct several new lines of tramways, and it was stipulated that if the Council failed to obtain the necessary consents the Highways Committee should have power to withdraw any of the schemes. One proposed new route is from Southend Village to Eltham, *via* two main roads to be constructed. A second will run from West Norwood to the Crystal Palace, and a third from Southwark Bridge City terminus to a point near Upper Thames Street. The total cost was estimated at £598 746.

Fares, Receipts and Passengers.

During the week ended October 27th, traffic receipts on the Mersey Railway totalled £4 223, bringing the total for the year to date to £193 706.

The traffic returns for the Reading Corporation Tramways show receipts from April 1st to October 4th amounting to £40 831, compared with £41 754 for the corresponding period last year.

To stimulate traffic Colne Council has decided to issue weekly transferable tickets at 2s. each, available on six days per week (Monday to Saturday) between any of the double stages, and for any number of journeys.

The introduction of penny tram fares at Dover has been a great success. The number of passengers carried in the six months since the institution of these fares has been well over two millions, showing an increase of nearly 415 000 on the same period last year.

Electric Railway Items.

The Middle Ward District Committee of Lanarkshire has approved of suggestions being made to the L.M. & S. Railway for the electrification of the system from Glasgow to East Kilbride.

New rolling stock is being put into service on the Mersey Railway. Of new design, the carriages were constructed by Cravens Railway Carriage and Wagon Co., under the supervision of Mr. J. Shaw, general manager of the railway. The electrical equipment was supplied by the Metropolitan-Vickers Electrical Co.

In announcing its intention to spend £4 000 000 on current work, and to place orders to the extent of £10 000 000, the London, Midland and Scottish Railway mentions that the electrification of the Manchester and Oldham line is contemplated, and will, it is hoped, be proceeded with at an early date. This is part of the policy of electrifying the lines in the northern suburbs of Manchester. The work includes the electrification of sidings at Newtown. The Scottish programme includes the electrification of the company's shops at Kilmarnock.

The electrification programme of the Southern Railway will cost, including work already sanctioned, over £5 250 000. It is understood that the whole work will be proceeded with at once so as to bring the new electrical services into operation by the end of 1925. The directors have now approved plans for the further extension of the electrification of the suburban area to Guildford and Dorking. The electrification extensions in hand and authorised are as follows: From Claygate to Guildford (extension of Waterloo-Claygate line), from Raynes Park to Guildford *via* Epsom and Leatherhead, from Leatherhead to Dorking, from Tulse Hill to Sutton *via* Streatham and Selhurst, from Selhurst to Coulsdon (Smitham), from Charing Cross, Cannon Street, and London Bridge:—To Dartford *via* Woolwich, *via* Bexley Heath, and *via* Sidcup, to Orpington *via* Chislehurst, *via* Ravensbourne, and *via* New Beckenham, to Bromley (North), to Hayes, to Addiscombe Road. From Holborn Viaduct and St. Paul's:—To London Bridge, to Victoria *via* Loughborough Junction, to Orpington *via* Dulwich, Penge and Bromley (South). From Victoria:—To Holborn Viaduct and St. Paul's; to Crystal Palace *via* Nunhead and Honor Oak; to Loughborough Junction, Nunhead and Greenwich Park; to Orpington *via* Dulwich.

WIRELESS CHAT.

The construction of a high-power wireless station in Australia to give direct communication with Great Britain and America will shortly be begun and will cost £487 000. It has yet to be decided whether the site of the station will be at Sydney or Melbourne. According to a Melbourne correspondent of "The Times" the transmitting equipment will consist of an electronic valve installation having a power in the neighbourhood of 1 000 kW with duplicated plant. The aerial system will be supported by twenty lattice steel masts each 80 ft. high. The receiving equipment is to consist of five complete sets of high-speed commercial apparatus, capable of receiving simultaneously from five different countries, if required, while the transmitting station is in full operation sending out messages to any one of them. If the main oversea station is placed in Sydney, as is probable, there will also be installed a group of feeder stations which will communicate direct by wireless with similar feeder stations in each of the other capital cities. These feeder stations will also be equipped with electronic valve transmitters, with directional receivers and with automatic sending and receiving apparatus.

Wireless on Ships.

A resolution has been passed by the Belfast Chamber of Commerce protesting against the recent French Decree which requires vessels with a gross tonnage of 500 and over to be fitted with a wireless receiving installation when entering French ports. The Board of Trade has sent a communication to the French Government regarding the application of this Decree to British ships, and they have been asked to accept compliance with British requirements as equivalent to compliance with French law. Attention has been drawn to the fact that British law requires a complete wireless installation and a competent wireless operator on ships between 1 600 and 2 000 tons gross. It is, therefore, in that respect in excess of the French law, and it has been suggested that the greater standard of safety on a limited number of ships may be regarded as a set-off against a smaller standard of safety on a larger number of ships. No reply has yet been received from the French Government.

Wireless Licences Statement.

It was reported that the Postmaster-General intended to make a statement on wireless licences this week, but at the time of going to press no such statement had been issued. Up to October 15th a grand total of 414 000 licences had been issued, including 200 000 interim and 27 000 constructors' licences. These numbers, it is understood, have been very considerably added to.

Wireless News in Brief.

The Sheffield Relay Station will be opened on November 16th.

It is reported that a wireless broadcasting company has been formed for South Africa with a capital of £560 000.

At a meeting of the Council of the Empire Press Union on Tuesday, the following resolution was unanimously adopted:—"This meeting of the Council of the Empire Press Union expresses its earnest hope that the Imperial Conference will not disperse without arriving at a decision in regard to Empire wireless telegraphy, thereby seriously delaying the improvement of news services between all parts of the British Empire."

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COMPANY NEWS.

Meetings, Reports and Dividends.

EVER READY CO. (GREAT BRITAIN).—An interim dividend of 3½ per cent. actual has been declared on both the preference and ordinary shares, payable on December 1st.

MARSHALL, SONS AND CO.—We are asked to state that Marshall, Sons and Co. emphatically deny the report (circulated by certain sections of the lay Press) that Vickers, Ltd., have taken over or acquired this firm. The report is absolutely without foundation.

MADRAS ELECTRIC TRAMWAYS (1904), LTD.—For the fortnight ended October 31st the traffic receipts totalled rs.49 669, an increase of 12·7 per cent. on the corresponding period last year. The gross receipts for the year to date are 8 per cent. higher than for the same period a year ago.

ELECTROLYTIC ZINC CO.—Cabled advices from Melbourne state that the net profit for the year ended June 30th last was £285 406 (against £95 333), making with £76 593 brought forward, £361 999. After making the necessary appropriation and paying dividends Nos. 1 and 3 there is a balance to carry forward of £78 262.

ITALIAN POWER CO.—According to cabled information received by Aldred & Co. the issue at 99 per cent. of $2 000 000 Italian Power Co. five-year 6½ per cent. collateral trust gold bonds Series A, secured by the Edison Electric Co. of Milan (Società Generale Italiana Edison di Elettricita) has been largely oversubscribed.

SIEMENS BROTHERS AND CO.—Various reasons have been advanced to account for recent activity in the company's shares, and the "Financier" mentions a rumour that the company has secured an important contract as giving the reason for the rise in the price of the shares. It is stated, however, that this supposition was not confirmed on inquiry at the company's offices.

AMERICAN TELEPHONE AND TELEGRAPH CO.—A syndicate of bankers, headed by J. P. Morgan and Co., is reported to have purchased from the company $100 000 000 25½ per cent. debentures which will be offered to the public at 98½ per cent. It is understood that the proceeds of the issue will be used for additions and improvements, and to redeem $40 000 000 6 per cent. notes due on February 1st next.

GEORGE M. CALLENDER AND CO.—Subject to corporation profits tax, the net profit for the year ended June 30th last was £5 730, plus £262 brought in, making £5 992, of which directors' fees absorb £666. The directors recommend a further division of the profits, making a total dividend on the preference shares of £10 per cent., and of £20 per cent. on the ordinary shares, and the placing of £1 500 to general reserve, leaving £415 to carry forward. The reserve fund will then stand at £10 000. The annual meeting was held in London on Wednesday.

JOSEPH LUCAS LTD.—Including the profit of the Lucas Electrical Co. and after providing for depreciation and all taxation, the net profit for the year to August 31st last was £128 813, making with the amount brought in—less £500 further directors' remuneration—£73 963, a total of £202 776. After paying preference dividends the directors propose a final dividend on the ordinary shares of 12½ per cent., making 15 per cent. for the year, plus a bonus of 5 per cent., both less tax. The placing of £25 000 to reserve and £10 000 to staff superannuation fund leaves £88 427 to go forward.

TATA POWER CO.—On Monday the subscription lists were opened for an issue of £1 000 000 4½ per cent. guaranteed "A" mortgage debenture stock, 1928-1948, secured on a Government guarantee under the provisions of the Trade Facilities Acts. The subscription lists were closed on Thursday. In addition to this issue the company is reported to have in contemplation a further offer, which will probably follow shortly after the appearance of the Government guaranteed loan, of £750 000 7½ per cent. "B" mortgage debenture stock, for which it is understood the underwriting arrangements have already been completed.

CANADIAN GENERAL ELECTRIC CO.—Particulars are now available of a scheme which is being submitted to shareholders for effecting closer co-operation between the company and the General Electric Co. (U.S.A.). Under this proposal shareholders of the Canadian company will be offered for each $100 share the sum of $62·50 in cash (New York) and one new 7 per cent. preference share of $50 par value in the Canadian company. Subject to the necessary amount of Canadian stock being transferred, the American company will subscribe for $2 000 000 common stock of the Canadian company. The proposed arrangement will not involve any change in the total amount of the Canadian company's outstanding stock, which will remain at $12 800 000, as at present, nor will it affect its position as regards cash and surplus.

ELECTRIC SUPPLY CO. OF VICTORIA.—For the year ended March last the revenue was £147 549, and the gross profit £48 374. The balance to the credit of profit and loss is £47 458 plus £45 542 brought in, making £93 000, which, after all deductions have been made, leaves £75 302, which the directors propose dealing with as follows: payment of one year's dividend on the 6 per cent. preference shares, £10 500, leaving to carry forward £64 802. The report states that the board is contemplating a large extension of the generating plant at Ballarat and Bendigo, and a change over of the system of supply in both towns from direct to alternating current. Under these circumstances, although the balance to the credit of profit and loss would permit of the payment of a dividend on the ordinary shares, the board does not think it advisable to do so at the present time. The total amount of debenture stock redeemed to date is £108 682.

New Companies.

HARDEN CARTWRIGHT, LTD.—Cap., £1 000. Electrical engineers, etc. Reg. office: 19, Albion Street, Brierley Hill.

MOULE AND SONS, LTD.—Cap., £500. Electrical engineers, etc. Reg. office: School Street, Carriage Works, Wolverhampton.

HUDSWELL, CLARKE & CO., LTD.—Cap., £100 000. Manufacturers of dynamos, etc. Reg. office: Railway Foundry, Hunslet, Leeds.

J. H. BANCE AND CO., LTD.—Cap., £6 500. Electrical and general engineers, etc. Reg. office: 32, Victoria Street, Westminster, London, S.W.1.

B. GOODMAN, LTD.—Cap., £36 000. Manufacturers of and dealers in electrical appliances, etc. Reg. office: 33, Haggerston Road, Dalston, London, E.8.

LIGHTING, HEATING AND GLASS, LTD.—Cap., £1 000. Suppliers of or dealers in electrical apparatus, etc. Reg. office: Bilbao House, New Broad Street, London, E.C.

LINGHOLM TRUST, LTD.—Public. Cap., £90 000. To construct and manage electric light, power and telephone works, etc. Reg. office: 7, Norfolk Street, Manchester.

THOMPSON & HOWELLS (BRISTOL), LTD.—Cap., £1 000. Manufacturers of, agents for or dealers in telephone receiver holders, etc. Reg. office: 127, Victoria Street, Bristol.

RICHARD KLINGER, LTD.—Cap., £250. Manufacturers of and dealers in electrical machinery, accessories, etc. A subscriber: H. L. Mason, 120, Southwark Street, S.E.1.

DAVIS, ASH AND CO., LTD.—Cap., £10 000. To acquire the business of Ash and Hart, electrical engineers. Reg. office: 15, Grape Street, Shaftesbury Avenue, London, W.C.2.

UPTON & GARRETT, LTD.—Cap., £1 000. To acquire the business of electrical and wireless engineers now carried on as "Upton & Garrett." Reg. office: Electric House, Church Lane, Edgware.

HALCYON WIRELESS SUPPLY CO., LTD.—Cap., £2 000. Manufacturers of and dealers in wireless and electrical appliances, etc. Solicitors: Kennedy, Lindo & Co., 79, Coleman Street, London, E.C.2.

NEW ARMATURE CO., LTD.—Cap., £1 000. Electrical engineers and contractors, suppliers of electricity, manufacturers and repairers of tramway, electric, magnetic, galvanic and other apparatus, etc. Solicitor: C. W. Slater, 18, York Place, Swansea.

RINGWOOD ELECTRIC SUPPLY CO., LTD.—Cap., £15 000. To apply to the Electricity Commissioners for a special order authorising the company to supply electricity to the town of Ringwood, and neighbourhood. Reg. office: The Mill, Ringwood, Hants.

WORMIT ELECTRIC LIGHT CO., LTD.—Cap., £2 000. To take over the business of manufacturers and suppliers of electricity, recently carried on by the Tayside Electric and Gas Light Co., Ltd. (in liquidation). Reg. office: Newburgh Road, Wormit.

RADIO WORKS, LTD.—Cap., £100. Manufacturers, importers and exporters of and dealers in wireless, radio and electrical parts and accessories, electric, magnetic, galvanic and other apparatus, etc. Reg. office: Bank Chambers, 329, High Holborn, London.

UNITED PIONEER SYNDICATE, LTD.—Cap., £5 000. To apply for, purchase or otherwise acquire, work and turn to account any Acts of Parliament, concessions for the construction, completion, extension and operation of railways, tramways, etc. Reg. office: 11, Maiden Lane, London, E.C.4.

WALLINGFORD AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Cap., £13 000. To adopt an agreement with Edmundson's Electricity Corporation, and to generate and supply electricity in or near Wallingford, Clapcot, Benson, Crowmarsh and elsewhere in Berkshire and Oxfordshire. Reg. office: 16, Market Place, Wallingford.

COMPARE SECRET RADIO TELEGRAPH CO., LTD.—Cap., £200. To acquire and turn to account any patents, rights and inventions, relating to telegraphy, signalling, electric apparatus and appliances for operating and controlling musical instruments and other matters in connection with electrical inventions, etc. Reg. office: 13, Copthall Avenue, London, E.C.2.

W. H. MILLER AND CO., LTD.—Cap., £2 000. Manufacturers and repairers of, agents for and dealers in electrical goods and accessories, fittings, switch boards, indicators, bells, automatic time recorders, clocks, time switches, flashers, engine controls, etc. Reg. office: Queen's Square, Poulton-le-Fylde, Lancs.

LOUGH BROTHERS (CONTRACTORS), LTD.—Cap., £5000. Electrical engineers, etc. Reg. office: 4, The Crescent, Consett, Durham.

BUSINESS MEMS.

Mr. A. Southey has opened a wireless depot at 276, Stamford Street, Ashton-under-Lyne.

The Jackson Electric Stove Co. inform us that their agent for the Lancashire area is now Mr. R. Millett, Star Buildings, 30, Cross Street.

The Siemens and English Electric Lamp Co. has opened a store at 2, Wood Street, Cardiff, where a large stock of the firm's specialities will be carried.

The Western Union Telegraph Co. has removed from its branch office at Norfolk Street, Strand, to new premises at Bush House, Aldwych, London. The telephone No. is "City 3010."

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COMMERCIAL INFORMATION

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ALEXANDRA (A. C.) AND CO., LTD., 10, Iddesleigh House, Caxton Street, W., electrical engineers. £21 18s. 7d. October 2nd.

CENTRAL ELECTRIC CO., 159, Pentonville Road, King's Cross, electrical engineers. £11 7s. 10d. October 5th.

CLAR-O-PHONE RADIO CO., Palace Chambers, 9, Bridge Street, Westminster. £43 12s. 6d. September 26th.

MAJOR SQUIRE AND CO., 202, Manningham Lane, Bradford, electrical engineers. £19 1s. 5d. September 26th.

PREMIER ELECTRIC CO., 11, Paley Terrace, Bradford. £18 3s. 10d. September 28th.

RADIO STOCKS, LTD., 89, Newman Street, Oxford Street, W. £50 8s. 10d., September 17th; £23 15s., August 20th; and £13 2s. 3d., September 3rd.

ROBERTSON, John (trading as WALTER DAVIDSON), 8, Priory Street, Huntingdon Road, Cambridge, consulting electrical engineer. £34 5s. 9d. October 3rd.

WHITE AND CO., 18–19, Golden Square, W., electrical factors. £14 16s. 5d. October 2nd.

WHOLESALE ELECTRICAL CO. (1922), LTD., 78, Charlotte Street, Fitzroy Square, W. £10 7s. 4d. September 28th.

WINTER (J. H.) AND CO., Narrow Wine Street, Bristol, electricians. £22 13s. 3d. September 29th.

Receivership.

FRANK CRAFT (CASTLEFORD), LTD. E. V. Williamson, of East Parade, Leeds, was appointed receiver and manager on October 24th under powers contained in debenture dated October 3rd, 1923.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

ADAMS BROTHERS (LONGTON), LTD., electrical engineers. Registered October 19th, £1,000 debenture, to F. A. Spruce, Grindley Lane, Blyth Bridge, colliery agent; general charge. *£1 000. October 1st, 1923.

GENERAL RADIO CO., LTD., London, W. Registered October 10th, £6 000 debentures, present issue £3 500: general charge.

HINDHEAD AND DISTRICT ELECTRIC LIGHT CO., LTD. Registered October 16th, £250 debentures, part of amount already registered; general charge. *£5 000. August, 2nd, 1923.

SPRINGFIELD ELECTRIC MOTORS, LTD., Guiseley. Registered October 10th, £2 000 (not ex.) mortgage, to building society; charged on properties at Guiseley.

Satisfactions.

COOPER (H. G.), LTD., London, E.C., electrical engineers. Satisfaction registered October 15th, £500, registered May 15th, 1916.

MUSSELBURGH AND DISTRICT ELECTRIC LIGHT AND TRACTION CO., LTD., London, E.C. Satisfaction registered October 17th, £1 200, part of amount registered November 30th, 1905, and May 12th, 1909.

NORTH MELBOURNE ELECTRIC TRAMWAYS AND LIGHTING CO., LTD., London, E.C. Satisfaction registered October 17th, £200 000, registered January 1st, 1906.

OXFORD ELECTRIC CO., LTD. Satisfaction registered October 19th, £25 000 registered July 20th, 1920.

Private Meeting.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

SPREADBOROUGH, L., 14, Frith Street, Soho, and 539, High Road, Leytonstone, electrician and wireless dealer. Creditors were called together on November 2nd, when debtor's solicitor stated that so far as could be ascertained the liabilities amounted to about £360 with practically no assets, and offered a composition of 5s. in the £, guaranteed. It was stated that debtor had kept no books. He started business in 1901 with a capital of only £5. Up to the last two years the turnover has been about £3 000 a year, but since then it dropped to about £1 000 a year. The debtor had drawn about £5 a week out of the business. He admitted calling his creditors together about 1910, when he failed for about £200, and paid 5s. in the £. The present position was attributed to costs in a law action and to slump in trade. After discussion it was decided that the debtor should be given 14 days within which to come forward with an offer of a composition of no less than 10s. in the £ suitably guaranteed to the satisfaction of the three principal creditors.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Companies Winding-up Voluntarily.

H. P. R. WIRELESS, LTD.—R. E. Smith, 79, Mark Lane, London, E.C., appointed liquidator. Meeting of creditors at 79, Mark Lane, London, E.C.3, on November 15th, at 12 noon; creditors' claims by November 30th.

SANDERS, KENNEDY AND CO., LTD. F. J. Sully, Bank Chambers, Bridgwater, chartered accountant, appointed liquidator.

UNION ELECTRIC WELDING CO. (EGYPT), LTD.

Bankruptcy Information.

BACKHOUSE, Lawrence, THORNTON, Charles Henry, and EVANS, Sydney, trading as THE ARC ELECTRICAL CO., Palatine Buildings, Victoria Street, Manchester, electrical and wireless suppliers. First meeting, November 14th, 2.30 p.m., Official Receiver's Offices, Byrom Street, Manchester. Public examination, December 7th, 10 a.m., Court House, Quay Street, Manchester.

KENNEDY, Percy Sherbon (trading as MARTIN AND CO.), 102, High Street, Stoke Newington, London, electrical engineer. Receiving order, October 30th. Debtor's petition. First meeting, November 14th, 11 a.m.; and public examination, February 8th, 1924, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

TAYLOR, George William, 3, South View, London Road, Fletton, in the county of Huntingdon, electrical engineer, lately carrying on business as G. W. TAYLOR AND CO. Receiving order, October 30th. Debtor's petition.

THORPE, Francis Bertram, electrical engineer, 1, West Laithe Gate, Doncaster. First meeting, November 7th, 12 noon, Official Receiver's Offices, Figtree Lane, Sheffield. Public examination, November 15th, 2 p.m., County Court Hall, Bank Street, Sheffield.

Notice of Dividend.

BARLOW, Alfred James (trading as BARLOW BROTHERS), 9, Brunswick Place, City Road, London, N.1, electrical and general engineer. First dividend of 5s. per £, payable November 14th, Trustee's Offices, 14, Old Jewry Chambers, London, E.C.2.

METAL & CHEMICAL PRICES.

TUESDAY, November 6th

		Price.	Inc	Dec.
***Copper*—**				
Best Selected ..	per ton	£63 0 0	15s.	—
Electro Wirebars ..	„	£64 10 0	10s.	—
H.C. Wire, basis ..	per lb.	9⅝d.	1/16d.	—
Sheet	„	9⅞d	—	—
***Phosphor Bronze Wire (Telephone)*—**				
Phosphor Bronze Wire, basis	per lb.	1s. 1⅛d.	1/16d.	—
***Brass* 60/40—**				
Rod, basis	„	7½d.	—	—
Sheet, basis ..	„	10d.	—	—
Wire, basis	„	10d.	—	—
***Pig Iron*—**				
Cleveland Warrants	per ton	£5 5 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
***Lead Pig*—**				
English	„	£32 10 0	10s.	—
Foreign or Colonial	„	£30 0 0	—	10s.
***Tin*—**				
Ingot	„	£208 10 0	£3	—
Wire, basis	per lb.	2s. 9d.	⅛d.	—
Aluminium Ingots ..	per ton	£120 0 0	—	—
Spelter	„	£33 5 0	—	5s.
Mercury	per bottle	£10 0 0	10s.	—

Sulphur (Flowers)—Ton £8 10s. ***Sodium Chlorate***—Per lb. 2½d.
„ (Roll-Brimstone)—„ £8 10s. ***Sulphuric Acid*** (Pyrites, 168°)
Copper Sulphate.. „ £25 per ton, £7 10s.
Boric Acid (Crystals). „ £48 ***Sodium Bichromate***.—Per lb. 4½d.
Rubber.—Para fine, 1s. 0½d.; plantation 1st latex, 1s. 1½d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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R 000. RADIO COMMUNICATION (GENERAL).

G. W. O. Howe. Notes on Wireless Matters (*Electrician*, 11, p. 266, September 14th, 1923). R.000.
J. G. Harbord. Patents and the Public (*Wireless Age*, 10, pp. 59-60, August, 1923). R.008.
S. R. Winters. When Radio Clubs vie with Pig and Corn Clubs (*Radio News*, 5, p. 381, October, 1923). R.060.
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O. Lodge. Pioneer Work in Ether Waves (*Radio News*, 5, p. 377, October, 1923) R.090.

R 100. RADIO PRINCIPLES AND THEORY.

J. A. Fleming. Electrons, Electric Waves and Wireless Telephony (*Radio News*), 5, pp. 394-395, October; pp. 526-527, November, 1923). R.100.
C. Chree. Solar Activity and Atmospheric Electricity (*Nature*, 112, pp. 203-205, August 11th; pp. 361-362, September 8th, 1923). R.112.
L. W. Austin. Receiving Measurements and Atmospheric Disturbances at the United States Naval Radio Research Laboratory, Bureau of Standards, Washington, March and April, 1923 (*Proceedings of the Institute of Radio Engineers*, 11, pp. 333-338, August, 1923). R.113/270.
M. G. Bigourdain. On the propagation of hertzian waves over great distances (*Comptes Rendus*, 176, pp. 1099-1104, April 23rd, 1923). R.113.
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Final Report on the Fading Tests (*Q.S.T.*, 7, pp. 29-34, August; pp. 23-26, September, 1923). R.113.
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R. A. Watson Watt. Observations on Atmospherics (*Wireless World and Radio Review*, 12, pp. 601-612, August 1st, 1923). R. 114.
H. H. Beverage. C. W. Rice, and E. W. Kellog. The Wave Antenna (*Electrician*, 10, pp. 269-271, September 14th, 1923). R.123.
R. Gunn. The Best Dimensions for Amateur Antennas (*Q.S.T.*, 7, pp. 27-29, September, 1923). R.121.
Some Notes on the Design of Aerials for Short Wave Transmission (*Modern Wireless*, 1, pp. 559-560, August, 1923). R.122.
L. W. Austin. Loop Uni-directional Receiving Circuits for the Determination of the Direction of Atmospheric Disturbances (*Proceedings of the Institute of Radio Engineers*, 11, pp. 395-398, August, 1923). R.125.
J. Robinson. Directional Wireless (*Modern Wireless*, 1, pp. 523-526, August, 1923). R.125.
P. R. Coursey. Some Experiments Illustrating the Electrical Properties of Neon Lamps (*Wireless World and Radio Review*, 12, pp. 700-704, August 22nd, 1923). R.130.
L. Frank. Radio Frequency Amplification (*Radio News*, 5, pp. 396-397, October, 1923). R.132.
E. O. Hulbert. On Super-Regeneration (*Proceedings of the Institute of Radio Engineers*, 11, pp. 390-394, August, 1923). R.132/134.
D. C. Prince. Vacuum Tubes as Power Oscillators (*Proceedings of the Institute of Radio Engineers*, 11, pp. 405-436, August, 1923). R.133/344.
H. F. Mason. The Nodal Point Explained (*Q.S.T.*, 7, pp. 11-14, September, 1923). R.140.
D. R. Clemans. High Frequency Resistance (*Radio News*, 5, pp. 550-551, November, 1923). R.144.
F. S. Dettenbaugh. Electric Filters (*Q.S.T.*, 7, pp. 18-24, August, 1923). R.145.
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The Calculation and Measurement of Inductance (*Wireless Age*, 10, pp. 71-72, September, 1923). R.145/230.
W. P. Powers. Everyday Observations of the Beat Phenomenon (*Radio News*, 5, p. 535, November, 1923). R.147.
S. O. Pearson. Distortion in low-frequency Amplifiers (*Wireless World and Radio Review*, 13, pp. 3-6, October 3rd; pp. 40-44, October 10th, 1923). R.148.
A. Blondel. On the output of oscillating valves having a falling characteristic, and on the definition of their power (*Comptes Rendus*, 177, pp. 87-92, July 9th, 1923). R.150.
C. Dreher. Some Power Considerations in Radio Transmission (*Radio News*, 5, p. 534, November, 1923). R.150.

R 200. RADIO MEASUREMENTS AND STANDARDISATION.

J. B. Dempster and **E. O. Hulbert.** Standards of Capacity, Particularly for Radio Frequency Currents (*Proceedings of the Institute of Radio Engineers*, 11, pp. 399-404, August, 1923). R.200/145.
G. R. Garratt. A Simple Method of Coil Calibration (*Wireless World and Radio Review*, 13, pp. 38-39, October 10th, 1923). R.202.
P. R. Coursey. Heterodyne Methods of Measurement (*Wireless World and Radio Review*, 12, pp. 551-553, July 28th, 1923). R.203.
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F. H. Haynes. Combined High and Low Frequency Amplifier (*Wireless World and Radio Review*, 12, pp. 577-579, August 1st, 1923). R.342.
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G. P. Kendall. A Power Amplifier (*Modern Wireless*, 1, pp. 498-502, August, 1923). R.342.

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C. Dreoher. Static Elimination Phantasies (*Wireless Age*, 10, pp. 57-59, August, 1923). R.430.
M. V. Marrec. Selective Receiving Apparatus (*Wireless World and Radio Review*, 12, pp. 634-635, August 8th, 1923). R.430.
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J. English. Broadcasted Opera in the Argentine (*Wireless World and Radio Review*, 12, p. 214, May 19th, 1923) R.550.
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F. Kohlhauer. Radio-telephony in the service of everyday life (*Jahrbuch der drahtlosen Telegraphie*, 19, pp. 224-232, March, 1923). R.550/094.
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J. H. Hammond. The Radio Stathmometer (*Radio News*, 5, pp. 12-13, July, 1923). R.570.
P. Hemardinquer. Distant Control by Radio (*La Nature*, 21, pp. 333-336, May 26th, 1923). R.570.
The "Radio-Hound" (*Q.S.T.*, 6, pp. 33-34, January, 1923. R.570.
H. W. Webbe. A New System of Radio Control (*Radio News*, 5, pp. 20-21, July, 1923). R.570.
O. O. Whysall. Distant Control for Amateur Transmitters (*Q.S.T.*, 6, p. 34, July, 1923). R.570/480.
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PATENT RECORD.

Specifications Accepted.

190 149 Luma-Werke Akt.-Ges. Locking device for the electric switches or controllers of motor vehicles. (6/12/21.)
203 263 J. Vigneault. Electric water heaters or steam generators. (6/6/23.)
192 070 R. Bosch Art.-Ges. Battery ignition devices for internal combustion engines. (23/1/22.)
203 266 Philips' Gloeilampenfabrieken and G. L. Hertz. Cooling electrodes of X-ray tubes. (17/1/23.)
195 594 Metropolitan-Vickers Electrical Co. Electron discharge tubes for generating X-rays. (1/4/22.)
203 274 B. E. D. Kilburn (Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij). System of long distance telephony. (7/3/23.)
196 278 Metropolitan-Vickers Electrical Co. Electric power or distribution systems. (11/4/22.)
176 384 W. Muller. Telephone systems. (4/3/21.)
203 365 W. J. Nicholas and P. J. W. Roberts. Generators of electric lighting sets for motor vehicles and the like. (3/5/22.)
203 374 H. R. Jones and C. E. Wood. Electro-magnetic separators. (1/6/22.)
203 380 J. P. Williams. Electrical protection systems. (1/6/22.)

Applications for Patents.

October 19th.

26 063 W. Aitken. Automatic telephone systems.
26 070 F. A. Ross. Electric fuses.
26 080 E. V. Appleton. Wireless receiving device.
26 095 H. B. Andrews. Variable electric condenser.
26 115 L. V. Burgess. Means for disinfecting telephone mouthpieces, etc.
26 134 N. E. North. Electric resistances.
26 135 Western Electric Co. (Deakin, Schriben and Pappi). Impulse transmitting mechanism.
26 140 Soc. Anon. Le Carbone. Rendering electrodes impermeable to liquids. (21/2/23, France.)
26 145 N. R. Forssblad. Cable-guiding devices for mobile electric machines (20/10/22, France.)
26 170 British Thomson-Houston Co. Elastic fluid turbines. (5/12/22, U.S.)

October 20th.

26 172 R. A. Galloway. Electric signal lamp.
26 177 Stevens & Co. (1914) and C. W. Hayward. Cabinets for wireless apparatus.
26 187 R. W. Buttemer. Head bands for telephone receivers.
26 198 R. E. Milnes. Storage batteries.
26 199 L. J. Goldhill and L. P. Linden. Wireless receiving apparatus.
26 204 Mather and Platt and Whipp and Bourne. Electric switches.
26 208 Coventry Automatic Telephones, Ltd., and J. E. Collyer. Automatic telephone systems.
26 210 Dunlop Rubber Co. and J. T. T. Randles. Electric welding.
26 214 E. G. Edwards. Device for holding telephone receivers.
26 238 General Electric Co., Ltd. Packing glands for elastic fluid turbines, etc

October 22nd.

26 254 R. B. Matthews and W. H. R. Pike. Variometers, etc.
26 255 R. B. Matthews and W. H. R. Pike. Wireless receivers.
26 260 R. A. Simmons. Wireless crystal holder, etc.
26 269 J. A. Crabtree. Electric switches.
26 289 T. A. W. Robinson. System of winding multi-layer electrical coils.
26 295 H. S. Ryland. Diaphragms vibrated by electromagnetic means.
26 309 W. G. Read. Wireless aerials.
26 320 Thor Electric Safety Lamp Co., Pritchett and Gold and E.P.S. Co., and H. M. Genese and T. Stretton. Accumulators.
26 322 Western Electric Co. and G. H. Nash. Vacuum tube circuits.
26 323 Western Electric Co. and L. Polinkowsky. Telephone systems.
26 335 C. Scott Snell. Shades for electric lights, etc.
26 336 J. R. Spink Rheostats.
26 340 British Thomson-Houston Co. and E. B. Tuppen. Securing together of insulated parts of electrical apparatus.
26 341 British Thomson-Houston Co. (General Electric Co., N.Y.). Electro-magnetically operated apparatus, etc.
26 358 E. J. Erikson and H. Tillquist. Electric switches. (28/4/23, Sweden.)
26 368 N. P. Sjobriag and M. Swanson. Electric welding machines.

October 23rd.

26 379 A. L. Yates. Electric lamp bulbs for road illumination.
26 380 E. Paul. Wireless crystal clip.
26 384 F. Ball. Appliance for remagnetising magnetos.
26 388 P. Hausmeister. Production of compressed gas by electrolysis.
26 408 A. Shrieves and A. E. Bonner. Junction terminal for electrical apparatus.
26 430 H. S. Ryland. Light projectors.
26 432 T. R. and L. J. Hancock. Electric heating apparatus.
26 437 J. H. Williams. Crystal detectors.
26 443 Metropolitan-Vickers Electrical Co. Gas or oil power plant.
26 448 W. H. Scott. Application of electric power to steering, etc.
26 450 R. H. Johnston. Wireless telegraph apparatus, etc.
26 454 Ferranti, Ltd., and A. W. G. Tucker. High voltage oil-immersed transformers.
26 456 W. H. Briscoe & Co. and E. C. Briscoe. Electric condensers.
26 463 British Thomson-Houston Co. and A. S. FitzGerald. Circuit-controlling means.
26 464 British Thomson-Houston Co. and A. S. FitzGerald. Protective apparatus for a.c. systems.
26 469 J. Schulz. Magnets, electromotors and transformers.
26 491 T. H. Coates, L. G. Bacon and H. Hiley. Wireless receiving sets.

October 24th.

26 498 C. H. Woodward. Wireless receiving apparatus.
26 503 H. L. Wood. Two-coil holder for wireless apparatus.
26 513 J. Crossley and Co. and P. M. Thompson. Wireless aerials.
26 518 Richmond Electric Co. and J. Rogers. Wireless receiving apparatus.
26 546 M. Koopman. Electric couplings, terminals, etc.
26 547 W. Service. Electric cookers.
26 552 C. S. Lambton and F. Nelson. Panels and units for wireless installations, etc.
26 553 L. J. Shine. Detector for wireless telegraphy.
26 586 Tilling-Stevens Motors, Ltd., and H. K. Whitehorn. Dynamo-electric machines.
26 592 General Electric Co., Ltd. Tungsten arc lamps. (5/5/23, Germany.)
26 593 A. E. Chapman. Wireless receivers.
26 608 Burndept, Ltd., and S. F. Woodell. Variable resistance devices.
26 614 Mann, Egerton and Co., and H. R. Taunton. Wireless receiving apparatus.
26 619 H. Wade (Mills Novelty Co.). Thermionic valves.
26 625 Sir C. S. Forbes. Horns for wireless apparatus, etc.
26 627 A. M. Taylor. Electric transmission systems.

October 25th.

26 651 E. N. Pattison (Dictagraph Products Corporation). Machines for winding electric coils.
26 659 H. W. Forshaw and L. S. Palmer. Tuning systems for wireless apparatus.
26 698 H. E. Watson. Vacuum discharge devices.
26 702 P. Morley. Crystal detectors.
26 710 F. Holweek. Thermionic apparatus. (27/10/22, France.)
26 716 Igranic Electric Co. and A. H. Curtis. Terminal connecting means.
26 717 Igranic Electric Co., A. H. Curtis and G. Dandridge. Adjustment of inductance coils.
26 721 G. J. Sutton. Electrical etching of metals.
26 733 British Thomson-Houston Co. (General Electric Co., N.Y.). Automatic re-closing circuit breaker systems.
26 734 British Thomson-Houston Co. and H. F. Farmer. Electric switches.
26 739 C. A. Simpson. Aerials, etc., for wireless apparatus.
26 751 A. D. Pou. Electric heating.

October 26th.

26 754 R. B. Matthews. Crystal receivers.
26 771 H. J. Brookes. Wireless receiving sets.
26 772 F. R. Stocks. Tapped coils for wireless apparatus, etc.
26 780 H. B. Prentice. Electric resistances.
26 788 Electric Control, Ltd. System of motor control.
26 799 A. Reyrolle and Co. and F. Coates. Electric fuses.
26 800 A. Reyrolle and Co. and P. F. Harris. Electric synchroscopes, etc.
26 805 A. R. Angus. Devices for production and amplification of electric oscillations.
26 827 Western Electric Co. and J. F. Griffin. Continuously-loaded electric conductors.
26 828 Western Electric Co. High frequency transmission.
26 830 A. Reyrolle and Co. and B. H. Leeson. Electric protective arrangements.
26 837 Siemens Bros. and Co. and H. E. Humphries. Automatic telephone systems.
26 843 Metropolitan-Vickers Electrical Co. Engine starters. (23/11/22, U.S.)
26 849 E. H. Trump. Electric condensers.
26 852 T. Lenaghan. Automatic telephone systems.
26 857 Johnson and Phillips and C. F. Street. Telephone cables.
26 870 J. H. Runbaken and W. Torrance. Electric contact-makers for motor vehicles.
26 871 J. de Jong. Electric power transmitting set.

October 27th.

26 884 F. H. May. Contact-breaker bush fitter.
26 896 C. B. Frost. Electric ignition.
26 904 A. J. Stevens and Co. (1914) and H. Stevens. Electric condensers.
26 911 P. Ehrmann. Cooling enclosed electric machines. (27/4/23, France.)
26 932 Metropolitan-Vickers Electrical Co. Elastic fluid turbines.
26 937 W. J. Bowyer. Rectifiers for wireless telephony.
26 950 J. W. Fothergill. Aerials, etc., for wireless telegraphy.
26 953 L. S. Rayner. Detector for wireless telegraphy, etc.
26 957 H. C. Linzell. Electric plug connections for wireless receiving sets, etc.
26 962 S. J. Abbott. Crystal detectors.

ARRANGEMENTS FOR THE WEEK.

Friday, November 9th (To-day).

The Physical Society of London.
5 *p.m.* At the Imperial College of Science, South Kensington. Papers by Dr. Allan Ferguson and Prof. A. L. Narayan.
Institute of Metals (Sheffield Local Section).
7.30 *p.m.* In the Non-Ferrous Lecture Room of the University of St. George's Square, Sheffield. Lecture by Mr. E. A. Smith on "Substitutes for Platinum."

Saturday, November 10th.

Finsbury Technical College Old Students' Association.
7 *p.m.* At the Engineers' Club, Coventry Street, W. Twelfth Annual Dinner.

Monday, November 12th.

The Institute of Metals (Scottish Local Section).
7.30 *p.m.* At 39, Elmbank Crescent, Glasgow. Lecture by Mr. D. Turner on "Nickel Alloys."
The Institution of Electrical Engineers (North-Eastern Centre).
7.30 *p.m.* At Armstrong College, Newcastle-on-Tyne. Ordinary Meeting.
Hackney and Stoke Newington Chamber of Commerce.
8 *p.m.* At the Town Hall, Mare Street, Hackney, E.8. A short talk on "Maximum Demand System of Charging for Electricity in Connection with Shop Lighting," by Mr. L. L. Robinson, followed by a lecture and demonstration of "Modern Shop Lighting," by Mr. W. E. Bush.

Tuesday, November 13th.

The Institute of Metals (Birmingham Local Section).
7 *p.m.* In the Chamber of Commerce, New Street, Birmingham. Lecture by Dr. H. B. Keene on "X-Rays and Crystal Structure."
The Institution of Electrical Engineers (Scottish Centre).
7.30 *p.m.* At 207, Bath Street, Glasgow. Chairman's Inaugural Address.
The Illuminating Engineering Society.
8 *p.m.* At the House of the Royal Society of Arts, John Street, Adelphi, London. Opening Meeting. Reports on Progress during the Vacation and Developments in Lamps and Lighting Appliances.

Wednesday, November 14th.

The Institution of Civil Engineers.
7 *p.m.* At the Institution, Great George Street, Westminster, S.W.1. Informal Meeting.
Society of Technical Engineers.
7.30 *p.m.* In the Milton Hall, Deansgate, Manchester. Discussion on "The Function of the Staff Council in Industry."
Royal Society of Arts.
8 *p.m.* At John Street, Adelphi, London, W.C.2. Monsieur Edouard Belin on "The Electric Transmission and Reproduction of Writing, Designs and Photographs Without Wires."

Thursday, November 15th.

The Institution of Electrical Engineers.
6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.2. Mr. A. Bachellery on "The Electrification of the Midi Railway." (Joint Meeting with the Société des Ingénieurs Civils de France—British Section).
Manchester Wireless Society.
7.30 *p.m.* In the Council Chamber, Houldsworth Hall, 90, Deansgate, Manchester. Mr. J. Hollingsworth on "Amplifiers."
Belfast Association of Engineers.
7.30. In the Municipal College of Technology. Lecture by Mr. G. A. Hollings on "Automatic Telephones."

Friday, November 16th.

The Institution of Electrical Engineers (London Students' Section).
7 *p.m.* At Savoy Place, Victoria Embankment, London, W.C.2. Opening Meeting. Lecture by Mr. C. F. Elwell on "The De Forest Talking Motion Picture."
The Institute of Metals (Swansea Local Section).
7.15 *p.m.* In the Metallurgical Department, University College, Singleton Park. Lecture by Prof. T. Turner on "The Density of Alloys."
British Electrical Development Association.
7.30. At Saint Bride Foundation, Bride Lane, Fleet Street, London, E.C. Paper by Mr. A. F. Berry on "How to Sell 'Heat,' and Problems relating to the Warming of Air."
The Junior Institution of Engineers.
7.30 *p.m.* At 39, Victoria Street, Westminster. Annual General Meeting.

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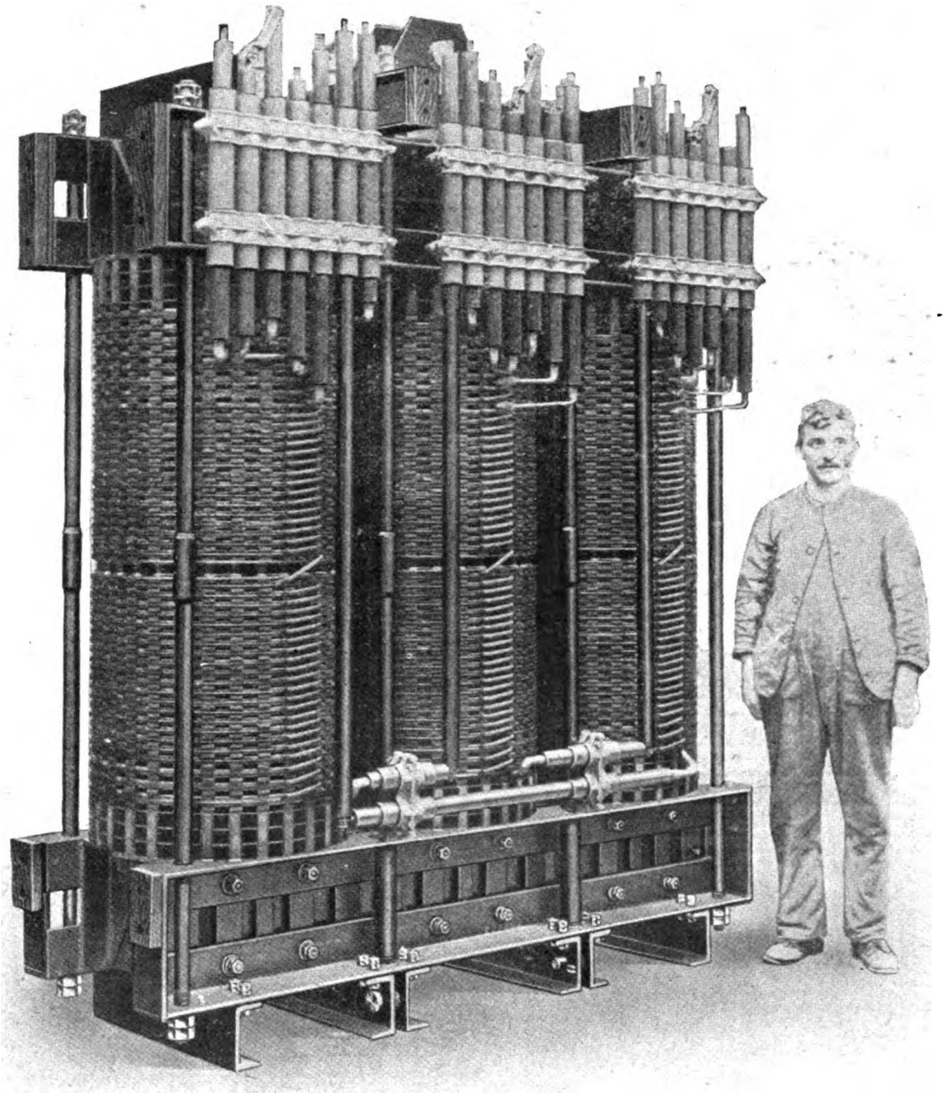

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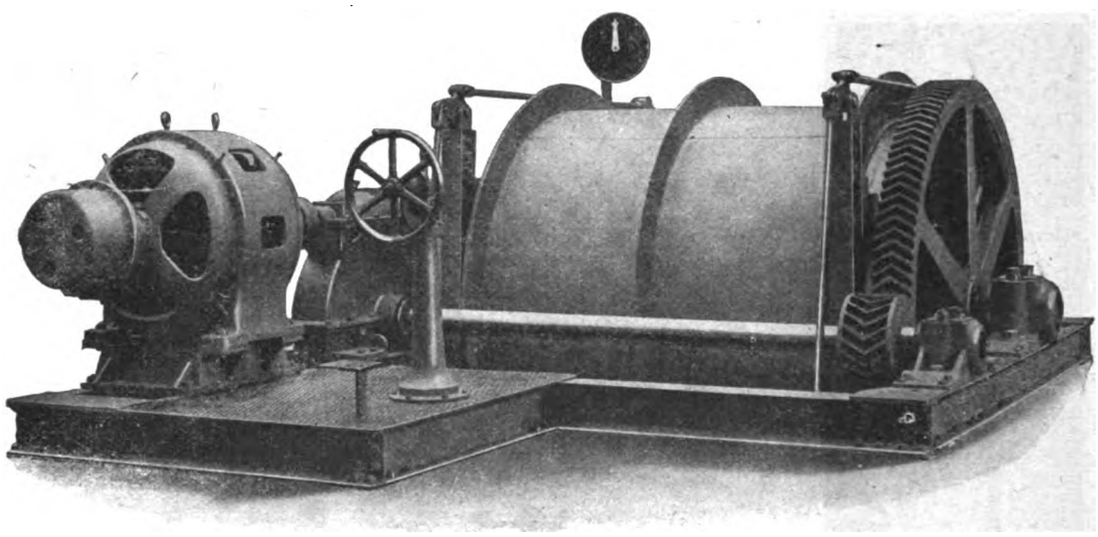

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ENGINEERS AND THE FUTURE.

This is an age of pessimism. The war left us with our industries disorganised and ourselves overburdened with taxation. Politically Augean stables of the filthiest had to be cleansed; and the means whereby this was to be effected were not clearly indicated. And to add to our difficulties, both men and women were afflicted with a mental and moral strain making that cheerfulness which is a most potent factor in the successful solving of difficulties almost non-existent. Yet, somehow or other, unless we are to sink altogether, we have got to lift up our hearts and set about those two great tasks of reconstruction and development. If we postulate that the faith which moves mountains will best be engendered by some mental and moral tonic, then Sir CHARLES LANGBRIDGE MORGAN'S Presidential Address to the Institution of Civil Engineers can be heartily recommended to the study of every engineer. Things, he admits, are bad; but they are not permanently bad, and there is no cause to think darkly of the future. The field of battle is not the same as it was in 1870; it is of different configuration and much larger. Yet the future still depends on the great fact that science creates a need for science, solving one problem only to create another, which it solves in its turn. Steam transport brought an alleviation of the distress that followed the Napoleonic wars; something else will be found to give an issue out of present afflictions. Though Sir CHARLES MORGAN does not say so, we may make a safe prophecy as to what that agency in engineering will be.

Sir CHARLES illustrates his thesis most interestingly by comparison between the traffic conditions in London in 1870 and in 1920. Means of public locomotion in Inner London in the former year were provided by the original underground railways (still under construction) by steamers, by horse cabs, by omnibuses, and by the suburban lines of the main railway companies. The population of Greater London was 3 813 632 and the journeys per head of population were 16 on the railways and 11 on the omnibuses. In the fifty years which have since elapsed, the suburban lines have been extended, tube railways have been built, the original underground and the tramways have been converted to electric traction, and the motor omnibus has been developed. In 1920 the population of Greater London was 7 460 000, a 95·61 per cent. increase over 1870, and the number of journeys per head of population had increased to 93 on the railways, 143 on the tramways, and 125 on the omnibuses. The increase since 1900, when the construction of the tube railways was begun in earnest is particularly striking. It shows a 129 per cent. increase on the railways, 175 per cent. on the tramways, and 205 per cent. on the omnibuses. The mileage of the local railways was in 1920 108 and of the tramways 350. In 1870 twenty trains per hour was considered a good showing on the Metropolitan Railway, but this has been doubled owing to the introduction of electric traction and automatic signalling, while a modern motor omnibus provides six times the accommodation of the old horse bus.

Unfortunately there is a reverse to the picture; and this reverse may be summed up in the word congestion. Commercial road transport occupies much more of the road than formerly, and severely obstructs other traffic while loading or discharging. Shorter hours of work and increased density of population means a sharper peak and complicates the problem. But as Sir CHARLES MORGAN says, the problem has been created by engineers, and is for engineers to solve by building arterial roads, reconstruction of docks, the greater use of mechanical handling appliances, and in other ways. In fact, the engineer has no cause for pessimism, for work will come to him from two never-failing sources—from the obsolescence and supersession of existing work, and from entirely new inventions.

The electrical engineer especially has no reason for despondency. Though Sir CHARLES MORGAN is not so enthusiastic about the part which electricity can play as we should like to see him, he quite rightly points out that electricity has done much towards the developments which have taken place, and adds that wireless telegraphy and telephony, and even the development of electricity in its applications to power are yet in their early stages. Without electricity the present efficiency of the Metropolitan Railway could not have been attained, and the working of the tube railways would have been impossible. At the same time, and there we disagree with him, he does not think the application of electric traction to main line traffic is a practical proposition. That, of course, remains to be seen; we only remark that similar prophecies have often been made, only to be falsified in the event. One thing, however, is certain, there is no reasonable limitation to further advance and progress.

The state of mind of the young engineer should therefore be optimistic rather than pessimistic. He has tasks in plenty to perform: Simplification, organisation, and reconstruction; he should perform them cheerfully. Compared with

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his prototype of 1870 the advantage is all on his side. There is more to do, and thanks to improved educational facilities he is better equipped for doing it. But the necessity still remains for consistent hard and continuous work to obtain knowledge of the practical side of his profession, and the proper application of his theoretical and scientific education to it. The combination of the two, with such moral qualities as rectitude and fairness, is absolutely essential. On their part we feel the great Institutions might do more to smooth the way of the young man who enters the professions that they represent. The communion with the older men that they provide is a great thing, the facilities for education are a still greater. But greater still is the work they can do in making the public realise the obligation it is under to the engineer, and in securing proper recognition for his services no less than his aims and objects.

Current Topics.

Electricity in the West Riding.

In dealing with the recent annual report of the Electricity Commissioners we drew attention to the difficulties that they had had to face in reorganising the West Riding (Aire and Calder) District. Here purely engineering considerations were complicated by political motives; in other words, the claims of the parish pump had been allowed to assume a preponderance altogether out of proportion to their true importance. These difficulties are reflected in the scheme which was published last week, too late for comment by us. Bradford, Halifax, Huddersfield, Leeds, with the surrounding boroughs, are made a reserved area from which the Yorkshire Power Co. and the Electrical Distribution of Yorkshire Co. are excluded, except in so far as the former will be called upon to supply it with electricity in bulk. In the rest of the district the Power Co. is to hand over its distributing powers to the Electrical Distribution of Yorkshire Co. and become a generating and transmitting concern pure and simple. The district is to be ruled by a Joint Authority of the usual complexion in which the municipal element dominates, and the Joint Authority is to be advised by an Engineers' Committee. The transmission lines of the Power Co. in the reserved area are to be acquired by the Joint Authority on Inland Revenue terms and the other cables and lines at an agreed price. The two companies are made responsible for electrical development in the portion of the district outside the reserved area, and existing purchase powers exercisable by local authorities are transferred to the Joint Authority and are suspended until 1966, when they will be effected on Inland Revenue terms. If they are not exercised then they may be exercised at any time thereafter on six months' notice on tramway terms.

Words and Deeds.

We suppose that the Commissioners have made the best of a bad job, but we do not like the arrangement at all. The position was one not unlike that in the London and Home Counties district, with the difference that the ramifications of the Power Co. were much more widespread. The suggested arrangement has the advantage from the Power Co.'s point of view that they are free to develop, though in a smaller district, and at the same time, possessing as they do the only really large station in the district, they will be in a dominating position as regards generation. On the other hand the warring elements will be left to go their own way and will be assisted by the complicated and varied purchase clauses. If the scheme does not work out well the Commissioners will naturally be blamed, as they have been over the impasse in the London and Home Counties District. For instance, Sir Harry Renwick, speaking at the recent annual meeting of the Provincial Electric Supply Committee, said that the Electricity (Supply) Act of 1922 had not done much to help matters forward. There was a general reluctance to set up joint authorities and the tendency was all against nationalisation. The Commissioners had the sympathy of the industry in their onerous task. We dare say we are right in saying that the Commissioners would prefer a gill of active assistance to many pints of such sympathy. Of that assistance they have much too little from the London companies or from anyone else. They are the body constituted by Parliament to administer a law. They should not be hampered in their duty. If Sir Harry Renwick is not satisfied, he must try and get the law changed so that we can go back to the state of muddle that existed before the war. But that will not bring about true electrical development any more than will the high prices for electricity that exist in many places.

Sir Oliver Lodge on Atomic Theory.

In his presidential address, delivered to the Röntgen Society last week, Sir Oliver Lodge dealt with the problems of atomic theory, and gave a useful historical outline of the work which has led up to present conceptions of atomic constitution. He said that quanta certainly explained the observed phenomena better than any other conception, but he warned his hearers not to extend this theory of discontinuity to space or time. Quanta might be brought into harmony with dynamics by supposing that the nucleus of an atom was in rotation about its axis at a speed comparable with the velocity of light and that the ether contained a constitutional rotation upon which, when a pair of electrical units were somehow generated, two equal opposite rotations were superimposed, one in opposition to the original rotation, giving the net result zero; the other in the same direction, giving a result slightly nearer to the velocity of light than before and conceivably enough to produce what would be otherwise the mirror-image of the electron—a mass 1 850 times as big. If that idea were unacceptable, he suggested that round the nucleus there was a circulation very intense close to it and decreasing with the distance according to some law which had nothing to do with the laws of gravitation or electrical force. In such a whirl there might well be strata where the speed would obey the inverse square law, and these strata might be called electrical levels and be separated by intervals measurable in quanta. In this way the quantum and dynamical theories might be reconciled. It is a pity that Sir Oliver was not able to put forward his theories at the British Association meeting as he had originally intended, and we shall look forward with interest to criticisms that will be made upon it.

A Broadcasting Disability.

Drake and Gorham have done the electrical industry a good turn by calling attention, in a letter to "The Times," to the interference caused to broadcasters by ships' stations. Some vessels, it is pointed out, delight to use their full power in transmitting on any but the allotted wave-length, and the result is detrimental to wireless development. The complaint has received no direct official reply, but "The Times" has also published a letter from Mr. B. H. Tubbs giving extracts from correspondence between the Post Office and Col. W. W. Ashley, M.P., in which it is stated that interference with broadcast reception in the vicinity of coast stations is unavoidable and that the operations of these stations cannot be curtailed so long as they comply with the International Radiographic Regulations. Ships must keep to the bands allotted to them to effect communication, and if they use others, disciplinary action is taken. The power used must vary with the conditions, and to require all ships to use modern apparatus would be impossible for financial reasons. Of these explanations the first requires a little comment. If ships can only communicate on one wave, disciplinary action because they use another would be unnecessary. The fact probably is that other waves are used occasionally, and that this is

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the cause of the trouble. Communication from ships is of course more important than broadcasting, but at the same time, if proper arrangements are made, there should be room for everybody. As DRAKE and GORHAM rightly point out, the selectiveness is at present insufficient to overcome the difficulty, but it is in this direction that a solution will probably be found. In dealing with this point in his address to the Wireless Section of the Institution of Electrical Engineers Mr. E. H. SHAUGHNESSY remarked that interference could be much reduced by the use of rejector circuits or by the employment of tonic train transmission. We hope that further an examination of these possibilities will be made so that the interference which Mr. SHAUGHNESSY seems to think inevitable, may at least be reduced to a minimum.

Broadcasting Amateur Trading.

ON another page of this issue we publish an article giving some general criticism on the All-British Wireless Exhibition which is now open at the White City. On the selling side the broadcasting business has always seemed to us more like selling cameras and gramophones than the products of high-power electrical engineering, and, therefore, we have waited with interest and some little anxiety to see whether it would be adequately handled by selling organisations used to big electrical contracts or the cold-blooded sale of "supplies" to wiring contractors. Our own impressions and the remarks of non-technical people upon the present wireless exhibition give us a nasty, chilly feeling and a conviction that all is not well. We wonder if many of the firms now in the broadcasting industry really went in for it seriously or whether, without proper thought, they allowed themselves to indulge in a side line which looked like easy profits? And we wonder whether those profits have materialised? Certain it is to our mind that if broadcasting is to become the tremendous thing it can be made it must emerge from the present rut. Firms not really interested should leave it alone, and the others should embark on it with a realisation of what is involved in presenting to the general public a wonderful new power which can only become available to them when the manufacturer produces simple, cheap and attractive apparatus which is reliable in use and inexpensive to maintain, and when the general public and the retailer understand something of the limitations of wireless and of the way to instal and care for the apparatus.

The Coming Election.

Now that Mr. Baldwin has thrown down the gauntlet it is of no use wasting good time in futile discussions as to the wisdom or otherwise of a General Election. The thing, as Mr. Neville Chamberlain remarked not long ago regarding a matter of even greater national importance, is "to set our teeth" and make the best of it. It must be a bad situation in which we can find nothing to be thankful for, and through the present *contretemps* there vibrates a very pronounced note of thanks that the pother is to be limited to something less than a month. Within the next three weeks the country may expect to be treated to the sharpest conflict between the political parties experienced for many years, the battle-cries being the old ones of Protection and Free Trade. The purely political aspect of the contest will cause us, personally, no sleepless nights, particularly as we are placing the utmost reliance on the reiterated assurances of our daily contemporaries that the Premier is honest—though why such emphasis need be laid on a virtue supposed to be inherent in the British character may be a little difficult to understand. Whatever the outcome of the fight at the polls, it is perfectly plain that the great need of the nation to-day is a big trade expansion, carrying with it, as it would, a solution of the grave problem of unemployment. The country is more concerned about the attainment of that goal than the choice of paths leading to it.

Trend of Trade.

It is to be hoped that the conditions thus brought about will not seriously retard the steady upward trend that has recently been manifesting itself in the trade of the country. In spite of many grave handicaps to industry, there is no doubt a feeling of optimism is spreading, and that this is by no means unjustified is apparent from a glance at the figures of the official trade returns for October. The improvement, particularly in the export department, is fairly general, while electrical machinery, apparatus and kindred manufactures make notable contributions to the substantial increases shown in the grand totals. It is perfectly true that the electrical industries escaped the severity of the slump experienced by the country generally in recent years, but they still have a good deal of leeway to make up, and whilst the present improvement is something to be thankful for, it can only be regarded as an earnest of that which it is hoped will come before very long.

Artistry in the Home.

ON the suggestion of our contemporary, the "Cabinet Maker," the "Daily Telegraph" is inaugurating a home-making competition which will be open to all residents in the London postal area of British nationality who live in houses of a rateable value of less than £150, or in flats of lower rental than £250. The idea is excellent not only in its inception, but for the impetus it will give towards more artistic and more comfortable homes. As the editor of the "Cabinet Maker" points out, men and women take a pride in such things as their motor-cars and their golf handicaps, and they might with more justification take a pride in the furnishing and arrangement of their homes. This competition should stimulate that interest. From the electrical point of view the matter is of great importance. Artistry without comfort is barren. Comfort without artistry reduces the benefit of that psychological effect which comes from the contemplation of good design and colour, of furniture designed to fulfil its purpose most efficiently, and of the pleasant appearance of the rooms as a whole. In fact, comfort and artistry must be combined in order that the ideal may be even approached. In making that approach easier electricity can be of the greatest assistance. Whether it be in lighting or in the use of labour-saving appliances, or in the employment of heating apparatus, it can help the search for better decoration and furniture easier and render the ultimate result more pleasing and more enjoyable. We shall watch the results of this competition with the greatest interest, and congratulate our contemporaries on their enterprise.

Electric Cooking and the Young Idea.

We have recently called attention to the important place which demonstration should play in the development of the greater and greater use of electrical domestic equipment. This demonstration may usefully take place in a showroom, but if it can be effected in the home so much the better. There is, however, an intermediate place which should not be neglected, especially having in view how important it is that the younger generation should be well acquainted with the electric idea. This intermediate place comprises the numerous training institutions throughout the country where cookery is taught as part of the curriculum. The housewife is conservative by nature. What she has been taught to use she will use, and a great deal of persuasion will be needed to make her change. At present most of these educational institutions are equipped with Victorian coal ranges or gas cookers, so that when the pupil in due course becomes a housewife she looks upon these as the only apparatus worth considering and is with difficulty convinced of the contrary. It should therefore be a part of the electrical propaganda, which everyone now recognises as necessary, to see that all these institutions are fitted with electric cookers and other apparatus, and that both teachers and pupils are made acquainted with their advantages.

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ROTARY CONVERTER TRANSFORMERS.

Design Influenced by Necessity of Providing Reactance.

By G. BERG.

Rotary converters are usually specified either without voltage control, in which case the transformer supplying the rotary is provided with tappings for plus or minus 5 per cent. voltage variation, or with plus or minus 5 per cent. *gradual* voltage control.

This variation may be obtained by :—

(*a*) Field regulation with series reactance.
(*b*) A synchronous a.c. booster.
(*c*) An induction regulator.
(*d*) Extra taps on the transformer.
(*e*) Regulating or split poles.

The comparative merits of these methods are continually under discussion, but, for the voltage variation specified

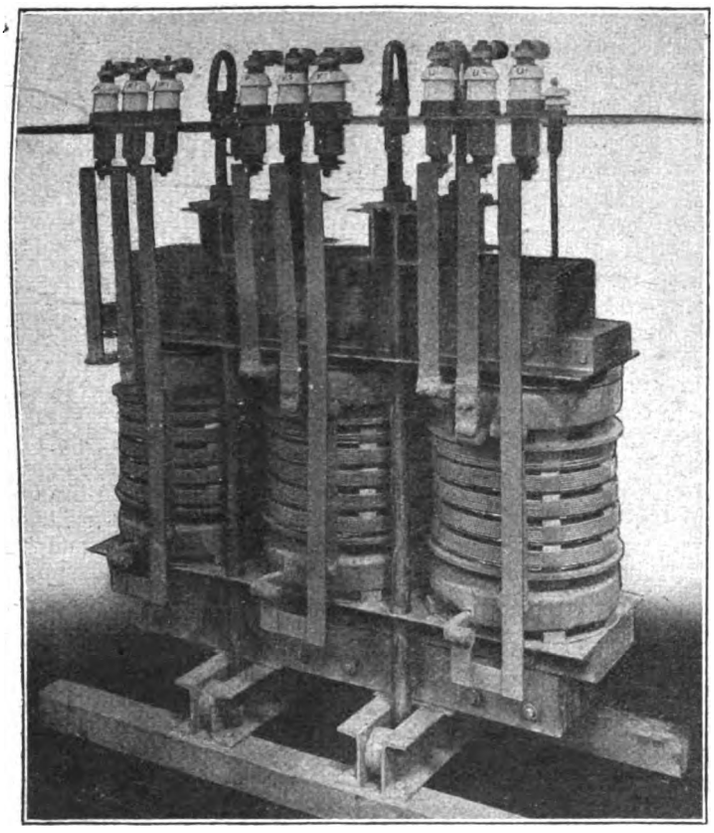

FIG. 1.—ROTARY CONVERTER TRANSFORMER. VIEW FROM THE L.T. SIDE.

above (i.e., ± 5 per cent.) which is the one most commonly met with, field regulation with series reactance in the armature circuit is used by most manufacturers, on account of its cheapness and simplicity. This method of voltage regulation does not necessitate any variation in the size of the rotary, except such as may be necessary to accommodate any extra field copper which is required to provide the necessary increase in field ampere turns.

In the transformer, however, the case is different, as the normal reactance of standard power transformers is insufficient to give the necessary reactance consistent with a reasonable no load wattless current in the converter armature. On the one hand this no load current should be kept down on account of armature heating, but, on the other hand, too high a reactance decreases the overload capacity of the converter ; the converter designer, therefore, usually makes a compromise between the two, and limits the lagging current at no load to about 30 or 40 per cent. of the full load current. This necessitates a full load reactance voltage of between 20 and 10 per cent.

As a standard power transformer has only about 5 per cent. internal reactance, the solution that suggests itself at once is the introduction of reactors in series with the transformer. This method has, however, the great disadvantage of being expensive for the following reasons : From the manufacturer's point of view, these reactors are equivalent to small transformers having an output of the order of 10 per cent. of the output of the main transformer. As for such small outputs the *price per kVA* is about twice that for the main transformer, the price of the reactors may reach about 20 per cent. of that of the transformer supplying the rotary ; in addition, the extra space taken up and the extra losses in the reactors are also important. In most cases, therefore, the reactance is supplied by the transformer.

With core type transformers the designer has the choice between (*a*) concentric windings and (*b*) sandwich windings.

In the case of concentric windings, the distance between the h.t. and l.t. windings would have to be so great and the proportion of copper and iron weight so abnormal, in order to give the required reactance, that the transformer would become very expensive, owing to the loss of space and the uneconomical utilisation and proportions of the active materials. Iron is therefore usually introduced, in the form of "reactance packets," between the l.t. and h.t. windings in order to increase the permeability of the leakage paths. This method has the disadvantage of still requiring a large distance between the high and low tension windings, as reactance packets have to be worked at a low flux density in order to prevent saturation at overloads ; it also makes the transformer assembly a difficult task unless every part of the transformer is manufactured with extreme accuracy.

In the case of sandwich windings, the necessary reactance may be obtained without loss of space and without reactance packets, by making a true sandwich, i.e., by placing the whole h.t. winding between the two halves of the l.t. winding (see Figs. 1 and 2). From the practical point of view, this arrangement is ideal, as it makes coil assembly an easy matter, which is an important consideration in case of repairs on site ; it also enables l.t. tappings to be brought out without difficulty.

Like everything in life, however, this ideal arrangement has a drawback ; it entails fairly high additional copper losses. The author has also found considerable difficulty

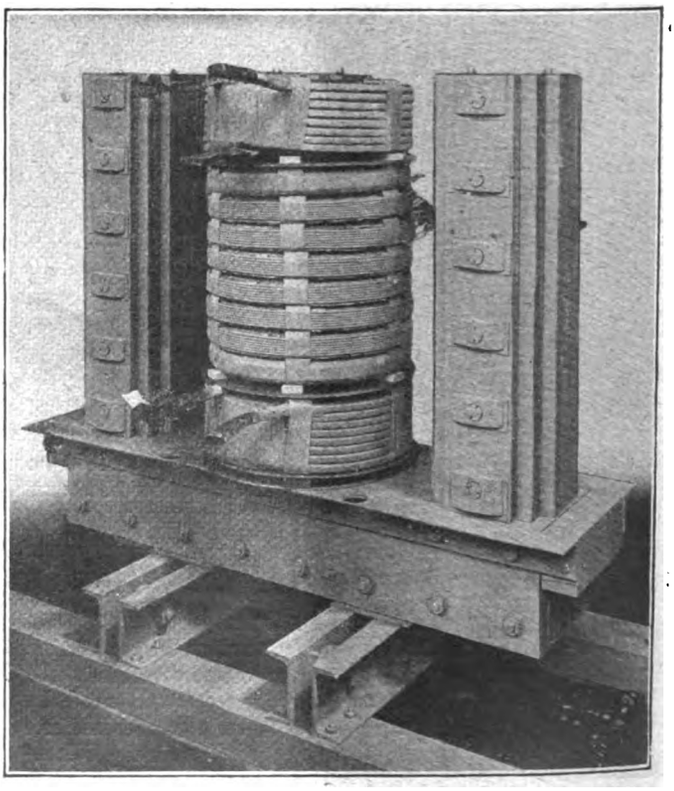

FIG. 2.—ROTARY CONVERTER TRANSFORMER IN COURSE OF ASSEMBLY.

in predetermining the reactance of this type of winding, as the formula proposed by Kapp, Arnold and others gives an inaccuracy of the order of 100 per cent. He has therefore been obliged to study the leakage of this particular type

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of winding in order to deduce a suitable formula for its reactance.

The object of this article is to describe the method employed and the results obtained.

In order to determine the distribution of the lines of force in the leakage field, direct current was sent through the winding on one limb of the transformer shown in Fig. 1, and adjusted to give equal but opposite ampere turns on the h.t. and l.t. windings. By means of a pilot needle, the path of the lines of force was reproduced on a vertical cardboard perpendicular to the plane of the three cores of the transformer (see Fig. 3). It will be seen that, with a slight modification, the lines of force of Fig. 3 may be represented by straight lines and quarter

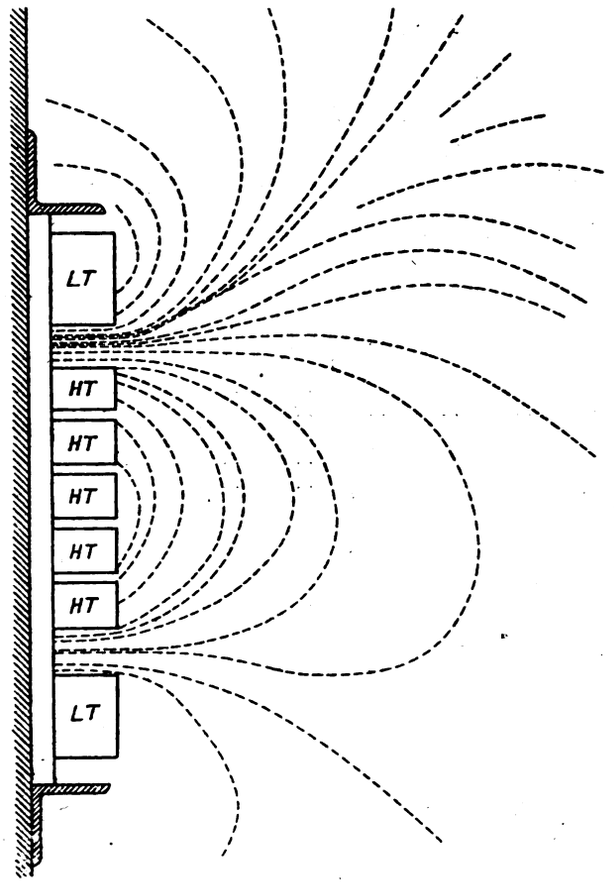

FIG. 3.

and half circles (see Fig. 4). The straight lines are perpendicular to the core and extend from the core to the exterior cylindrical surface of the coils. The circles belonging to one coil are concentric, their centre being situated—in the case of the extreme coils—on the extreme periphery of the coils (A), and—in the case of the central coil—on the central periphery of the coil (F).

In calculating the reluctance of the leakage paths, the portion situated beyond the plane represented in section by AA' will be neglected (see Fig. 4). This is justifiable, as the greater part of the lines of force enter directly into the yokes and flanges situated near that plane, and as the reluctance of the paths followed by the other part of these lines of force is small compared to the reluctance within AA'. It will be seen later on that this assumption enables us to leave the exact position of the planes of separation represented in section by CC' undetermined which simplifies the calculation.

The h.t. winding situated at the centre of the core is usually divided into several coils (see Figs. 1 and 2). This may or may not be the case for the two halves of the l.t. winding. In the following investigation it will be assumed that the whole h.t. winding and the two l.t. half windings are not subdivided; thus giving only three coils per core—namely, one h.t. and two l.t. coils.

An element of the l.t. leakage flux will be considered, represented in section by EE' (see Fig. 5). This element is situated at a distance x from A and has a thickness δx; it encircles the whole core, thus forming a closed curved ring. The flux inside the ring is radial as shown by EX.

As the thickness of the coils is small compared with their diameter, it may be assumed that the circumferential length of all parts of the ring is the same and equal to the mean turn length of the coils (l_m).

The radial permeability of the ring EE' is given by

$$P_{EE'}=\frac{l_m\,\delta_x}{L+\frac{\pi}{2}x}$$

calling t the number of turns per cm. height of coil and i the current passing through the coil, then itx are the ampere turns acting on the element EE' and the flux produced ($\delta\Phi$) in the ring EE' is given by

$$\delta\Phi=\frac{0{\cdot}4\pi\, itxl_m\delta x}{L+\frac{\pi}{2}x}$$

To obtain the flux between X and B we integrate this expression between Δ and x, where Δ is the height of the coil (see Fig. 5).

i.e. $$\Phi_{XB}=0{\cdot}4\pi itl_m\int_x^{\Delta}\frac{x}{L+\frac{\pi}{2}x}dx$$

$$=0{\cdot}4\pi itl_m\left[\frac{2}{\pi}x-\left(\frac{2}{\pi}\right)^2 L\log\left(\frac{\pi}{2}x+L\right)\right]_x^{\Delta}$$

$$=0{\cdot}4\pi itl_m\frac{2}{\pi}\left[\Delta-x-\frac{2}{\pi}L\left\{\log\left(\frac{\pi}{2}\Delta+L\right)-\log\left(\frac{\pi}{2}x+L\right)\right\}\right]$$

In this expression L is the mean distance between the core and the exterior cylindrical surface of the coil.

The flux between B and C (Φ_{BC}) is given by

$$\Phi_{BC}=\frac{0{\cdot}4\pi\, itl_m\Delta a}{L+\frac{\pi}{2}\Delta}$$

where a is the distance between the extremity of the coil and the plane of separation of the flux (see Fig. 5).

The flux between X and C (Φ_{XC}) is then given by

$$\Phi_{XC}=\Phi_{XB}+\Phi_{BC}$$

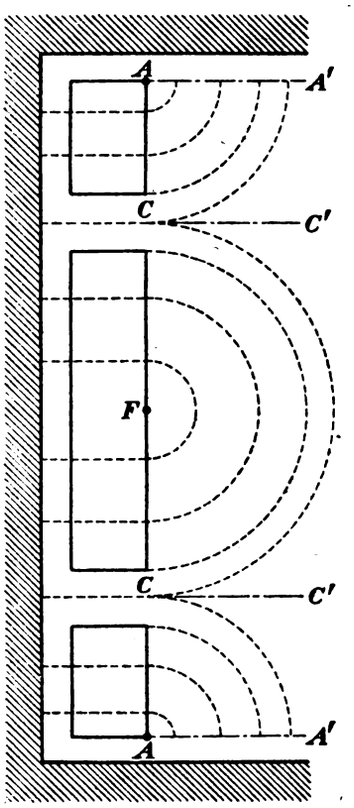

FIG. 4.

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$$=0{\cdot}4\pi itl_m\left[\frac{\Delta a}{L+\frac{\pi}{2}\Delta}+\frac{2}{\pi}\left\{\Delta-x-\frac{2}{\pi}L\left[\log\left(\frac{\pi}{2}\Delta+L\right)-\log\left(\frac{\pi}{2}x+L\right)\right]\right\}\right]$$

This flux induces in the turns contained in the element δx an e.m.f.

$\delta e=4{\cdot}44t\,\delta x f\Phi_{XC}\,10^{-8}$ *V*, where f is the frequency of the supply.

Substituting for Φ_{XC}

$$\delta e=4{\cdot}44\,tf10^{-8}\,.\,0{\cdot}4\pi itl_m\left[\frac{\Delta a}{L+\frac{\pi}{2}\Delta}+\frac{2}{\pi}\left\{\Delta-x-\frac{2}{\pi}L\left[\log\left(\frac{\pi}{2}\Delta+L\right)-\log\left(\frac{\pi}{2}x+L\right)\right]\right\}\right]\delta x$$

In order to simplify the expression, we shall put

$$k=4{\cdot}44tf10^{-8}\times0{\cdot}4\pi itl_m.$$

By integrating the expression between o and Δ we obtain the total E.M.F. induced in the coil by the leakage flux.

$$e_1=k\int_o^{\Delta}\left[\frac{\Delta a}{L+\frac{\pi}{2}\Delta}+\frac{2}{\pi}\left\{\Delta-x-\frac{2}{\pi}L\left[\log\left(\frac{\pi}{2}\Delta+L\right)-\log\left(\frac{\pi}{2}x+L\right)\right]\right\}\right]dx$$

$$=k\left[\frac{\Delta^2 a}{L+\frac{\pi}{2}}+\frac{2}{\pi}\left\{\frac{\Delta^2}{2}-\frac{2}{\pi}L\left[\Delta-\frac{2L}{\pi}\log\frac{\frac{\pi}{2}\Delta+L}{L}\right]\right\}\right]$$

Putting $C=\frac{L}{\Delta}$ we obtain

$$e_1=k\left[\frac{\Delta^2\alpha}{\Delta\left(c+\frac{\pi}{2}\right)}+\frac{2}{\pi}\left\{\frac{\Delta^2}{2}-\frac{2}{\pi}c\Delta\left[\Delta-\frac{2c\Delta}{\pi}\log\left(\frac{\pi}{2c}+1\right)\right]\right\}\right]$$

$$=k\Delta\left[\frac{a}{c+\frac{\pi}{2}}+\frac{2\Delta}{\pi}\left\{\frac{1}{2}-\frac{2}{\pi}c+\left(\frac{2}{\pi}c\right)^2\log\left(\frac{\pi}{2c}+1\right)\right\}\right]$$

Now the main flux Φ also induces in the coil an e.m.f. of value

$$E_1=4{\cdot}44\Phi t\,\Delta f10^{-8}\ \text{V}$$

or introducing k into the expression,

$$E_1=\frac{k\,.\,\Delta\Phi}{i\,0{\cdot}4\pi itl_m}$$

The leakage reactance voltage as a percentage of the main voltage is then given by

Percentage $e_x=100\,\frac{e_1}{E_1}$

$$=\frac{100\times0{\cdot}4\pi itl_m}{\Phi}\left[\frac{a}{c+\frac{\pi}{2}}+\frac{2\Delta}{\pi}\left\{\frac{1}{2}-\frac{2}{\pi}c+\left(\frac{2}{\pi}c\right)^2\log\left(\frac{\pi}{2c}+1\right)\right\}\right]$$

Making a similar calculation for the central h.t. winding we arrive at the same result. This was to be expected, as Fig. 4 clearly shows that each half of the h.t. winding is in the same condition as regards leakage flux as a l.t. coil.

By assuming that the ampere-turns of the h.t. and l.t. windings are equal and exactly opposed in phase (this is practically true) and taking l_m as being the mean of the h.t. and l.t. mean length of turn (the radial thicknesses of the h.t. and l.t. coils being usually nearly the same, and, further, the internal diameter of the coils being large compared to their thickness, this assumption is very nearly true) we may easily add the expressions obtained for the h.t. and l.t. percentage leakage reactance. We then obtain for the *total* leakage reactance as a percentage of the main induced voltage

Percentage $e_x=$

$$\frac{100\times0{\cdot}4\pi itl_m}{\Phi}\left[\frac{a+b}{c+\frac{\pi}{2}}+\frac{2\Delta}{\pi}\left\{1-\frac{4}{\pi}c+\frac{8c^2}{\pi^2}\log\left(\frac{\pi}{2c}+1\right)\right\}\right]$$

calling $\Delta_x=a+b$, AT the h.t. ampere-turns *per core* and substituting $\frac{AT}{2\Delta}$ for it, we obtain

Percentage $e_x=$

$$\frac{100\times0{\cdot}4\pi\,ATl_m}{\Phi2\Delta}\left[\frac{\Delta e}{c+\frac{\pi}{2}}+\frac{2\Delta}{\pi}\left\{1-\frac{4c}{\pi}+\frac{8c^2}{\pi^2}\log\left(\frac{\pi}{2c}+1\right)\right\}\right]$$

Simplifying, substituting a decimal log. for the natural log. and introducing an empirical constant *, we finally obtain :

Percentage $e_x=$

$$\frac{150ATl_m}{\Phi\Delta}\left[\frac{\Delta e}{c+1{\cdot}57}+\frac{\Delta}{1{\cdot}57}\left\{1-1{\cdot}27\,c+1{\cdot}87\,c^2\log_{10}\left(\frac{1{\cdot}57}{c}+1\right)\right\}\right]\qquad(1)$$

In this expression

AT = h.t. ampere-turns *per core*.

LM = mean length of turn (in cm.).

Φ = maximum flux (in C.G.S. units).

2Δ = height of one extreme coil plus half the height of the central coil (in cm.) (†).

Δ_e = distance between h.t. and l.t. coils (in cm.).

L = *mean* distance between core and exterior cylindrical surface of the coil (in cm.).

$c=\frac{L}{\Delta}$

EXAMPLE : Considering the case of the transformer represented in Fig. 1, for which the following characteristics exist :

H.t. current per phase	20 A.
Number of h.t. turns per core ..	414.
Mean length of turn (lm.)	98 cm.
Flux (Φ)	3·85 by 10^6 C.G.S. units.
Height of the central coils	22 cm.
Height of one extreme coil	7·2 cm.
Mean radial thickness of the coils ..	5 cm.
Mean distance between the core and the *interior* cylindrical surface of the coils	2·2 cm.
Finally, distance between the central and one extreme coil (Δe)	3·7 cm.

This gives the following values :—

$$AT=20{\cdot}6\times414=8540.$$
$$\Delta=1/2\ (7{\cdot}2\times22/2)=9{\cdot}1.$$
$$L=5+2{\cdot}2=7{\cdot}2.$$
$$C=\frac{L}{\Delta}=\frac{7{\cdot}2}{9{\cdot}1}=0{\cdot}79.$$
$$1{\cdot}57+C=2{\cdot}36.$$

We then have

Percentage e_x

$$=\frac{150\times8{,}540\times98}{3{\cdot}85\times10^6\times9{\cdot}1}\left[\frac{3{\cdot}7}{2{\cdot}36}+\frac{9{\cdot}1}{1{\cdot}57}\left\{1-1{\cdot}27\times0{\cdot}79+1{\cdot}86\times0{\cdot}79^2\log_{10}\left(\frac{1{\cdot}57}{0{\cdot}79}+1\right)\right\}\right]$$

$$=3{\cdot}59\,[1{\cdot}57+5{\cdot}79\,\{1-1+0{\cdot}55.\}]$$

$$=17{\cdot}1.$$

The percentage leakage reactance on test was 19 per cent.

This formula may be considered as the exact formula for calculating the leakage reactance of the type of transformer considered.

As in the preliminary stage of the design, it is often necessary to ascertain the approximate leakage reactance without knowing the exact values of the coil dimension, we shall indicate below the extent to which the leakage reactance is influenced by some of these dimensions.

It has been seen that L stood for the mean distance between the core and the exterior cylindrical surface of the coils. It is interesting to note that, by slightly modifying the value of the constant in equation (1), L may be replaced by L', L' being equal to the mean radial thickness *of the coils* ; the distance

* This empirical constant was derived from a large number of tests, some results of which are given in Table 1. Its justification lies in the fact that it is " constant constant " as may be seen from Table 1 where the fourth column shows a maximum difference of 11 per cent. between calculation and results observed on test.

† It should be noted that this height includes the spaces due to the subdivision of the windings into coils separated by oil or other insulating mediums.

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which separates the coils from the core may be neglected. We shall call the corresponding value of C: C_1

thus $$C_1=\frac{L'}{\Delta}$$

the formula becomes then:

Percentage e_x

$$=\frac{135ATlm}{\Phi\Delta}\left[\frac{\Delta e}{c_1+1{\cdot}57}+\frac{\Delta}{1{\cdot}57}\left\{1-1{\cdot}27\,c_1+1{\cdot}87\,c_1^2\log_{10}\left(\frac{1{\cdot}57}{c^1}+1\right)\right\}\right] \quad (2)$$

For the previous example we have

$$L'=5$$

thus $$C_1=\frac{L'}{\Delta}=\frac{5}{9{\cdot}1}=0{\cdot}55$$

substituting these values in equation (2) we obtain:

Percentage e_x 17·4, which only differs by 2 per cent. from the results obtained by formula (1)

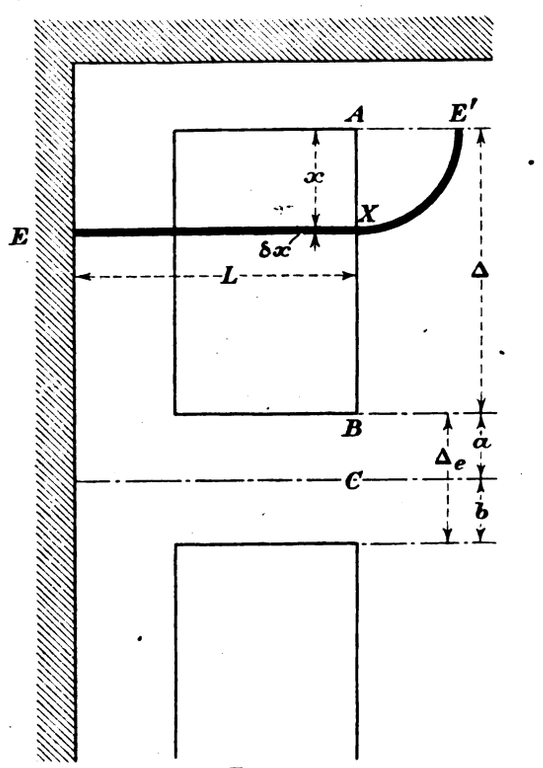

FIG. 5.

It is also interesting to note that a variation of about 10 per cent. in the value of Δ hardly influences the result.

Thus we saw that Δ includes the oil spaces separating the h.t. or l.t. coils. If we then neglect these values—i.e., if we measure only the effective height of copper, the values found for the leakage reactance will not appreciably differ from the one previously found.

This new value is called Δ′

In the previous example, the height of copper of the h.t. winding was 18·3 cm. (the height including oil ducts was 22 cm.) and of the l.t. winding: 7·2 cm.

therefore $$\Delta'=1/2\left(7{\cdot}2\text{ plus }\frac{18{\cdot}3}{2}\right)$$

$$=8{\cdot}18\text{ (in the previous case we had: 9·1)}$$

substituting this value in formula (2) we obtain:

Percentage $e_x=17{\cdot}5$, which hardly differs from the value obtained with Δ.

(For other transformers compare columns 5 and 6 of Table 1.)

The above formula may be entirely calculated on the slide-rule without difficulty. For the designer, however, who has to calculate daily the leakage reactance of several transformers it has the disadvantage of being cumbersome.

To overcome this drawback, the author has deduced a shorter formula by making certain simplifications, especially as regards the flux distribution. It has been assumed that:

1. The path of the leakage flux *inside* a coil is perpendicular to the core (as we have done before) and equal in length to the thickness of the coil (L').

2. The magnetic leakage field *outside* a coil, which we have previously represented by concentric circles, may be replaced by an equivalent system in which all the lines of force have the same length, this length being equal to the height of the coil concerned.

The total length of a line of force is then given by $L'+\Delta$ (compare Fig. 5).

The formula becomes then:

$$\text{Percentage } e_x=25\times10^{-6}\,\frac{ATlm}{\Phi}\left(\frac{5\Delta_e+3\Delta}{L'+\Delta}\right) \quad (3)$$

Applying this formula to the previous example, we have

$$\text{Percentage } e_x=\frac{25\times8{,}540\times98}{3{\cdot}85\times10^6}\left(\frac{(5\times3{\cdot}7+3\times9{\cdot}1}{5+9{\cdot}1}\right)$$

$$=5{\cdot}43\times3{\cdot}24$$

$$=17{\cdot}7$$

This differs only by 7 per cent. from the test value obtained.

In order to justify the values chosen for the empirical constants, and in order to show the degree of accuracy obtained by the above formulæ, a table (shown below) has been drawn up giving for six different transformers the percentage difference between the percentage reactance obtained by calculation and on test.

TABLE 1.

Number.	KVA	Percentage reactance voltage observed on test.	Percentage difference between calculations and tests.			
			Formula (1)	Formula (2) using		Formula (3)
				Δ	Δ′	
1	215	16·7	2	3	2	−3
2*	220	19	−11	−9	−9	−7
3	550	39	1	1	1	0
4	555	24·4	7	9	9	0
5	580	25·4	0	0	−1	10
6	650	27·7	0	1	−1	−1

* The reactance of this transformer has been calculated above.

Summary.

Formula (1) Percentage e_x

$$=\frac{150ATl_m}{\Phi\Delta}\left[\frac{\Delta_e}{c+1{\cdot}57}+\frac{\Delta}{1{\cdot}57}\left\{1+1{\cdot}27\,c+1{\cdot}87\,c^2\log_{10}\left(\frac{1{\cdot}57}{c}+1\right)\right\}\right]$$

Formula (2) Percentage e_x

$$=\frac{135ATl_m}{\Phi\Delta}\left[\frac{\Delta_e}{c_1+1{\cdot}57}+\frac{\Delta}{1{\cdot}57}\left\{1-1{\cdot}27\,c+1{\cdot}87\,c_1^2\log_{10}\left(\frac{(1{\cdot}57}{c_1}+1\right)\right\}\right]$$

Formula (3) Percentage $e_x=25\times10^{-6}\,\frac{ATl_m}{\Phi}\left[\frac{5\Delta_e+3\Delta}{L^1+\Delta}\right]$

AT = H.T. ampere-turns *per core*.
l_m = mean length of turns (in cm.).
Φ = maximum flux (in C.G.S. units).
Δ_e = distance separating the h.t. winding from the l.t. winding (in cm.).
2Δ = total overall height of the half l.t. winding plus ½ total overall height of the central h.t. winding (in cm.).
$2\Delta'$ = net copper height of the half l.t. winding plus ½ net copper height of the central h.t. winding (in cm.).
L = mean distance between the core and the exterior cylindrical surface of the coils.
L' = mean radial thickness of the coils.
$C=\frac{L}{\Delta}$
$c_1=\frac{L'}{\Delta}$ or $\frac{L'}{\Delta'}$

These formulæ have given the author *a maximum* inaccuracy of 15 per cent. in the case of formula (1) and 20 per cent. in the case of the other formulæ.

This is a great improvement on the formulæ employed up to now, as these often gave an inaccuracy of 200 per cent.

As the proportions of the coils and other minor details vary with different manufacturers, the author cordially invites engineers having the opportunity of comparing the above formulæ with results obtained on test, to communicate to him the accuracy observed.

The author also wishes to take this opportunity of thanking the Constructions Electriques de Belgique for their permission to take the photographs illustrating this article.

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WIRELESS DEVELOPMENT.*

Progressive Valve Manufacture—Ship and Shore Stations Interference—Eliminating Harmonics—Some Experimental Results.

Perhaps the most striking recent development in radio work is that of broadcasting, and it is interesting to note that this country appears to have started its broadcasting under conditions which the directors of the Radio Corporation of America indicated in their Annual Report for 1922 as being essential for success. Many people thought that overhearing troubles, alternation and distortion would be too great to permit any large degree of simultaneous broadcasting, but the Post Office engineers have been able to select such good trunk lines for this purpose as to give the Broadcasting Co. every opportunity to exercise their skill and ingenuity. And these results could not be obtained in so short a time had broadcasting been in the hands of several groups and different authorities. Some months ago there were few satisfactory loud-speakers, but to-day, owing to the attention that has been given to the problem and the associated problem of low-frequency amplifiers, there is a much wider choice of satisfactory loud-speaking equipment. Considerable incentive has also been given to the manufacture of receiving valves, and a number of makers have successfully produced dull emitter valves consuming low-filament power.

The life of transmitting valves is steadily improving. At a station where ten valves were in use in 1921, 18 were renewed after an average life of 450 hours. In 1922 five valves were renewed after an average life of 1 000 hours, and this year three valves have been renewed after over 3 000 hours, while several have been in operation for over 5 000 hours. At another station 14 large glass valves have been working for over 4 000 hours, and only one has burnt out. These figures refer to actual working hours. All these valves are of the General Electric Co's make, and the increased life is due to improved manufacture and a better understanding of their management, especially the necessity of a constant filament voltage. A life of from 6 000 to 8 000 hours for the valves now in use may reasonably be expected.

Where Development is Marked.

There has also been marked development in the power output of individual valves. Some Western Electric Co. valves were installed at Northolt in July last and are still running. They are rated to give 1 000 kW at 10 000 V on the anode. Tests were carried out on three of these valves with 12 500 V on the anode for three hours and an output of 42·5 kW was obtained in the aerial, or over 14 kW per valve.

The Holweck valve is a type of water-cooled valve, in which all the parts are easily demountable and a pump is permanently attached to the valve while it is in operation. An input of 10 kW at 5 000 V on the anode has given an output of 8 kW of oscillating energy. A burnt-out filament can be renewed quickly at a low cost.

Valves should now be rated on their output power, anode volts and anode dissipation. The latter alone is no indication of the maximum output of the larger valves.

The interference of ship and shore stations with broadcasting reception has been the subject of some tests by the Post Office. A 1·5 kW spark transmitter was used in London and was adjusted to the correct wave-length with as good a resonance curve as obtainable. Signals could be received on a valve receiver at the North Foreland over a wave-band of from 470 to 850 m. The broadcasting programme from Birmingham (420 m.) was transmitted while this was taking place, and this station could not be satisfactorily received at Dollis Hill, Ilford or Grove Park. The interference could, however, be considerably reduced by the use of rejector circuits. Using the same aerial on the G.P.O. and a tonic train-valve transmitter 800 note, the North Foreland station was able to read signals over a band of from 470 to 750 m., but the maximum signal tuning was sharper than with the spark. The disturbance of the Birmingham reception on receivers not using reaction at all the places mentioned was about equal to the Birmingham signals. On using reaction at Dollis Hill the strength of Birmingham was considerably increased without affecting the tonic train disturbance. Comparisons of signal strength at the North Foreland using crystal reception showed that with 5 A in the aerial signals were readable on spark transmission and were not audible with the same aerial current on tonic train transmission. With a tonic train using 8·5 aerial ampères the signals were just audible, but dead weak at North Foreland. As most of the British and foreign ships are fitted with crystal receivers, it will be seen that changing to tonic train with the present power would considerably reduce the range of working. Using valve reception at the North Foreland the spark reception was only slightly stronger than the tonic train.

The second part of the address deals with experiences at the Leafield station. Arc transmission was chosen because the apparatus exceeded in power and efficiency any other proved type of high-frequency generator, and the patent having run out it could be obtained at a reasonable cost. At first complaints were received about harmonics, but these were reduced as the staff became more expert in handling the equipment. It was suggested that these harmonics were due to the type of aerial used. Another type of emission produces what is called the "mush," and with Leafield working at 9 000 m. this appears between 2 000 and 3 000 m.

Tests at Dollis Hill.

To improve these matters tests were undertaken at Dollis Hill, a distance of 101 km. from Leafield. Observations on the fundamental wave-length were carried out, using frame aerials, while those on the harmonics were made using a single-wire aerial 100 to 110 ft. high, and having a top run of about 150 ft. The signal from the emitting station was tuned in on the aerial until a maximum strength was obtained. A local oscillator of the same frequency of emission was then arranged to induce into a dummy aerial circuit of the same characteristics as those of the aerial, and the strength of the oscillation was observed in the same receiver. The local oscillator was adjusted until the signals were equal and the voltage induced in the dummy aerial was then the same as the voltage induced in the real aerial by the emitting station. From this voltage the known characteristics of the receiving station, the distance between the stations and the current in the emitting aerial the radiation valves required could then be calculated.

It is thought that the harmonic emissions are almost entirely due to the operation of the arc, and are not due to radiation from stay-wires of harmonic oscillation of the aerial, while the tests show that the aerial does not oscillate harmonically, but that emissions are due to forced oscillations set up in the aerial by the operation of the arc, and this was confirmed by changing the fundamental wave-length to other values and re-testing. The tests also show that the energy wasted in harmonic radiation is a negligible percentage of the total radiation, being 0·000194 kW on the second harmonic 4 525 m. when 3·95 kW are being radiated at 9 050 m. It is, however, important to know that such a small amount of radiated power can cause interference. It has been suggested that the permissible undesirable emission from a transmitting station shall be a percentage of the power of the station, and it may be that in future a fixed maximum amount will have to be decided upon for the largest stations.

What the Experiments Showed.

Experiments between Aberdeen and Stonehaven showed that when the primary of the coupled circuit was energised with the aerial and the secondary circuit disconnected weak fundamental signals but no harmonics were received, and this was considered sufficiently promising to make tests at Northolt, where a large arc with a 450 ft. aerial is installed. Observations at Dollis Hill, seven miles away, showed that with a coupled circuit the harmonics were practically eliminated, and "mush" was reduced to a negligible quantity. The wave-length at Northolt is 7 000 metres, and the coupled circuit has been installed for about 12 months. The Dubilier mica condenser in the primary circuit is subjected under working conditions to 30 000 V at a frequency of about 40 000, and has behaved satisfactorily. These results have encouraged the Post Office to proceed with a coupled circuit for Leafield, but the work is not yet completed.

It might be concluded from these remarks that a large arc is a disturbing element, but weak signals can be received at Banbury when Leafield is working on full power and reception from Cairo, and Marion is also possible at a distance of ten miles whilst Leafield is in operation. Neither are valve oscillators entirely free from harmonics.

* Abstract of an Address delivered by Mr. E. H. Shaughnessy to the Wireless Section of the Institution of Electrical Engineers.

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RECENT ELECTRICAL DEVELOPMENTS.

British and American Practice Compared—A New Winding System—Progress in Rolling Mills.

Mr. G. A. JUHLIN delivered his address as Chairman of the North-Western Centre of Institution of Electrical Engineers at the Midland Hotel, Manchester, on November 6th. A large portion of the address was devoted to a review of current electrical progress, particularly in America. He pointed out that ten years ago the largest turbo generator unit running at 3 000 revs. per min. was 3 750 kVA, whereas at present units developing 40 000 kVA at 1 500 revs. per min. and 18 750 kVA at 3 000 revs. per min. were in commercial operation, while some of 25 000 kVA at 3 000 revs. per min. were under construction. The returns of two large companies showed that in 1921 break-downs were less than 1 per cent., and this figure was decreasing. Much larger units had been built in America and Germany, but such sizes were indications of the nature of the demand rather than of the manufacturing resources. The total kilowatt capacity of plant ordered since 1912 had increased from 162 000 kW in that year to 405 000 in 1923, with a peak in 1920 of 736 000 kW.

The largest transformers so far built in England were the 19 500 kVA 3-phase 50-cycle sets for Barton and the 7 800 kVA single phase 25-cycle for Dalmarnock, both of the oil-immersed forced cooled type with water-cooled external oil coolers. British manufacturers had already ordered and delivered transformers for voltages up to 110 000 V.

In England armour clad designs had been adopted for systems up to 35 000 V, individual breakers having a rupturing capacity of 1½ million kVA. In American practice the phases were completely segregated from each other. Outdoor switchgear had been developed to suit outdoor transformers, which were now in operation for 22 000 V and 33 000 V, and in one case up to 66 000 V.

Great progress had been made in the electrification of rolling mills, and there were over 600 electrically-driven mills in 1921, the largest having a maximum rating of 21 000 H.P., but one half having a rating of 300 H.P. or above. Practically all the recent reversing mills were electrically driven. In the same year the United States had over 700 mills of 300 H.P. or above, totally over one million H.P. An interesting colliery development was the S.P. scheme for winders. A turbine was used to drive d.c. generators through gearing with a flywheel mounted on the shaft of the generators. The speed of the turbine was reduced by a special governor when a peak occurred and the flywheel was allowed to give out its stored energy.

Recent American Developments.

Machines were under construction in the States of 62 500 kVA capacity, 60 cycles at 1 200 revs. per min. The weight of the rotor was over 100 tons. Waterwheel generators of 45 000 kVA output had been operating successfully at Queenston, Ontario, for about two years. Five units were installed and five additional sets, each of 55 000 kVA output were under construction. On the American side of the Niagara Falls two sets were being installed, each of 65 000 kW, the rotor of one being built up of ten rings side by side, each weighing 40 000 lb., the diameter 23 ft., the total weight being over 700 tons. Comparing these figures with those of generators built in 1903 for the same company, in twenty years the size of individual units had increased 17 times.

The 220 000 V system of the South California Edison and the South Pacific Gas and Electric Co. has been put into operation. An oil switch on this system weighs 45 tons, and has over 2 000 gallons of oil per pole.

Perhaps the most remarkable recent development was that relating to systems of control by which the operation of a number of sub-stations might be supervised. Two methods of achieving control had been developed—audible supervision mainly for hydroelectric generating plants and sub-stations, and visual control for large systems with a number of large sub-stations. Under the audible system the supervisor could at any time put himself into telephonic communication with any station under his control by means of a specially developed keyboard and automatic dial. Pressure on a particular key would connect him to a particular station, and by audible signals he could ascertain the head of water, gate opening, etc. These signals were repeated automatically until the operator completed another dialing operation. When anything went wrong, warning was given by a high frequency current over the line which operated a loud speaker in the supervisor's office.

For visual control a definite numerical code was arranged for every operation in the sub-station. The signal for any desired operation could be transmitted by telephone keys operating relays, which in turn operated an automatic selector switch. Through this the code was transmitted to the station and de-coded by a similar selector switch which operated the required relays to perform the desired operation. Having performed the operation the relays signalled back to the supervisor the fact that the operation had been completed. Small lamps were used for this purpose, and the relays and selector switches were those used for standard automatic telephone work. The receiving circuit used in connection with the sender and the automatic sender in the sub-station would not respond to any incomplete or distorted code, and incorrect operation was almost impossible.

The Tramways Co. in Cleveland, Ohio, operated four automatic sub-stations also controlled by a supervisor located in the main offices.

Mr. Juhlin made the suggestion that the standard of papers before the Institution deterred many members from presenting their experiences, and suggested that papers be forthcoming from operating engineers, power users, mining electrical engineers and marine engineers; also he suggested more papers on actual workshop problems, manufacturing methods and shop organisation.

ENGINEERING TRAINING.

Some Informal Suggestions for Improvement.

At the first meeting of the Informal Section of the Institution of Electricial Engineers, the President, Dr. A. RUSSELL, opened a discussion on "Engineering Training." He said it was agreed that a student's training should be practical and theoretical, but the difficulty was to determine how long each should last. It was very important in the national interest that some of the best boys should be attracted into the engineering. The Public Schools aimed generally at scholarship and letters because successes here reflected glory on the school. Engineering success should be equally glorious. The idea of raising the status of the profession by stiffening the examinations was wrong. Clever boys were often eccentric and unable to pass exams creditably.

In the course of the discussion Lieut.-Col. W. A. J. O'MEARA said that the engineering profession had not attained the status it deserved largely because anyone might term himself an engineer. In many foreign countries this was not allowed.

Mr. P. M. BAKER advocated that workshop training should follow as closely as possible the actual routine of business so that students produced against cost rates.

Prof. C. L. FORTESCUE called attention to the remarkable sectionalisation of engineering in the past few years. We had administrators, research men, production men, salesmen, draughtsmen—and a few designers. He thought that some of the claims made for the field of the research man almost eliminated the engineer. Psychology should be taught to salesmen and to production men a knowledge of physiology and the muscular powers of operatives.

Dr. R. M. WALMSLEY said that he had been for eighteen years connected with the Senate of London University and in regard to some of the references to examinations he could not divest himself of responsibility, but the evils of exams as well as their inevitableness were recognised and the tendency was to modify them. He regarded engineering training as consisting of fundamentals that all engineers must know, whether they be designers, production men or salesmen.

Dr. F. T. CHAPMAN said that many forms of training produced good results, but the old system of five years' apprenticeship was no longer held to be adequate. A successful method for training one grade of engineer was apprenticeship combined with eight hours or so of day school training per week. Long periods of bench and lathe training were not essential for higher grade engineers.

Mr. W. DAY wondered whether the aim of training sometimes was to produce a certain degree of mental nimbleness instead of mental tools. He said the acid test of an engineer must always be what could he *do*, not what did he *know*. The employer required of his men character, capacity for work, energy and intelligence, none of which academic honours guaranteed.

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FIFTY YEARS OF LONDON TRAFFIC.*

The Use of Electricity—The Task of the Engineer to Solve the Present Tangle.

The profession of engineering is passing through very troublous times, and the young men who now enter it must sometimes be tempted to believe that it has entered upon a permanent decline and that they will never find that outlet for their energy and enterprise which any young man who has to make his way in the world is entitled to expect. There is, however, no cause to think darkly of the future, and it may not be inappropriate to consider the circumstances of the profession fifty years ago, to pass on to the circumstances to-day, and to look forward to those of to-morrow.

In 1870 the provision for public locomotion in inner London was by rail on the sections of the Metropolitan and District Railways, by steamboat, by horse-drawn omnibuses and cabs; and these means of travel were already being found inadequate for the needs of the public. The Great Eastern Railway Company must be given credit for being the first company to make special provision for the traffic from the outer suburban area. It was a bold policy, but it proved to be a sound one, and indeed proved the turning point in the history of that company. During the period 1870–90 many extensions of the inner and outer suburban lines were brought into use, including the Inner Circle Line in 1884, and the pioneer tube, the City and South London Railway, in 1890. In 1900 the City and South London line was extended, and the Central London Railway was opened, while since 1900 there have been rapid developments in the construction of tube railways, in the conversion of the tramways to electric traction, and in the development of motor omnibuses, while the approaches of all the main line railways to London have been greatly improved by widenings and additional stations.

Population Doubled.

In 1870 the population of Greater London was 3 813 632, while in 1920 it was 7 460 000, an increase of 95·61 per cent. In the former year the passengers carried on the "local" railways were 60 000 000 and on the omnibuses 42 935 471. In 1920 the passengers on the "local" railways were 722 586 489, on the suburban sections of main-line railways 401 000 000, on the tramways 1 065 788 631, and on the omnibuses 935 946 002, making a grand total of 3 125 321 122. The increase in the number of passengers carried in 1920 over 1870 was, on the local railways 1 104·3 per cent., and on the omnibuses 2 080 per cent., while since 1902 the traffic on the suburban lines has increased by 68·5 per cent., and since 1880 on the tramways by 1 544·3 per cent. The journeys per head of population show an increase of 129 per cent. on the railways, 175 on the tramways, and 205 on the omnibuses.

The foregoing returns give some idea of the passenger-traffic developments in the period under review, but the conditions which have been secured by additional carrying capacity and speed must be allowed for to arrive at anything like a true measure of the increased facilities. For instance, in 1870 the working of twenty trains per hour on the Metropolitan Railway was considered good, whereas to-day on certain sections the number has been doubled, this being possible principally owing to electric traction and automatic signalling, while the modern motor bus provides an accommodation equal, on a safe estimate, to about six of the old horse buses. The figures quoted, however, do not touch more than the fringe of the problem of road congestion, and when, in addition, the enormous increase of road traffic resulting from the general development of our trade is considered, it is clear that the problem is most urgent.

Vehicles engaged in commercial traffic are among the most serious causes of the present unsatisfactory conditions. Another cause is that the hours of work are less spread than formerly, and this concentrates the peak load of all means of transport upon shorter periods, while a further cause is the increasing density of the business population. The problem is serious, but the solution will bring work to engineers. Developments of engineering have created the problem; further developments will solve it.

Without electricity the present efficiency of the Metropolitan Railway could not have been attained and the working of our tube system would have been impossible.

But remembering the high efficiency of the present steam locomotives and their elasticity under load, the desirability as a commercial proposition of the application of electric traction to main-line traffic is very doubtful. Whatever may be the future of the electric traction on the railways in this country, it is most necessary that a common system should be standardised, so as to allow of free and complete interchangeability of rolling stock over the lines of the various railway companies. Trade has been hampered in the past by differences of gauge, and this should be a warning not to make any analogous error in our electrical systems.

The answer to the question of what lies ahead for the community in general, and for our profession in particular, lies in the fact that science creates a need for science. Steam transport came as an answer to the industrial revolution at the end of the eighteenth century and the beginning of the nineteenth century, but it has brought with it a quadrupling of the population, 75 per cent. of which in 1901 was living in towns. Road congestion is but an example of the problems created by this change, which it will be, in the future, the duty of engineers to solve. Work will come from two never-failing sources—from the obsolescence and supersession of existing work and from entirely new inventions.

The Victorian era created more problems than it solved. There is no sort of finality in the past, no reason to anticipate stagnation in the future.

During the nineteenth century discovery and development came so fast that they resulted in overcrowding, and often in confusion. It is our present task to unravel the tangle of social, political and imperial problems of a type and magnitude that were undreamed of fifty years ago. The task of the nineteenth century was to enlarge, to expand and to grasp at each new source of power and develop it, sometimes without full thought of social consequences, to its fullest extent. The task of the twentieth century is to bring back to life some of that order and leisure and spaciousness which was submerged in the too hasty tide of Victorian prosperity. Engineers who were largely responsible for that prosperity will be called upon to undertake the great task of simplification and organisation and reconstruction without which that prosperity cannot bear the fullest and best fruit. There is no reasonable limitation to further advance and progress, and our vastly improved educational advantages enable the best use to be made of our knowledge to-day.

* Abstract of Sir Charles Morgan's Presidential Address to the Institution of Civil Engineers.

THE "REDA" MOTOR.*

By B. KAMENSKY.

Hitherto it has not been possible to connect electric motors direct to the pumps used in borings and artesian wells, etc., because of the small diameters of such. In this service a motor would have to withstand breakdown during long immersion in water, oil, or other fluid; or work safely in an atmosphere of explosive gas. The "Reda" motor constructed by A. S. Arutünoff is intended to solve the problem: it is a water- and air-tight, enclosed, explosion-proof, high-speed three-phase motor, with an exceptionally large ratio of length to diameter. The motor is direct connected to the pump, and is placed within the well-bore. The large axial length and small diameter results in good cooling properties; the actual cooling is effected by oil-circulation under the action of a small pressure pump mounted on the shaft, the oil serving also for lubrication. The overload capacity is normal, and voltages range from the usual supply up to 2 000 V. In motors of more than 5 H.P. an automatic starting device is fitted, which includes slip-rings, brushes, brush-lifting gear and rheostats. Squirrel-cage rotors are used for smaller sizes.

In one particular installation aggregating 40 H.P., the motors work under water, without leakage, with a 2 000 V 50 cycle supply. The cooling is so good that the motors can operate satisfactorily even in water up to 80 deg. C.

Where the motors are arranged vertically below the pumps, the current is led down by an armoured cable, ending in a muff just above the pump. Motors are provided with obstruction chambers, operating on the back-pressure principle, to prevent damage through foreign bodies being drawn up with the water or oil. With average sizes the efficiency is of the order 50 to 60 per cent.

* Abstract of an article in the "Elektrotechnische Zeitschrift."

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ELECTRIFICATION OF A SHIPYARD.

Developments on the Tyneside—Installation of a Complete New Scheme—How the Yard is Equipped.

One of the best known names in North-East Coast shipping circles is Smith's Dock Co., who possess three large repair yards on the Tyne and one repair yard and one shipbuilding yard on the Tees. The whole of these yards are equipped with modern machinery, and considerable use is made of electricity both for power and lighting.

This article is concerned more particularly with the ship repairing yard of the firm at South Shields. Electricity has been used in this yard for some considerable time. Originally a 550 V d.c. supply from traction circuits was installed, but as this was found unsuitable for modern requirements it was decided to put in hand a complete new scheme of electrification, arrangements being made with the South Shields Corporation Electricity Works for a 2 200 V 50 cycle three-phase supply. This supply is brought to a sub-station which contains three transformers, two of 500 kW for power supply, and the third of 75 kW for lighting. The line voltage of the latter is 115 V. The incoming supply on the high tension side of the transformer is controlled by a steel boiler plate cubicle switchboard which comprises special interlocking arrangements to ensure a maximum degree of safety in operation. The isolating links are operated by a pull rod from the back, the link chamber being interlocked with the oil switch so that it is

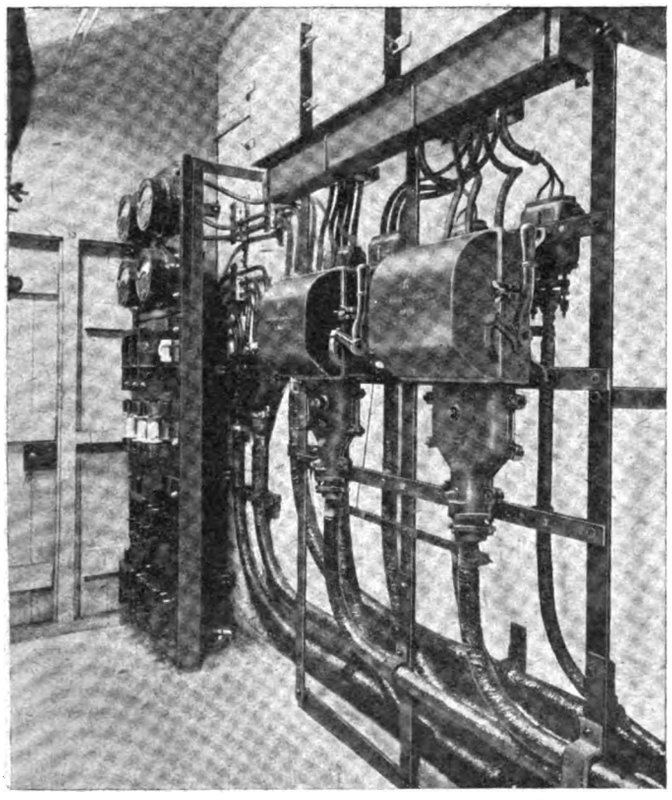

FIG. 1.—LIGHTING CONTROL PANEL AND ISOLATING SWITCHES.

impossible to open the door until the former is in the " off " position.

The voltage on the low tension side of the power transformers is 440 ; this is the pressure of distribution throughout the yard and workshops. For the lighting supply a main panel, shown in Fig. 1, is installed in a special compartment in the office block. By the side of this panel are two ironclad switches which act as isolating switches from the sub-station to the dock department.

The yard equipment includes smiths' shops, fitting shops, carpenters' shops, plumbers' shops, and so on, and throughout the whole of these shops electric motors, mainly of the squirrel cage type, are used for driving the various mechanical appliances. In the main, standard sizes of motors have been adopted, a large majority being either 15 or 30 H.P.

One of the exceptions to this rule is to be found for the main plate bending rolls, which are shown in Fig. 2. The main dimensions of these rolls are as follows :—Length 25 ft. 2 in., diameter of one large roll 15 in., and of two smaller rolls, 12 in. Plates 25 ft. long and 1 in. thick can be handled. Until a short time ago these rolls were driven by steam, but a considerable saving in space and cost has been effected by the installation of the electric drive. The motor driving the main rolls is 100 H.P., while the motor driving the screwing

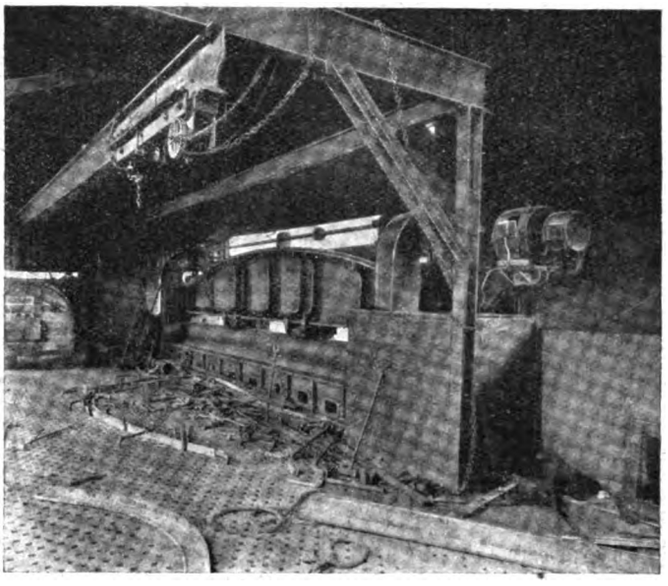

FIG. 2.—MAIN PLATE BENDING ROLLS, WITH 20 H.P. MOTOR DRIVING SCREWING DOWN GEAR.

down gear is 20 H.P., both machines being of the slipring type. The latter is clearly seen on the right hand side of Fig.2. The top of the former can be seen in Fig. 3, which shows how some of the control gear is accommodated in a shed. In the centre of the picture is a pedestal-mounted oil switch which controls the power distribution locally in the yard. To the right is the top half of the motor control unit for the 20 H.P. slipring motor. This consists of an oil circuit breaker and an oil immersed reversing drum type controller which is interlocked with the oil switch, so that should the breaker trip, the controller must be brought to the " off " position before the breaker can be closed again.

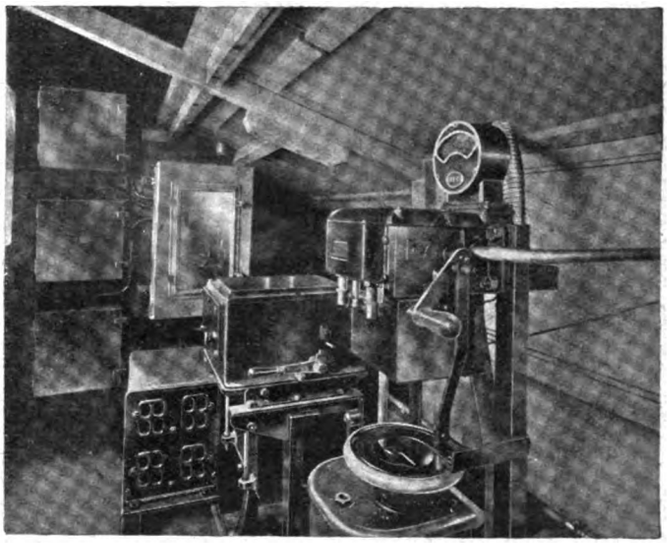

FIG. 3.—INTERIOR OF ELECTRIC CONTROL HUT.

The General Electric Co. acted as the main contractors for this scheme, and the whole of the motors, and switch and control gear, were manufactured at their Witton works. The main cabling and a large part of the auxiliary cabling being produced at the Pirelli Cable Works, Southampton.

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THE ALL-BRITISH WIRELESS EXHIBITION.

Some Impressions and Criticisms by a Technical Visitor.

By B. MITTELL.

The All-British Wireless Exhibition is being held in London, from November 8th to 21st, at the White City, close to the Shepherd's Bush station of the Central London Railway. Like previous wireless exhibitions, it is intended to appeal both to the public and to the trade. The three halls are well filled with exhibits, and, although organised primarily for the National Association of Radio Manufacturers, it seems to be fairly representative of the whole British Broadcasting industry. Readers of THE ELECTRICIAN who are interested in broadcasting are strongly advised to find time for a visit, in order to help them to make an estimate of the present position of things in this new industry. They will then be able to form their own judgment, which may or may not be in agreement with the impressions and conclusions now reported for the benefit of those not able to attend.

Few New Designs.

There is comfort for the absentee in the disappointment expressed by a number of visitors. Rumour had been active for some time, and great things were expected from the exhibition. It is certainly unwise to set limits to the possibility of achievement in wireless invention, but it is certainly as desirable to retain some commercial sense of proportion. Wireless seems to be perpetually beset by optimists (and others), whose extravagant claims might with some excuse be accepted by the layman, but should not without a full investigation sway the electrician. It is a good thing that, almost without exception, the exhibits make no extravagant claims. In some cases there seems to be no change of design since the spring and in most there are only small improvements towards better appearance and ease of control. Considering the serious slump in which manufacturers have been involved and the chaotic state of the regulation-ridden industry, the developments that are shown are to the credit of the individual firms responsible for them.

Viewed as a collective whole, the exhibition strikes the visitor as amateurish, the collective publicity being entirely inadequate. Obviously the broadcasting industry needs someone to preach the advantages of co-operation in a clear policy so as to carry a definite sales message to the public. If the exhibition had been confined to the trade it would have presented an excellent opportunity of doing good work by enabling manufacturers and retailers to exchange views in conference and to demonstrate the methods proved so far to be the best for displaying apparatus, attracting the public and installing sets. As it is, the display amounts merely to a row of booths pushing the wares of competitive manufacturers to a mixed audience of the trade and the public, all more or less in doubt as to the practical merits of the broadcasting idea, and seeking rather for plain and simple demonstrations of the cost, difficulty, and reliability of an installation than the relative technical details of the various sets.

On the first day of the exhibition the undeveloped state of the industry was obvious from the "picnic" atmosphere, the diffidence of the demonstrators on the stands, the lack of catalogues, and the fact that the representatives of more than one well known firm found it impossible to give any particulars or prices of some of their exhibits.

Items of Chief Interest.

Interest centres chiefly in the new valves of comparatively low energy consumption for filament heating, the systems of components on the "Meccano" principle for building sets, a few new sets and some special items in accessories. The new season's prices are now available, and it is observed that the general practice now seems to be to add the B.B.C. tariff at its net figure, allowing no trade discount on the item. By this procedure the difference in cost between home-built and ready-made sets becomes less.

Valves to operate satisfactorily on dry cells of normal dimensions are the most obvious need of the broadcasting trade. Hitherto the valves put forward for this purpose were hardly satisfactory. Their characteristics were in some instances uncertain, and there was no reasonable expectation of life for what was a fairly expensive article. Two types of valve are now becoming available, in which the filament energy is within the ability of a fairly large dry cell, to handle, and plans seem to have been made for supplying them in bulk. If we are correctly informed, by far the most important valve development, from the commercial point of view, is a *life guarantee*. Surely such a reform is most essential and long overdue in the interest of all concerned.

The grant of the constructor's licence has released a very considerable volume of business in the supply of systems for making home construction easy. A number of firms are showing fully-developed lines, with complete instructions. We predict some trouble for firms handling these lines if they do not make adequate provision for handling, without dislocation of their business, the flood of inquiries they are sure to receive when Jones Minor or the elderly curate are unable to stop their valves from oscillating, etc. Many of the exhibiting firms have some form or other of this idea: those making the most prominent display being Metropolitan-Vickers Electrical Co. (who have a most excellent and complete catalogue of wireless parts and call their line "Radiobrix"); the Polar people (Radio Communication Co.), with their "Polarbloc" system; and Peto Scott, who have long made a speciality of inexpensive sets of components.

Inexpensive Components.

Comparatively few new components of outstanding merit are shown, although there is a steady improvement in many of the well known lines, as for example, Igranic coil-holders and transformers. An inexpensive variable air condenser by the Formo Co. has a self-contained vernier condenser; it sells for 10s. in the 0·001 microfarad size and is made up in a small bulk through the use of vanes stiffened by concentric corrugations. Another variable air condenser of special merit is shown by the Sterling Telephone and Electric Co., well built, very nicely finished and having specially shaped vanes to give a regular increase of wavelength over the whole scale. This condenser is also sold mounted in laboratory fashion with an ivorine finely divided scale. Many of the component parts exhibited are of the cheap and nasty type, but they seem nevertheless to find a steady sale, particularly among school boys.

There are several three valve sets which give good loud speaking results at ranges of 50 miles or more. These are a good and reliable proposition for the man who does not seek very much volume and is content to tune his set with care. Good sets can be bought complete with loud speaker for £40, and the buyer is well advised to see that the full range of wavelengths can be obtained without the nuisance of changing coils. One particular set was credited with extraordinary results quite beyond what has so far been done by anyone else. It is unfortunate that no sets are available for demonstration and that the makers' works are too busy to admit of a visit for a trial there. Lacking further information, such a proposition should be approached with the utmost caution. The finish of the sets still leaves much to be desired, and designers should beware of pandering to a priggish feeling that looks do not count when the wonderful merits of their sets are considered!

In spite of makers' claims to the contrary, practically all the sets put forward for the reception of distant broadcasting require very careful and patient tuning, and with them the novice may get nothing. It is a sound policy to warn customers on this point, and if the local broadcasting is good, at least to recommend a simple set to them. Crystal sets with several stages of low frequency can be obtained to give extremely clear loud speaking results at a range of 25 miles. They are comparatively inexpensive, free from distortion when properly designed, and easy to adjust. They fulfil what is urged as a sound policy throughout broadcasting business, viz., modest claims and good reliable performance.

In an address to the Association of Electragists in Washington, Mr. J. F. Gilchrist, vice-president of the Commonwealth Edison Co., Chicago, said that it should be possible to sell $700 worth of appliances to the average residence consumer. As the rate was at present only $10 a year, it would be 70 years before these homes were equipped to any extent. Houses were being built faster than electrical men were equipping them.

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POWER STATIONS.*

Modern Practice Reviewed—Motor-Driven Auxiliaries.

By H. M. HOLLINGSWORTH.

The interests of the whole electrical industry are closely bound up with electricity supply. Optimistic prophecies of a universal cheap supply from "super-stations" have not yet been fulfilled, but there have been recently many advances in power station design. Developments in the use of very high steam pressures and temperatures indicate courage, and have outpaced the knowledge of metallurgists. Will the gain of the thermal efficiency be obtained only at the sacrifice of reliability? The test of service alone can answer this. The advent of extra high voltage cables of large carrying capacity has eliminated one factor governing choice of site—proximity to load centre. The factors of importance are:—abundant supplies of cooling water, facilities for railway transport, and large adjacent areas for storage of coal and disposal of ashes.

Station buildings are becoming standardised. Great importance is now attached to ventilation and adequate daylight illumination. Mechanical handling and conveying of coal is done in various ways. The great increase in size and outputs of boilers is noteworthy, units of 16 000 sq. ft. and 120 000 lb. actual evaporation are now in operation. In America capacities of 200 000 lb. evaporation are becoming common. Even with the present large boilers the space occupied is unduly great as compared with that devoted to turbines (about 1·75 to 1). Expert opinion considers a steam temperature of 750 deg. F. practicable, but there is some divergence of opinion as to the advantages gained. In twelve British stations total steam temperatures vary from 550 deg. to 750 deg. F. and steam pressures from 200 to 475 lb. per sq. in. In the latest American stations higher values are met with. Some experimental plants even run at 1 200 lb. per sq. in.

One of the Problems.

Preheating of air for combustion and other waste heat refinements are now being more widely used. Disposal of ash and clinker is still a problem and various methods of discharge have been developed. The increased flue gas temperature in high-pressure boilers has brought economisers into favour again. Many engineers hold that the highest overall efficiency lies in a compromise between feed water heating by stage bleeding and air and water heating by utilising the waste heat of the gases leaving the boilers. The general use of high pressures and temperatures has brought the question of feed water purification into greater prominence. The most perfect treatment with softening plants will not entirely prevent corrosion. Modern stations use a feed water circuit closed so far as possible from atmospheric contact so as to prevent aeration, and utilising degassing methods.

The modern tendency is towards 6 600 V, three-phase 50 cycles, with a maximum speed of 3 000 revs. per min. for general supply. In this country the size of sets has so far been limited to 30 000 kW at 1 500 revs. per min., and 20 000 kW at 3 000 revs. per min. In America where station capacities are larger sets up to 60 000 kW are in use. There have been many advances in large alternator construction, especially in obtaining more perfect ventilation, on the closed circuit principle. Practice tends towards the use of motor-driven auxiliaries. The electric drive has the advantage of lower first cost, more adaptability and greater economy; and it can be rendered as reliable as steam by duplication of motors supplied with energy from different sources.

Power station apparatus for controlling large amounts of energy is undergoing constant change in design, especially in view of the development of interlinking. The practice of direct connecting generators to step-up transformers, with control apparatus on the extra h.t. side, has led to notable advances in switchgear design. There are now oil circuit breakers in use at 33 000 V. It is usual to isolate the switch and transformer house from the main building, the gear being operated by electric remote control.

From data published by the Electricity Commissioners the maximum thermal efficiency does not reach 18 per cent. and shows little advance on the previous year. However, things are moving rapidly and we may realise sooner than expected the possibility of producing 1 kWh from 1¼ lb. of inferior coal.

*Abstract of an address to the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers.

CORRESPONDENCE.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

GAS v. ELECTRICITY.

[To the Editor.]

Sir,—1. May I beg the courtesy of a few lines of your space to correct a misapprehension indicated by a note in your publication of October 26th, in which I am drawn, I hope undeservedly, into a controversy under a title, you will agree, unworthy of a journal of standing.

2. You refer to an article of mine in the Gas Industries Number of the "Manchester Guardian Commercial Supplement," entitled "Metallurgy and the Gas Furnace," from which you quote a statement that "for the heating of small forgings and the heat treatment of small parts it cannot be said that the town's gas furnace should have any competitors, but it has such in the furnaces heated by oil, coke, coal and —who knows how soon?—electricity." Following this, my article is alleged to have contained an illustration of a battery of gas-fired boilers supplying water in a London municipal bath, surely a most appropriate subject wherewith to illustrate an impartial discussion on the scientific aspect of the gas furnace as it affects the metallurgist.

3. I wish to disclaim all responsibility for this illustration. It happened to be on the same page as my article, but it had nothing whatever to do with it, a fact which should have been obvious to anyone reading the article.

4. The metallurgical industry probably uses considerably more electricity for manufacturing purposes than it does town's gas—unfortunately I have no statistics on the point—and it is quite prepared to welcome the development of electricity for heat-treating operations and the like under economic conditions. But no metallurgist can wish to be drawn into a controversy of dubious title, bearing as it does on the respective merits of two great industries, both of which have contributed in such a marked degree to the advance of metallurgical practice.

5. I am most interested to learn that the battery of gas boilers in question has been substituted by an electrical installation, a matter in which, previous to having my attention drawn to your note I, had been neither concerned nor interested.—I am, etc. R. T. Sarjant.

Sheffield,
November 8th.

ENGINEERS AND PUBLICITY.

[To the Editor.]

Sir,—Referring to your editorial remarks on Engineers and Publicity in this week's issue, engineers are "doers," not "talkers." You cannot expect a good engineer to be an eloquent speaker, for he is not trained to talk, but to accomplish things. We leave the talking to the politicians—that is their job. Ours is to be of some service to mankind.—I am, etc., H. C. Silver.

New Malden,
November 10th.

[Mr. Silver takes a very narrow view of the duties of an engineer.—Ed. E.]

Electric Welding Tests.

To ascertain the relative merits of riveted as compared with electric-welded tanks, four steel tanks, 4 ft. in diameter and 10 ft. long, made of mild steel plates, were tested under hydrostatic pressure by the American Bureau of Standards. The tanks were designed for a stress of 16 000 lb. per sq. in., at a working pressure of 200 lb. per sq. in. Two of the tanks were butt-welded, one was lap-welded, and the fourth was of the ordinary lap-riveted construction. The ends of the tanks were spherical, having a radius of 4 ft. Strain gauge measurements were made at various portions of the tanks and at pressure increments of 50 lb. per sq. in. until failure. Unfortunately, secondary failures such as leaks round the fittings rendered the tests rather inconclusive. But some of them might have been avoided by better welding and greater reinforcement.

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ELECTRIC COOKING*

Its Effect on Power Station Loads—A Swedish Example—"Hours of Embargo."

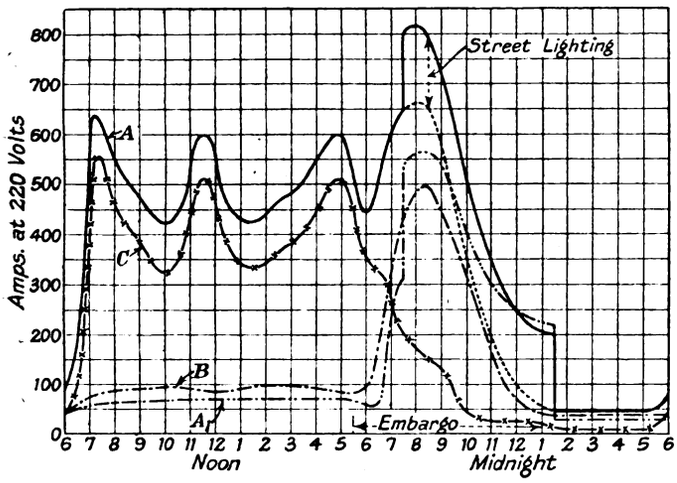
By CHARLES HÄSSLER.

Electric cooking has become more and more important during the last few years, and great interest is now being taken in it. Hitherto the question has been discussed mainly from the point of view of comparison between the advantages of electricity, gas and coal for the purpose, and the convenience, construction and life of the apparatus. With the growth of electric cooking it becomes necessary to investigate its influence on the loading of the various parts of a system.

The question arises: How will the cooking load influence the system, both at the station and in the distribution and service loads? The following account of the Djursholm supply system, which for many years has encouraged the introduction of electric cooking, may be given.

Djursholm is a district in the neighbourhood of Stockholm (Sweden), composed mainly of superior class residences. The electricity supply was started in 1911 with direct current at 2×110 V, the feeding lines being buried, and the distribution being by overhead wires. To control the cooking load a double tariff was initiated with special "hours of embargo" at the time of maximum lighting load. The cooking and lighting consumptions are separately metered.

The generating station supplies energy for interior and street lighting, and for cooking; the motor load is small. Observations have shown that the mean yearly consumption for interior lighting is 190 kWh for each service tapping. The cooking consumption averages 1 750 kWh per service point per year, i.e., nearly ten times the lighting load. The cooking consumption naturally varies with the number of persons supplied from one service, as the following table will show:—



Number of persons.	3,	4,	5,	6,	7,	8,	9,	10.
Cooking consumption per person per year:	605,	567,	340,	460,	258,	206,	280,	240 kWh.

The mean value is 323 kWh per person per year, i.e., about 0·9 kWh per person per day. The cooking consumption during the hours of embargo is about 20 per cent. of the total.

Of more importance than the energy consumptions are the relative peak loads due to cooking and lighting respectively. The load can be measured at Djursholm, and subdivided approximately to give the cooking and lighting consumptions. The figure shows such a subdivision for a normal day in September, 1920. It will be noticed that the cooking load *C* is very high, and has three distinct peaks, in the morning (7-8 a.m.), at noon, and at 5 p.m. The curve *A*, for total consumption, shows the great importance of the cooking load on the output of the station. Comparison should be made with curve A_1, for September, 1915. At this time there were no electric cooking appliances installed, and the curve is therefore typical of an ordinary lighting station.

From observations it was found that with the double tariff the maximum cooking load per point in the time between 3 p.m. and 10 p.m. in the winter months was 0·44 kW, and the yearly consumption per point was about 1 750 kWh, corresponding to about 4 000 hours use; further, that lighting furnished a maximum load of 0·152 kW and a yearly consumption of 190 kWh, corresponding to about 1 250 hours use.

It is seen that with the double tariff, a peak load can be transferred to the morning hours if the number of cookers connected is sufficient; the load is then much more uniform over the day, which is very desirable.

The cooking consumption loads up the distribution lines and feeders, so that for supply systems which are already fully loaded for lighting, and for whom the cost of enlarging cables is prohibitive, it will be necessary to institute some means whereby the cooking load can be much reduced at the times of peak load, in order to keep these peaks within limits. By thus distributing the output more uniformly over the day, the cables can take the extra load during otherwise slack times.

It is interesting to note that of 1 000 consumers on the Djursholm system, about 225 have all electric cooking arrangements, and after only five years of propaganda; it should be understood that the customers are comparatively well to do, and further that there is no gas supply. The curves and examples indicate that the most desirable number of consumers taking cooking loads is in the present case about one third of the total. With this number the peaks would be as nearly as possible equalised.

The remarks in the foregoing do not apply to heat storing apparatus, but only to direct-acting heat elements. The former imposes a totally different load on the system, as in normal circumstances it is always connected to the supply. The consumption of such ovens of average size (i.e., for four to five persons) is from 350 to 500 W. If automatic arrangements were fitted to cut out the heat storing apparatus during times of peak lighting load, an effect on the loading of the system should be obtained somewhat similar to that described.

* Abstract of an article in the "Elektrotechnische Zeitschrift."

REVIEW.

Principles and Practice of Wireless Transmission.

By G. PARR. (London: Ernest Benn, Ltd.) Pp. 163 5s. net.

I suppose there are people who know nothing of electricity, and still some who have no intention of knowing anything about it. But, generally speaking, the younger generation, possessed of a secondary school education, knows something of the hows and whys of electricity and is not content to see electric light and trams without having some idea of how electricity is generated.

This very numerous class should provide a wide circulation for Parr's recent book on the "Principles and Practice of Wireless Transmission" if they can be brought to believe that it is a book which they can understand and which does not involve the months of painful study appropriate to a ponderous volume or standard treatise which its title rather implies. The title might be improved so as to encourage the dabbler and not to disappoint those seeking something heavier. The book is attractively bound and printed, and the reader finds himself being led pleasantly and rapidly through a very well and lucidly written introduction to those principles of electrical engineering which are involved in a knowledge of some of the principles of wireless transmission.

Since some knowledge of the electron theory is thought necessary for an understanding of the valve, the book begins right away to talk about electrons as being minute particles whose movement constitutes a current of electricity. This is a good idea.

The preliminary sections carry numerical examples in every case, and to me they seem perfectly clear and very much more valuable than simple descriptions which shirk coming to grips with units and dimensions. How far the general reader will agree has yet to be seen, but the attempt is to be commended.

The descriptions of Wave Motion and Electromagnetic Radiation are among the best that I have seen, but after this point the author seems to have been hurried or oppressed by space limitations. In some 74 small pages of large type he tries to explain the spark system and the several methods of C.W. transmission, including telephony. The treatment must obviously be sketchy, and it is; although the author can be seen struggling to give the same thorough treatment as in the beginning of the book and only yielding a half-hearted assent to the obvious fact that the space makes it impossible.

B. MITTELL.

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ALL BRITISH WIRELESS EXHIBITION.

(*Concluded from page* 519).

MARCONI'S WIRELESS TELEGRAPH Co. are displaying a full range of Marconiphone wireless receivers and voice amplifiers together with Sterling and Amplion loud speakers. The sets include the Marconiphone new crystal junior set, which is a greatly improved modification of the earlier model. The Marconiphone valve crystal set is also a very neat and compact apparatus for amateur use. It has a considerable range and is produced in a form which makes it very handy and portable. The Marconiphone V.2 set is a two-valve instrument capable of receiving all the B.B.C. stations from any part of the British Isles, while the Marconiphone V.3 (Fig. 11) has a highly selective three-valve receiver possessing sufficient amplification

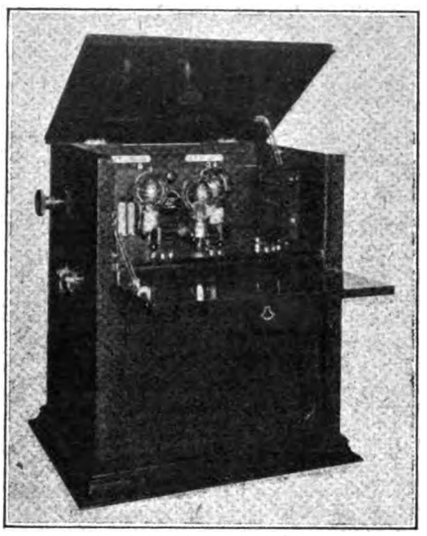

FIG. 11. VIEW OF THE MARCONIPHONE V. 3 RECEIVING SET.

to operate a loud speaker direct at moderate ranges. It can be connected to a voice amplifier if long distance reception on a loud speaker is desired. The apparatus can be embodied in a cabinet of special design which incorporates a loud speaker as well as batteries and other accessories. An even more sensitive set is the Marconiphone V.4, which has four valves. The Marconiphone voice amplifiers shown are said to give distortionless magnification of very weak signals, rather than great volume of sound, and to attain this end has been the primary consideration in the design. The Marconiphone frame aerial table (Fig. 12) has a unique form of frame aerial incorporated in it of artistic design. It has been expressly designed for the Marconiphone multivalve sets.

Special features on the stand of the ASHLEY WIRELESS TELEPHONE Co. are the "Claritone" loud speaker and a new type of headgear which has been designed to be extremely comfortable to wear and hygienic to use. The ear pieces of this head set are of moulded ebonite; the pole pieces being moulded solidly into the ear pieces, while each ear piece is quickly removable from the stirrup. A lever adjustment prevents the ear cap from swivelling too far round. The loud speaker has been designed on the principle that weak signals can only be satisfactorily transformed into sound if the air gap is correspondingly reduced and the magnet brought nearer the diaphragm, at the same time preserving parallelism. In the "Claritone" loud speaker this adjustment is provided for by a radial lever which projects through a slot in the base. The firm are also showing a very complete series of accessories which have the very interesting feature that they are each packed in a small carton together with a small pamphlet of instructions on the working of the components, and that each component is guaranteed. This should be a great advantage, not only to the trader but to the user.

The SOLIDITE MANUFACTURING Co. are showing a complete range of their moulded insulation parts which they make a speciality in supplying to customers' own drawings or models. These include knobs, valve-holders, transformers and condenser parts.

It is perhaps hardly too much to say that the success of the average wireless set depends on the batteries employed, and for this reason visitors to the exhibition may well pay attention to the stand of FULLER'S UNITED ELECTRIC WORKS, LTD., where the firm's celebrated wireless "block" batteries are to be found in many forms. It is claimed for these batteries that in intermittent use they give practically twice the service at one charge as does the ordinary plate type of the same rated capacity. The block construction largely eliminates the risk of internal shorting and sulphation. Other wireless apparatus to be found on this stand include iron-clad transformers of various types, which, owing to their patented construction, are immune from interaction effects, filament resistances which are designed to occupy similar space to that occupied by the valve socket, potentiometers, valve holders, coil holders, condensers and insulators. All these accessories are correctly designed, well-finished devices, in which every feature has been carefully studied with a view to obtaining really satisfactory results.

The MARCONI SCIENTIFIC INSTRUMENT Co. are showing a portable receiver which is entirely self-contained, the aerial being in the form of a loop arranged round the inside of the lid, while the batteries and phones are placed in special compartments. Ease in transport is effected by the use of an accumulator of the non-spillable type. The instrument is of the six-valve type, three of the valves being used for high frequency amplification, one as a detector and the others as note amplifiers. The set is operated with the lid in a vertical position, and the directional properties of the aerial necessitate its operation in a position pointing towards the transmitting station it is desired to receive. The heterodyne wave meter is another of the company's products, which has been designed to meet the requirements of the discriminating amateur and experimenter. The wave length ranges of the different coils are controlled by a variable condenser of 0·001 micro farads capacity, and the set comprises four coils of range lengths ranging from 150 to 4 000 metres. The Sybarite in wireless receiving sets has been catered for by the five-valve cabinet set which is designed on the lines of sensitiveness combined with simplicity of operation. Two valves are used for note magnification, and these are

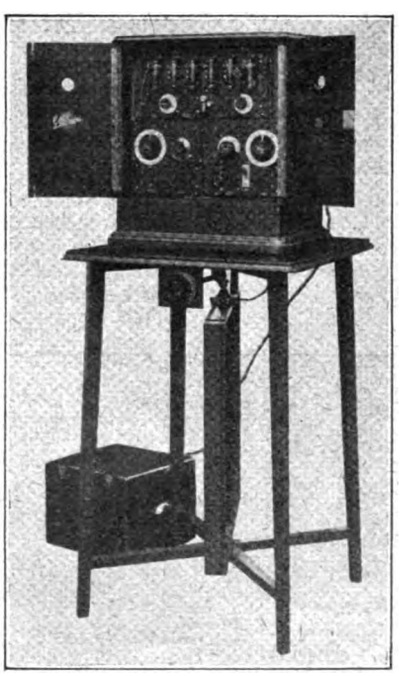

FIG. 12. MARCONIPHONE MULTIVALVE SET ON FRAME AERIAL TABLE.

connected through a three-position barrel switch so that three, four or five valves can be used at will. A change-over switch is provided so that either telephone or loud speaker may be employed. External connections are effected by means of plugs which are so designed that no accidental misconnections can be made.

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Collapsible frame aerials are in some districts an essential part of the broadcaster's equipment. The collapsible frame aerial which McLELLAND AND Co. are exhibiting will therefore be of interest. It can be erected or folded in three seconds. A coil holder incorporates a switching device which does away with the necessity of shorting the coil holder when reaction is not in use. This firm are also showing a number of wireless accessories, including variometers of the standard and anode types, a wavemeter, which is a combination instrument principally designed for measuring or transmitting waves, and which by a simple switching can be converted into a crystal receiving set for use over the broadcast range, a tuner for valve sets, a capacity measurer, or a variometer alone. Terminals are fitted which allow the instrument to be used as a "wave trap."

ABBEY INDUSTRIES are showing a comprehensive range of receiving sets and accessories of their own design and manufacture. These include a miniature set upon which broadcasting has been clearly received by users 30 miles away, It costs only 10s. 6d. There are also more normal crystal and valve sets, including a new range which will allow of full reaction, as well as accessories of all kinds. An interesting apparatus is the "Abbindaerial," an indoor aerial equipment which can be erected in five minutes, and is specially designed for use in flats.

W. VANSTONE, LTD., are showing examples of their "Stanophone" receiving sets, included among which are single and two-valve amplifiers. The feature of these amplifiers is the special circuit used, which it is claimed gives absolute distortionless reproduction. A popular model made by the firm contains two valves, and is fitted with a non-radiating variable-reaction. Under normal conditions all the B.B.C. stations can be heard on this set, as well as the Hague and Continental stations. Attention has been paid to simplicity of adjustment. An apparatus of interest to many is the interference rejector, which, when fitted to any receiver, will cut out the local broadcasting station and leave the set free to receive from other stations. We are informed that this rejector functions quite satisfactorily within 400 yd. of 2LO.

HARWELL, LTD., are essentially a firm who supply components and materials of interest to amateurs and constructional manufacturers. They are showing a large range of mica, micanite sheets, mouldings, tubes and washers, together with Bakelised paper, ebonite sheets and other forms of insulators. They are also exhibiting an insulating material known as Belleroid, which is made by Barrett and Elers, Ltd., and is a composition similar to ebonite suitable for voltages up to 20 000 V. It is non-hygroscopic, unaffected by weak solution of acids, alkalis and oils, and has the great advantage over most insulating materials of being unaffected by a constant temperature of 300 deg. F.

No exhibition would be complete without an exhibit of the RAWLPLUG CO., and wireless constructors will find this useful little accessory no less adapted to their needs than to those of many other class of workers. Rawlplugs are, of course, particularly suited for use in connection with the erection of aerials.

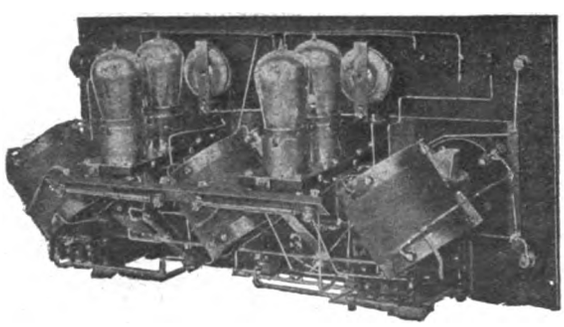

FIG. 13. VIEW OF A NEUTRODYNE RECEIVING SET.

The HAZELTINE NEUTRODYNE RADIO SETS, LTD., are showing a range of instruments which make use of the well-known Hazeltine neutrodyne circuit. The instruments are enclosed in a polished wooden case with a sliding glass front, all the exterior connections being so arranged that the instrument can be closed up after the adjustments have been made. Terminals have been reduced to a minimum for the sake of simplicity. A view of one of these sets is given in Fig. 13.

Our readers are already so familiar with the wireless products of the STERLING TELEPHONE AND ELECTRIC CO. that it seems hardly necessary to say more than that their stand is full of examples of their receiving sets, loud-speakers, amplifiers telephone condensers, transformers, detectors and variometers. Attention may, however, be called to their No. 2 crystal receiving set, which is a variometer-tuned instrument capable

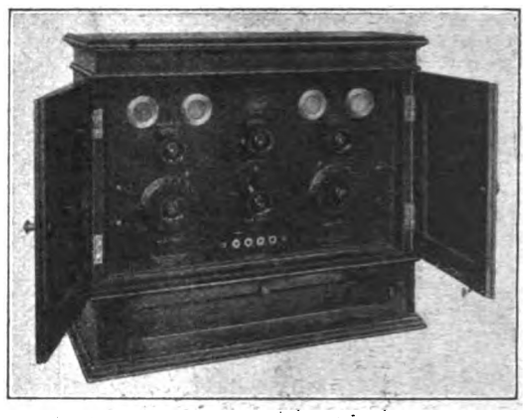

FIG. 14. A STERLING 4-VALVE LONG RANGE SET.

of receiving broadcast messages within a range of about 30 miles. It is fitted with a semi-automatic crystal detector, which is capable of rapid adjustment, and being entirely enclosed is not subject to oxidation. A metal panel which acts as a screen against disturbances is fitted. Fig. 14 shows a typical Sterling valve set.

On the stand of C. DAVENPORT special attention is centred on a new headphone of exceptionally light construction with adjustable headband, and carefully manufactured headpieces. The magnets are specially prepared steel, and are wound to 1 000 Ω, giving a total resistance of 4 000 Ω. It is claimed that reception is both true and undistorted with this headphone, which will be marketed through the trade at 17s. 6d. per pair.

In the new "DW3" regenerative reaction set, three anode coils replace the ordinary tapped anode. These are controlled by one special anti-capacity switch. The reaction coil operates on the particular anode coil in circuit. Aerial tuning is carried out by means of a Lissen tuner with variable air condenser, whilst the anode circuits are tuned by a 0·001 variable air condenser with vernier plate and separate control. Separate filament control is fitted individually to each valve by means of a combined valve holder and filament rheostat, The main control switch connects the h.t. and l.t. batteries, or alternatively disconnects the set and switches aerial to earth. The panel is handsomely mounted in an enclosed cabinet of Jacobean design, whilst all terminals are at the rear of the panel. It is claimed that with this set all British Broadcasting stations can be received, under good conditions, on a loud speaker, whilst the range also includes The Hague, Paris and Berlin broadcasting.

Amongst the accessories exhibited are the new aluminium shielded condensers, which are of sound construction. The valve holders and valve adaptors include one which enables V. 24 valves to be plugged into the ordinary four pin valve holder, and another which enables duolateral coils to be plugged into a four pin valve holder when this is used for high frequency transformer purposes. There are also reactance capacity couplings and anode resistances of a new plug-in type, which enable resistance to be used for the higher ranges where duolateral coils normally take their place.

HESTAVOX, LTD., are showing all sorts of wireless apparatus, whose prices have been reduced without any departure from the high standard of quality and workmanship. The exhibits include every type of receiver from a crystal to a multivalve cabinet set, while an entirely new unit system, together with every component required by the experimenter or home constructor, has been designed.

AUTOVEYERS, LTD., are showing their well-known "Clix" link which consists of a combined plug and socket which provides an instantaneous contact suitable for any point of electrical connection. It may be employed as a multi-terminal, contact stud, valve leg or socket, coil plug or socket, battery plug or socket, multi-phone plug or tag, soldering tag, etc. Dead-end switches, series-parallel switches, or, in fact, any type of switch may be built up without difficulty.

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A bridge tuning and rejector unit which applies bridge methods to reception is also shown as well as the filtron for such circuits as require a variable high ohmic resistance of precision.

The staticrester prevents damage to coils and condensers from atmospheric discharges. It can easily be fitted to any set.

W. J. HENDERSON AND Co. are exhibiting a two-valve receiver which has been designed to give maximum efficiency over all wave-lengths. Simplicity of control is a feature of this apparatus, and it has great selectivity. It is claimed that by using this set not only can all the B.B.C. stations be picked up, but Continental stations using a wave-length of 2 600, and under good conditions, American stations as well. This firm is also showing a variometer which is suitable for broadcast wave lengths, whether crystal or valve receivers are used. It is made up of silk-covered wires wound on ebonite formers.

In addition to the other apparatus which we described in our last week's issue, the GENERAL ELECTRIC Co. are demonstrating their new D3 Marconi valve. This valve, which is being shown for the first time, has the low filament current of 0.06 A at 2.4 to 3 V. It can therefore be used in connection with the ordinary commercial dry cell. The valve is a general purpose valve, i.e., it may be used either as a detector or as a low or high frequency amplifier, and can therefore take the place of the ordinary R type valve in standard receiving sets. The plate voltage can be varied between 30 and 80 V, the general value being of the order of 45 V. The emission of the valve is 6 mA, so that it can be used for working a loud speaker. A low power valve of this kind is interesting for two reasons: It makes broadcast receiving possible in country districts where accumulator charging facilities are not available, while the employment of portable sets also becomes practical politics.

The EVER-READY Co. are showing a wide range of their batteries and accumulators. The former hardly require any mention except to say that they include ordinary dry cells as well as those of high-tension type specially designed for wireless users. The Hercules low-tension dry batteries have been manufactured for use with dull to low temperature emitter valves, with filament voltages up to 3.5 V. They are, of course, particularly valuable in districts where accumulators cannot be easily charged. The accumulators are contained in celluloid cases, and are of the unspillable type.

The HART ACCUMULATOR Co. are exhibiting examples of their well-known batteries for wireless purposes. These have been standardised in a wide range of capacities and voltages. In the Hart high-tension battery each cell is contained in a circular glass box with a sealed lid, and each group of cells in a waxed wood box with a lid.

The CHLORIDE ELECTRICAL STORAGE Co. are exhibiting storage batteries of every type including low-tension batteries for valves. Two interesting new types are shown. One is the H.2, which has been specially designed for dull-emitter valves. This discharges at very low rates and will retain its charge for six months. The other is the D.T.G. which is specially suitable for use with the peanut valve. This is contained in a glass box, and is supplied in a dry-charged condition, so that only the addition of the electrolyte is required to make it ready for service.

J. A. COOMES AND Co. are showing a new three-valve set containing a tuned anode and a reactance to give selectivity and volume. Their aerophone amplifier is a two-valve unit with control so arranged that either one or two valves may be used. In addition, examples of the ionophone sets, Coomes' crystal sets and accessories are shown.

J. BURNS have a wide range of equipment, including crystal and valve sets and accessories of all kinds.

A. W. GAMAGE, LTD., are showing a complete range of crystal and valve sets to meet every requirement, together with component parts, so that the constructor can make up his own apparatus if desired. The experimenter is being catered for by a range of scientific apparatus, and special attention is called to the display of "permanite" crystals which are on view.

ROGERS, FOSTER AND HOWELL, are now supplying practically all their well-known R.F.H. reaction instruments in complete sets of parts. These components are packed in a strong box, each part being neatly placed in its appropriate division with a clear drawing of the circuit pasted on the inside of the lid. The ebonite panels are drilled and engraved, and are all ready for screwing down in a polished cabinet which is also provided. Two, three and four-valve sets are available in this way as well as a crystal set of a cheap and simple type.

The BOWYER-LOWE Co. have a very complete range of B.B.C. receiving sets both in the crystal and valve patterns. They are also showing a wavemeter which acts equally well in this capacity or as a wave trap. By its use 2LO can be cut out completely at a distance of 2½ miles.

J. E. HOUGH is exhibiting a crystal set which is provided with sockets to take coils so as to make a greater wave length possible, while connections are also furnished so that a note magnifier may be used. The variometer exhibited is wound for broadcast reception and the close coupling between rotor and stator windings ensures a very wide range of tuning. The twin crystal detector exhibited is contained in two dust and damp proof glass tubes, each of which contains a highly sensitive crystal fitted with ball and socket adjustment. By moving a switch the operator can pass from one crystal immediately to the other, and so by comparison obtain the very best results.

The ECONOMIC CAR LIGHT Co. are showing a broadcasting receiving set which is complete with three low temperature valves and a dry battery which will run the set for 80 hours before renewal is required. The whole is contained in a polished mahogany cabinet fitted with a loud speaker, and is a handsome piece of equipment which would disgrace no room. An interesting point about this set is that within a radius of 15 miles of the station no aerial or earth connection is required.

HART COLLINS, LTD., make a speciality of fitting their instruments to the customer's own furniture. As examples of what they can do in this way, they are showing a four-valve cabinet broadcasting receiver in cabinets of oak, mahogany and other woods. The same receiver is also shown in a *de luxe* model which has small refinements such as vernier filament resistances and opal windows. In all the valve models the accumulator compartment is treated with anti-sulphuric compound to prevent corrosion of wood by acid.

RADIO SUPPLIES, LTD., are devoting themselves to the needs of the constructor, and are showing a large range of apparatus and components which will suit this class of licensee as well as experimenters.

The WILTON WIRELESS Co. are showing a B.B.C. crystal set with a large range of accessories, including a novel type of tapped ball coupler.

The Labour Party and Electricity.

Mr. Herbert Morrison, besides being a London County Councillor, is at work in the school of Mr. J. W. Beauchamp, Mr. L. L. Robinson, Mrs. Ald. Hanmer and the other electrical developers. At the beginning of the year he wrote a series of articles in the "London Labour Chronicle" entitled "Better Times for the Housewife." In these he pointed out how trying and exacting is her work and how the policy of the Labour Party is to improve these conditions by making greater use of electricity. This, at least, is a constructive policy which will have our whole-hearted support. Mr. Morrison enlightens his theories by examples mostly drawn from Hackney and by illustrations drawn from the same source and from E.D.A. The reprint has an introduction by Mr. Robert Smillie, which is rather political than electrical, but in his appeal for better housing conditions, which means electrical houses, we are all with him. The pamphlet only costs 2d., and might judiciously be used by supply engineers among those consumers who think that a recommendation to use electricity is only another ruse of the capitalist to enthral them.

We have often prophesied that if electrical engineers did not set about developing the domestic electric idea they would soon be forced to do so by the indignant populace. Our prophesy has come true. Mrs. Sarah Gibson has been writing to the "Southend Times" lauding the advantages of an electric cooking outfit, and pointing out that many a woman after stooping and getting fumes in her face does not want any dinner.

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THE WIRELESS EXHIBITION.

Some Representative Displays at the All-British Wireless Exhibition at the White City.

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NEWS IN A NUTSHELL.

A " Times " message from Luxor states that the tomb of Tutankhamen is to be lighted electrically.

In a paper on the " Lesser Known Electrical Utilities," read before the Paisley Association of Electrical Engineers last week, Mr. James Orr laid stress on the flexibility of the electrical method of steering ships.

In future special Entry cadets in the cruiser " Courageous " are to be instructed in the practical supply and distribution of high power electricity in a capital ship and the practical working of searchlights, as part of their syllabus on electricity.

No fewer than 500 men have already been given work on the North Wales Power Co.'s £1 600 000 water power development scheme, which will, it is understood, involve the construction of 600 miles of transmission lines and will provide work for 2 000 men for at least three years.

Commenting on the fact that it is just 45 years since Bradford was first lighted electrically, the " Yorkshire Observer " recalls that one electric light was sufficient for an area previously covered by sixty or seventy gas lights, and that wool, which looked all the same shade in gas light, was discovered to be of various shades when the electric light was turned on.

A " Times " message from Riga states that the Soviet Government announces that the Ukranian Commissariat for Foreign Trade has signed an agreement with a group of British firms for the delivery of great quantities of electro-technical equipment. The firms are granting the Ukranian Commissariat seven years' credit.

According to the " Japan Chronicle," 20 electric locomotives were destroyed in the Japanese earthquake. In Tokyo 850 out of 1 900 electric tramcars were burnt, and the total damage to the tramway system in that city is estimated at £5 000 000. In Yokohama 100 out of 150 cars were destroyed, and the total damage to the tramway service is estimated at £1 000 000.

The utilisation of existing water power in Esthonia is progressing favourably, according to the report for 1922 of the Bank of Esthonia, which states that it is proposed to build a hydro-electric power station to develop 60 000 H.P. on the Narova rapids. Although this enterprise cannot for financial reasons be proceeded with at present, smaller rivers are already being utilised to a great extent. Within a very short time, the report adds, the power station at Ellamaa will be able to supply the energy for the electrification of the railway line between Reval and Hapsal, and towns and villages along the line will also be supplied with electricity.

Lt.-Col. G. R. Lane-Fox, M.P., Secretary for Mines announces that on October 27th he made an Order under Section 33 of the Coal Mines Act, 1911, approving for use in all mines to which the Act applies, subject to the conditions specified in the Schedule to the Order, the following types of safety lamps :—J.C.P. Lamps, Nos. 19A, 19FA, and 27A ; Patterson's Miners' Electric Hand Lamp, Type G.1A ; " Kingsway II " Pillarless Electric Hand Lamp ; Gray-Sussmann Electric Hand Lamps, Nos. 5 and 6 ; " Ceag " Shaft and Roadway Lamp, Type B. The Order, which is published by H.M. Stationery Office at 5d., also amends the Schedules to previous Safety Lamp Orders in respect to the specifications of certain types of safety lamps already approved.

The Electricity Commissioners have issued new regulations for the use of overhead lines. These regulations, which only came to hand as we were going to press, make considerable alterations in those now in force, and we shall deal with these in full in our next issue. The revised code now put forward has been adopted after consultation with various sections of the industry through the medium of a special Committee of the Institution of Electrical Engineers. It is not to have retrospective effect, but will apply to all future overhead lines erected by authorised undertakers in Great Britain. The regulations are divided into two parts : general and specific, the latter being sub-divided to cover pressures not exceeding 650 V d.c. and 325 V a.c. and pressures above those values. The first section deals with the material strength and size of conductors, supports, factors of safety and service lines. Each of the sub-sections deals with the minimum height of conductors and provision to guard against danger. The regulations are published by the Stationery Office and can be obtained through the usual channels at the price of 2d.

One electric truck will replace, on an average, five hand barrows.

A new alternating current motor, claimed to possess marked advantages over other types, was reported at the Omaha Convention of the National Electric Light Association to have been invented by Messrs. V. A. Flynn and Hans Weichsel.

A demonstration of the De Forest " Phonofilms " was given to Press representatives at the Surrey Theatre, London, on Tuesday. As previously announced, this invention is to be described at the Institution of Electrical Engineers to-night (Friday) by Mr. C. F. Elwell.

The Melbourne " Herald " states that the Melbourne and Metropolitan Tramways Board expects to spend nearly £2 000 000 in extending tramway facilities by the end of 1925. Of this sum £800 000 will be spent on new lines. The Board has acquired 16 acres of land at Preston, on which to erect what will probably be the largest workshops in Victoria.

Although it has been reported that Mr. J. A. Van der Byl, the chairman of the South African Electricity Control Board, has left Johannesburg for London to discuss the terms of the licence of the proposed Witbank Power Station to be erected by the Victoria Falls and Transvaal Power Co., nothing is known at the company's London offices regarding this matter.

Before the war the Germans had been experimenting with a device for marking rifle targets electrically, and trials of a similar device were carried out in this country about 18 years ago. It is now reported that the Belgian Army has been investigating this problem, and that an apparatus has been perfected whereby every hit on the main target is electrically and automatically registered on a miniature target fixed at the firing point.

Last Saturday Sir T. O. Callender unveiled the memorial erected to members of the Erith works of Callender's Cable and Construction Co. who lost their lives in the war. A photo of the memorial tablet is reproduced on our picture page this week, together with a view of the ceremony, in which will be seen Mr. P. V. Hunter, Mr. C. Pipkin, Mr. Th. Petersen, Sir Ernest W. Moir, Sir T. O. Callender, Mr. A. W. Tait and Sir J. Malcolm Fraser. Wreaths were laid at the foot of the tablet by Sir T. O. Callender, and Mr. P. Walker, Erith Works manager, on behalf of the directors and management, and by Mr. J. Dear and Mr. A. Wells—the two oldest members of the factory personnel, who have each served the company for forty years—on behalf of the employees at the Erith Works.

The new cable steamer " Faraday," belonging to Siemens Bros. and Co., Woolwich, has now returned from her maiden cable-laying expedition. She has successfully completed the laying of the section of cable connecting New York and Canso, Nova Scotia, about 1 000 miles, notwithstanding the fact that she encountered exceptionally bad weather, during which a mishap occurred to the cable and the end was lost in 3 000 fathoms of water. The vessel here proved her excellent qualities as a cable steamer, as the end was recovered very quickly, and the whole section completed to the satisfaction of the engineers of the Commercial Cable Co., who have had it in continual use since laying. This section forms a part of the Commercial Cable Co.'s new cable connection between America and England, which has the greatest traffic-carrying capacity of any existing cable.

The following nominations for the Grand Council of the Federation of British Industries for the ensuing year were due to be confirmed this week : Main Group 4 (Electrical Engineering) :—Sub-Group 1 (Electrical and Allied Machinery Manufacturers)—C. W. Sulley, A. F. Berry, D. N. Dunlop, Col. R. K. Morcom, F. H. Nalder, E. S. New, W. O. Smith, John Taylor, Harold Gwynne Allen, R. Dumas. Sub-Group 2 (Cable Makers)—Llewellyn B. Atkinson, A. E. Tanner, Sir George Sutton. Sub-Group 3 (Electrical Engineers to the Motor and Allied Trades)—J. Macpherson. Main Group 14 (Public Utility) :—Sub-Group 1 (Electrical Undertakings)—J. S. Highfield, Sir Harry Renwick. Sub-Group 2 (Tramways)—Andrew Henry Beatty, C. H. Dade. Sub-Group 4 (Railways)—C. G. Tegetmeier. Sub-Group 6 (Wireless Telegraphy)—Godfrey C. Isaacs. The following are among those who have been elected to serve on the executive committee—B. Longbottom, D. N. Dunlop, Sir George Sutton and Sir H. Renwick.

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LEGAL INTELLIGENCE.

Investments in an Electrical Firm.

In the Chancery Division last week, Mr. Justice Eve had before him a case in which Mr. S. Hodgson, of Torquay, claimed against Messrs. W. T. Reeve and G. Bayman, of the firm of Reeve and Bayman, electrical engineers, of Plymouth, specific performance of an agreement by the defendants to re-purchase from him 500 £1 shares bought by him in Reeve and Bayman, Ltd.—Giving judgment, his Lordship said the case was a good illustration of the trouble caused by persons attempting to embark on transactions they did not comprehend. The defendants converted their business into a limited company without competent advice. The plaintiff invested £500 in it, and it looked as if he would lose every penny, for the defendants had lost their assets. His lordship accepted the plaintiff's statement that the defendants agreed to re-purchase his shares if he wished to return to Australia. There would therefore be judgment for plaintiff for £500, although that would be very little use to him in view of the defendants' position. His Lordship accepted Reeve's denial of misrepresentation.

Deals in Electrical Fittings.

In the Shoreditch County Court, on November 8th, before Judge Cluer, the Standard Glass Co., of 169, New North Road, London, glass merchants, sued W. Sitch and Co., Ltd., electrical fittings manufacturers, 48, Berwick Street, Oxford Street, London, to recover £5 7s. 6d., balance of an account of £183 7s. 6d. for glass electric globes supplied.—The defendants denied liability beyond £1 11s. 6d., which was paid into court.—The plaintiff said the glass globes were ordered by the defendants on August 22nd, 1921. The order was for a gross at 22s. 6d. each, but they made 163, delivered them, and they were accepted, no complaint as to the quality being made. They got £10 from the defendants, but on making further application for a settlement, they were referred to Mr. Hayward, the receiver to the company. On January 1st, 1922, the plaintiffs obtained £20 from Mr. Hayward, and from time to time received further sums, leaving the balance sued for due. Continuing, the plaintiff said that a defence had been set up that £3 7s. 6d. was to be allowed, but he alleged that that agreement was obtained by representations making out that the defendants were short of money, when as a matter of fact they were paying out money to other people.—Judge Cluer pointed out that under 200 years old law a business man could make an arrangement with a debtor to settle, say, £100 for £90, but directly he had received the £90 he could sue for the odd £10. To make such a settlement legally, there must be a consideration for the balance. The defendants owed only £1 11s. 6d., and this was paid in ample time into court, so there must be judgment for the defendants, with costs.

B.T-H. Patent Litigation.

Mr. Justice P. O. Lawrence in the Chancery Division on November 9th concluded the hearing of an action by the British Thomson-Houston Co. against J. M. Webber and Co., incandescent lighting specialists, of Great Eastern Street, London, for an injunction restraining an alleged infringement of the plaintiffs' letters patent 23 499 of 1909 "for improvements in and relating to the treatment of tungsten to facilitate working."—The infringement was denied by the defendants, and Mr. C. Terrell, for the defendants, asked for an adjournment until after the trial of an action set down for hearing by Mr. Justice Russell in which the validity of the plaintiffs' patent was attacked. Counsel stated that the British Thomson-Houston Co. had brought 100 actions against a number of people many of whom were not in a position to go to the expense of fighting the validity of the patents. The patent was granted in 1919, and it was not until recently that any action had been taken. In this case the defendants were merely purchasers of the lamps and did not know how they were manufactured. He submitted that the numerous actions against little users should be postponed until the substantial fight had been decided.—His Lordship said that this action had been in the warned list for ten days, and now when it came on for trial he was asked to postpone it because another case was coming on which raised the question of validity, which was not raised in this action. It would not in his opinion, be right in the interests of the plaintiffs or of the public to entertain such an application.—Mr. Courtney Terrell said that in that case he must submit to an injunction, but asked that it should be limited to the lifetime of the patent.—His Lordship granted the injunction asked for, limiting it to the life of the patent, and made an order for the delivery up of the infringing articles, and an inquiry as to damages.

Mr. Justice Russell, in the Chancery Division on Tuesday, commenced the hearing of an action brought by the British Thomson-Houston Co., Ltd., against the British Insulated and Helsby Cables, of Prescot, Lancs., for an injunction to restrain the defendants from infringing letters patent No. 23490, granted to plaintiffs in 1909 for an invention "for improvements in and relating to the treatment of tungsten to facilitate working."—Plaintiffs alleged that defendants had imported or manufactured lamps the filament of which infringed plaintiffs' invention.—Defendants denied infringement. Sir Arthur Colefax, for plaintiffs, stated that the usual defences to the action were raised, namely, non-infringement and invalidity of the patent. As to invalidity, the issues raised were want of novelty, subject matter and utility, and also insufficiency. The plaintiffs' patent was for an invention concerned with the production of a body of mechanically worked tungsten which was ductile at ordinary temperature. The use or practical application of the invention was the production of the filaments for practically all the incandescent lamps in use to-day, and certainly the filaments of all those which were in fact composed of tungsten. After describing the properties of tungsten, counsel said that up to the date of plaintiffs' patent, tungsten was only known as a brittle metal, and it had never been obtained ductile cold. No means were known at the date of the patent by which a tungsten filament for use in an incandescent electric lamp could be made, and much less were means known by which the metal could be made ductile at ordinary temperature.. Plaintiffs' patent related to an invention by Dr. Coolidge. The filaments were first put on the market in 1911, and they had entirely displaced all other tungsten filaments.—The hearing was adjourned.

Engineer's Claim Dismissed.

Mr. Justice Bailhache heard last week an action by Mr. Florence O'Driscoll, engineer, against Marconi's Wireless Telegraph Co., to recover damages for alleged breach of contract.—Sir Henry Maddocks, K.C., Mr. Comyns Carr, and Mr. Percy Handcock appeared for the plaintiff, and Mr. Stuart Bevan, K.C., and Mr. Somerville for defendants.—Sir Henry Maddocks explained that the action referred to a contract between Mr. O'Driscoll and Mr. Godfrey Isaacs, on behalf of the defendant company, for the employment of Mr. O'Driscoll upon certain terms. The defence was that plaintiff was not employed by the defendants but by an Argentine company, of which the London company was the parent. In 1905 the company in the Argentine was formed and the London company retained control of the Argentine company, which was to establish a high-power wireless station in the Argentine. In October, 1912, Mr. O'Driscoll was appointed a director of the Argentine company. At the time he held an appointment with "The Times" at Buenos Ayres. In 1913 he was appointed manager for "The Times" in South America, on condition that he resigned his directorship of the Argentine Wireless Co. After discussion, Mr. Godfrey Isaacs invited him to name his terms for acting as defendants' representative in South America. Mr. O'Driscoll said he would want a salary of £1 500 a year and an appointment as supervising engineer at 1 000 paper dollars a month in connection with the erection of the proposed station. He also required a call on 10 000 fully paid shares in the Argentine company. These terms were accepted, and he resigned his position with "The Times." He remained in London during 1913 and 1914 arranging specifications, plans, etc. When the war broke out operations were stopped, and plaintiff was told he would receive his salary from the Argentine company. The Argentine company wrote to defendant company saying they could not go on paying plaintiff's salary indefinitely, and from that time he received payment from defendants. In September, 1916, he went to Brazil to discuss matters with regard to the Brazilian station, and remained there until July, 1918. In November, 1920, at the request of Mr. Godfrey Isaacs, plaintiff again went to Buenos Ayres to see if he could put an end to the agreement with the American company.

He found the Germans had obtained a concession for a high-power station, as well as the French and Spaniards. Mr. Isaacs then concluded that the best thing would be to join hands with the Germans and other people in their enterprise. Plaintiff then pressed for a new agreement with defendants, who offered him a salary of £3 500 for three years. Plaintiff stipulated for six years, and the arrangement fell through.—Plaintiff, in evidence, said the post on "The Times" which he relinquished was estimated to be worth at least £5 000 a year. The difference between himself and Mr. Isaacs was one of principle. He (plaintiff) could not associate himself with what he looked upon as an attempt to rob the Argentine shareholders. Nothing had been done by the Argentine company for six years. If they had made a call upon shares there would have been a fearful row. He denied that under the consortium agreement the benefits obtained by the London company would have gone into the pockets of the Argentine shareholders.—Mr. Godfrey Isaacs said the English company had retained a controlling interest in the subsidiary Argentine company. In his opinion, the Ambrosetti installation was not a sound commercial proposition for the Argentine in 1918. It was a fact that the stations which had been developed by 1918, supplying the deficiencies of the Ambrosetti station, cost substantially more. Defendants intended to erect a similar station in this country at a cost of about £600 000. The station now erected, and working in part, in the Argentine had taken three years to erect and was not yet complete. It was using the Marconi system in part. They were using a system based upon the best of the American, French, German and English inventions. The Argentine company had secured the Marconi patents for South America. In handing those patents over to the new company defendants had taken a risk pending the Argentine company's ratification of the agreement.—His Lordship, in giving judgment, said no doubt plaintiff was greatly influenced by the option he had to a call on 10 000 shares at 10s. per share. On the assumption that plaintiff was employed by defendants, it was clear that, so far from his being wrongfully dismissed by defendants, he dismissed himself. Upon any assumption it was clear that he suffered no damage. The terms he was offered by the English company were considerably better than the old ones. He was satisfied that in entering into the consortium arrangement defendants had no intention of injuring plaintiff. For those reasons the action would be dismissed, with costs.

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TRADE IN OCTOBER.

Ten Months' Electrical Exports Valued at nearly Ten Millions.

The figures for the month of October show still more notable increases in the imports of telegraph and telephone instruments and apparatus and also of glow lamps, whereas the imports of batteries are decreasing at a progressive rate. Total electrical imports for the month, however, are only slightly over 50 per cent. up, compared with an increase of considerably over 100 per cent for September. The imports for the ten months are about 25 per cent. above those of the corresponding period last year, which does not show much divergence from the proportion of increase for the nine months ended September.

	Month of October.		Ten Months.	
	1922.	1923.	1922.	1923.
	£	£	£	£
Electrical Machinery	44 538	75 009	1 027 758	854 738
Electric Wires and Cables, Insulated—				
Rubber Insulated (other than Telegraph or Telephone)	17 774	15 128	98 285	102 254
Insulation other than Rubber (not other than Telegraph or Telephone)	15 406	19 259	74 351	128 635
Telegraph and Telephone Wires and Cables (not Submarine)	2 098	7 716	23 247	72 406
Submarine Telegraph and Telephone Cables	—	—	—	—
Telegraph and Telephone Instruments and Apparatus (except Wireless Valves)	26 877	66 304	217 950	443 497
Carbons	6 300	10 095	31 157	67 258
Electric Glow Lamps and Parts	20 611	31 773	144 030	167 009
Arc Lamps and Searchlights	352	3	1 134	2 885
Parts of Arc Lamps and Searchlights	637	863	9 988	11 138
Batteries and Parts	19 758	16 900	96 859	120 036
Electrical Instruments, Scientific and Commercial (including Ammeters, Voltmeters, etc.) and House Service Meters)	5 460	7 216	55 547	77 617
Switchboards	121	—	2 547	1 927
Electrical Goods and Apparatus, all other Sorts	57 160	81 156	415 922	701 859
Total of Electrical Machinery, Apparatus and Material	217 092	331 422	2 198 775	2 751 259

Progressive Increase in Exports.

There are substantial increases in most of the items under exports for the month, although this is not so general in the case of the ten months' figures, but this fact in itself shows an improvement, even though it may be but temporary. There are, however, increases in the total exports, both for the month and the ten months, and the aggregate figure for the ten months is nearly ten million pounds, compared with imports amounting to two and three-quarter millions.

	Month of October.		Ten Months.	
	1922.	1923.	1922.	1923.
	£	£	£	£
Electrical Machinery—				
Railway and Tramway Motors	24 089	35 141	160 879	274 950
Other Motors and Generators	132 582	143 161	1 799 947	1 547 992
All other Sorts	149 385	166 232	1 567 539	1 299 408
Electric Wires and Cables Insulated—				
Rubber Insulated (other than Telegraph or Telephone	80 562	141 135	570 170	905 034
Insulations other than Rubber (other than Telegraph or Telephone)	87 052	75 813	860 424	742 771
Telegraph and Telephone Wires and Cables (not Submarine)	73 399	101 011	494 428	737 161
Submarine Telegraph and Telephone Cables	36 467	14 473	288 172	598 154
Telegraph and Telephone Instruments and Apparatus (except Wireless Valves	147 326	175 629	1 598 916	1 500 132
Carbons	8 243	11 895	47 853	58 646
Electric Glow Lamps	30 343	40 112	313 641	284 406
Arc Lamps and Searchlights	58	697	4 648	6 063
Parts of Arc Lamps and Searchlights	117	436	6 044	2 155
Batteries and Parts	68 532	49 392	419 192	440 007
Electrical Instruments, Scientific and Commercial (including Ammeters, Voltmeters, etc.) and House Service Meters	30 713	36 453	275 607	281 780
Switchboards	10 467	7 683	190 878	92 260
Electrical Goods and Apparatus, all other Sorts	128 846	178 296	1 014 592	1 223 922
Total of Electrical Machinery, Apparatus and Material	1 008 281	1 177 559	9 612 930	9 994 841

The Coventry Breakdown.

We understand that the breakdown which recently occurred at Coventry was due primarily to a breakdown in the insulation on one of the 6 000 kW turbo-alternators. In the course of operation this machine was automatically removed from the busbars, and this in its turn caused one of the feeder breakers to come out. The result was that a flash-over took place between the busbar contact of the switch isolating link and its earthed metal base. Unfortunately this did not end the chapter of accidents, for the overload thrown on the other machines caused a distortion in the stator winding of one of the 3 000 kW alternators, and the complete burning out of this machine then followed. At present, therefore, supply has had to be restricted between 4 and 6 p.m., but it is hoped that normal conditions will be resumed at the beginning of next week.

ELECTRICITY DISTRICTS.

Aire and Calder Joint Authority Established by Commissioners.

As briefly stated in our previous issue, a draft order constituting the West Riding (Aire and Calder) Electricity District and establishing and incorporating the West Riding (Aire and Calder) Joint Electricity Authority has been issued by the Electricity Commissioners. It will be remembered that there has been considerable delay in dealing with this district for reasons which were mentioned by the Commissioners in their last annual report.

The Joint Authority is to consist of 28 members, five of whom are to be appointed by each of the Corporations of Bradford and Leeds, two by each of the Corporations of Halifax and Huddersfield, and five by other Corporation and Local Authority undertakings in the area. The Yorkshire Electric Power Co. is to have two representatives and the other company undertakings one jointly. Local authorities not possessing electricity undertakings are to have three representatives, the West Riding County Council one, and the railway companies two.

The Joint Authority is to appoint an Engineering Advisory Committee to deal with the technical scheme for the supply of electricity for railway or navigation purposes and other technical matters. This Committee is to have power to co-opt an electrical engineer of the railways concerned. The district is to contain a reserved area consisting of Bradford, Halifax, Leeds, Huddersfield, Keighley, Morley and Pudsey, and various other urban districts, rural districts and parishes, and within this area the Yorkshire Electric Power Co. is not to exercise any of its powers of supply under its various Acts without the consent of the Joint Authority, and is to transfer to the Joint Authority and to the Electrical Distribution of Yorkshire all its property within the reserved area, main transmission lines being transferred on Inland Revenue terms and other cables and lines on terms to be agreed.

Assignation of Rights.

The Power Company is to assign to the Distribution Company its rights under an agreement made between it and the borough of Pudsey, and to enter into an agreement with the Joint Authority for the supply of electricity in bulk within the reserved area, the Power Company and the Distribution Company being jointly responsible for developments in any district outside the reserved area which does not form part of the area of any authorised distributor.

The powers of certain local authorities to purchase undertakings or parts thereof under various orders are transferred to the Joint Authority, whose powers of purchase are suspended until 1966.

The technical scheme provides for the use without further extension within the reserved area of the stations of the Halifax, Keighley, Huddersfield (St. Andrew's Road), Bradford (Valley Road), and Leeds (Whitehall Road), and for the closing down of the Crown Point and Longroyd Bridge stations of the Leeds and Huddersfield Corporations and of the stations at Ilkley and Shipley. In order that the most effective use may be made of generating stations to be utilised under the scheme a schedule of main transmission lines for interconnection has been prepared. Outside the reserved area the stations at Barnsley and Wakefield are to be used without further extension, and the stations at Batley, Dewsbury, Hebden Bridge, Heckmondwike, Holmfirth, Tadcaster, and the Belleisle and Castleford stations of the Yorkshire (West Riding) Tramways Co. are to be closed down as soon as possible.

The Ferrybridge station of the Yorkshire Electric Power Co. is to be used under the scheme and is to be extended from time to time as may be authorised, while the stations of the Company at Barugh and Thornhill are to be used without further extensions.

E.D.A. at the Lord Mayor's Show.

The Lord Mayor's Show this year was largely devoted to representing the progress of British Industry through the Ages, and the part played by the electrical industry was shown on a car provided by the Electrical Development Association. In view of the difficulty in dealing with so large a subject, and particularly of using attractive lighting schemes in the daytime, it was decided to put up a representation of a modern electrical development of the greatest use and interest to everyone, and not yet so well known by the general public as many other methods of employing electrical energy. The car represented briefly the progress of the art of cookery, showing the early methods of preparing food with the crudest implements over an open fire in comparison with the modern and efficient use of electricity in the kitchen. The electric cooker, which was in operation during the progress of the car along the route, was supplied with energy from a battery carried upon the vehicle which transported the exhibit. Apart from this display and supporting features of sundry electrical appliances of general use and value, the vehicle itself was propelled electrically, and was, in fact, one of the latest types of heavy electric lorry with tipping mechanism. The E.D.A. wishes to acknowledge the kind and prompt assistance received in getting this display together at such short notice from: The Metropolitan Borough of Hackney, for the loan of their electric vehicle; Mr. L. L. Robinson and his staff, for wiring and attention given; the Chloride Electrical Storage Co., Ltd., for the loan of an Ironclad Exide type battery; and the British Electric Transformer Co., for adapting a Hackney cooker to the voltage available.

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ELECTRICITY SUPPLY.

Extensions and Developments.

A new generating set is to be installed at the Nelson municipal electricity works.

Sleaford Urban Council has received sanction to a loan of £2 000 for mains extensions.

Darlington Town Council has received sanction to a loan of £2 000 for laying new feeder cables.

Dumfries Town Council has decided to extend the electricity works at an estimated cost of £22 000.

The Ramsey Gas Co. has applied to the Manx Tynwald Court for leave to introduce a Bill authorising the company to supply electricity. The application has been referred to a committee for consideration.

In anticipation of the use of the high tension cable recently laid along the Liverpool, Waterloo and Southport Electric Railway, power house and transformer extensions are being effected at Seaforth, Formby and Birkdale.

Having regard to the attitude of the Electricity Commissioners, the Ealing Town Council has asked the conference of local authorities owning electricity undertakings to receive a deputation with reference to the future position of municipal undertakings.

Birmingham Corporation has decided to construct a new destructor at Hay Mills at a cost of £100 000. This expenditure will include £4 000 for two 100 kW steam driven generators, with switchgear, distribution boxes, condenser, piping, etc., £250 for wiring up motors, £1 250 for connection to Corporation electric main, including transformer, rotary converter, switchgear, etc., £1 500 for electric vehicle-charging plant (two 5-wire balancers, ten charging panels, cables, etc.), and £1 000 for engine and plant foundations.

Alterations in Charges.

Malvern Urban Council has reduced the charges for electricity as under as from the Michaelmas quarter readings: power and heating, up to 200 kWh per quarter, 4d.; 200 to 400, 3¾d.; 400 to 600, 3½d.; 600 to 800, 3¼d.; 800 to 1 000, 3d.; 1 000 to 1 500, 2¾d.; 1 500 to 2 000, 2½d.; beyond, 2¼d., less 7½ per cent. for payment within 14 days; lighting, up to 200 kWh per quarter, 7d.; 200 to 400, 6¾d.; 400 to 600, 6½d; 600 to 800, 6¼d.; 800 to 1 000, 6d.; beyond, 5¾d., less 7½ per cent.

Tapping New Areas.

Wanstead Urban Council has consented to the application of the County of London Electric Supply Co. for an order to supply electricity in the Council's area.

Woodford Urban Council has approved a draft agreement with the County of London Electric Supply Co. for a supply of electricity. There is to be a flat rate of 6d. for lighting, and 3d. per kWh for heating, cooking or power.

Inquiries and Orders.

Mr. Walter Glover has applied to the Electricity Commissioners for a Special Order to generate and supply electrical energy in Callington urban and Launceston rural districts. Objections to the Secretary, Electricity Commission, Whitehall, London, by November 22nd.

The Minister of Transport proposes to confirm the (1) Lanarkshire (Western Area), (2) Holytown, Carfin and Cleland and (3) Overtown and Law Electricity Special Orders. Any objections must be sent to the Secretary, Ministry of Transport, Whitehall Gardens, London, by December 1st.

Torquay Corporation is applying to the Electricity Commissioners for a Special Order extending the Corporation's electricity supply area so as to include part of Newton Abbot rural district. Objections to the Secretary, Electricity Commission, Whitehall, London, by November 26th.

The Minister of Transport proposes to confirm the Chasetown and District and Burley-in-Wharfedale and District Electricity Special Orders and the Wellingborough and Kettering Electricity (Extension) Special Orders. Objections to the Secretary, Ministry of Transport, Whitehall Gardens, London, by December 1st.

The Electricity Commissioners have made a Special Order under the Electricity Supply Acts, authorising Mr. Gilbert Boys Smith, of The Cottage, Seaton, Devon, to supply electrical energy for public or private purposes within the urban district of Seaton and the parish of Beer, in the parish of Axmouth and the parish of Colyton.

Major B. J. Day and Lt.-Col. C. B. Bartley have applied to the Electricity Commissioners for a Special Order to extend the area of supply under the Cranbrook Rural District Electricity Special Order so as to include the borough and part of the rural district of Tenterden. Objections to the Secretary, Whitehall, London, by November 19th.

The Minister of Transport proposes to confirm the Maesteg Electricity Special Order granted to Maesteg Urban Council, the Wantage Electricity Special Order granted to the Western Electric Distributing Corporation, and the Rushden and District Electricity (Extension) Special Order granted to the Rushden and District Electric Supply Co.

The North Berwick and District Electric Light and Power Co. has applied to the Electricity Commissioners for a Special Order to

(*Continued at foot of next column.*)

PERSONAL GOSSIP.

Mr. L. F. Christy, electrical engineer, of Christy Brothers and Co., has been re-elected a member of the Chelmsford Town Council.

Mr. A. de V. Leigh has been appointed Secretary of the London Chamber of Commerce in succession to the late Mr. Charles E. Musgrave.

Councillor Edwin Laidler, a member of the firm of J. Laidler and Sons, electrical engineers and brassfounders, has been elected Mayor of Durham.

Mr. H. A. S. Mugford, electrical engineer, of 109, Albert Road, South Norwood, London, has been re-elected a member of the Croydon Town Council.

Councillor William Hammer, the new Mayor of Hackney, is chairman of the Electricity Committee, and has been a member of the Council for 23 years.

Mr. J. Makin, chief electrical engineer of Hereford, is to have his salary increased from £700 to £800 in recognition of his efforts on behalf of the city's electricity undertaking.

Mr. W. A. Chamen, general manager of the South Wales Electrical Power Distribution Co., of Cardiff, has been elected President of the South Wales Institute of Engineers for the ensuing year.

The new Mayor of Hampstead is Alderman Frank G. Howard, who previously held that office in 1921. He is an electrical engineer, and superintended the installation of electric lighting in the Khedive's Palace.

The late Dr. Edmund Knowles Muspratt, of Liverpool, who was a director of the British Insulated and Helsby Cables, the Electric Supply Co., of Victoria, the Midland Electric Corporation for Power Distribution, and other companies, left estate valued at £434 842 net.

Mr. C. Douglas Terry, the son of Mr. Alfred E. Terry, has lately joined the staff of Herbert Terry and Sons, Ltd., Redditch. During the war he served in the R.F.A., entering the Army direct from school. Afterwards he continued his education at Cambridge. He is still continuing his engineering studies, and at the same time entering upon the practical and commercial side of the business.

At the last meeting of the American Institute of Radio Engineers Mr. Harold H. Beverage, an engineer of the Radio Corporation of America, was awarded a vote of honour for his contribution to radio communication devices, which took the form of the so-called "wave antenna," described in a recent issue of THE ELECTRICIAN. Mr. Beverage was also presented with a Liebmann Memorial prize of $500.

Sunderland Town Council has presented the freedom of the borough, together with a gift of plate, to Alderman Wm. Bruce, one of the oldest members of the Corporation, who was for sixteen years chairman of the Electricity Committee, from which he retired in 1919 owing to ill health. The Mayor said it was due almost entirely to Alderman Bruce's business acumen and pugnacity that the undertaking had grown up and prospered.

Prof. Robert Andrew Millikan, who, as announced in our previous issue, has been awarded the Hughes Medal of the Royal Society has, according to a report from Stockholm, been awarded the Nobel Prize for Physics for 1923. Born at Morrison (Ill.) in 1868, Prof. Millikan has had a distinguished scientific career, and is the author of a number of books and papers on electricity and physics. He is vice-chairman of the National Research Council at Washington, and during the war served in the scientific research department of the American Signal Corps.

Amongst the first directors of the Power and Traction Finance Co. (Poland), Ltd., a recently registered public company, with a nominal capital of £1 000 000, are Mr. W. L. Hichens, deputy-chairman of the English Electric Co., and a director of the Power and Traction Finance Co.; Sir James Kemnal, managing director of Babcock and Wilcox, and director of the Power Securities Corporation, Tube Investments, Ltd., and Worthington-Simpson, Ltd.; Lord Meston, chairman of the Calcutta Electric Supply Corporation, and director of the English Electric Co., Power and Traction Finance Co., and Willans and Robinson; Mr. J. Pybus, managing director of the English Electric Co., Phœnix Dynamo Manufacturing Co., Power and Traction Finance Co., and Willans and Robinson, and chairman of Siemens and English Electric Supplies; and Mr. John Sampson, director of English Electric Co., Ltd., and Power and Traction Finance Co.

(*Continued from preceding column.*)

supply electricity in the burgh of North Berwick and parts of the parishes of North Berwick and Dirleton. Copies of the draft order can be obtained from Wilkinson, Bowen, Jackson and Carran, 54, Nicholas Lane, London, E.C.4.

Topsham Electricity Supply Co. has applied for an Order to enable the company to supply the whole of the parish with electricity. The Parish Council has already applied to the Exeter City Council for a supply, and the St. Thomas Rural Council, in whose area the parish is, has decided to await a reply from the Parish Council before coming to any decision in the matter.

Lieut.-Col. H. W. Woodall has applied to the Electricity Commissioners for a Special Order to produce and supply electricity in the boroughs of Deal and Sandwich, the urban district of Walmer, the rural districts of Eastry, and the Isle of Thanet and part of the rural district of Dover. Objections to the Secretary, Electricity Commission, Whitehall, London, by November 10th.

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[7 and 8, "*Electrician*" photos.

ELECTRICAL NEWS IN PICTURES.

1.—Lt.-Col. A. B. Robertson, D.S.O., of Glasgow, is the new President of the Electrical Contractors' Association of Scotland.

2.—Mr. W. J. Corse, a well-known Plymouth electrical engineer, whose death is announced after a short illness (p. 558).

3.—Alderman T. C. Newman, the new Mayor of Swindon, is also Chairman of the Electricity Committee.

4.—E.D.A.'s way of electrifying the Lord Mayor's Show (p. 555).

5.—The War Memorial erected at the Erith works of Callender's Cable and Construction Co. to employees killed in the war (p. 553).

6.—Thomas Gunn, Ltd., a London firm of electrical contractors, make effective use of a familiar poster in this window display.

7.—Sir T. O. Callender unveiling Callender's Erith War Memorial. (p: 553).

8.—The Palace of Engineering at Wembley was handed over by the contractors on Monday to the Board of the British Empire Exhibition.

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WIRELESS BROADCASTING.

Terms of the Supplementary Agreement with the B.B.C.

Particulars are now available of the terms of the supplementary agreement between the Postmaster-General and the British Broadcasting Co. providing for the modification of the licence of January 18th last, rendered necessary by the adoption by the Postmaster-General of certain of the recommendations of the Committee on Wireless Broadcasting. The agreement extends the period of the company's licence until the end of 1926, and provides for the erection of further broadcasting stations when authorised by the Postmaster-General.

An important modification of Clause 4 reads: "The company shall not without the consent in writing of the Postmaster-General receive money or any valuable consideration from any person in respect of the transmission of messages by means of the licensed apparatus. Provided that nothing in this clause shall be construed as precluding the company from (1) Broadcasting matter provided gratuitously by any person with or without an acknowledgment of such provision by means of the broadcasting service; (2) receiving a consideration for broadcasting names of publishers and prices of matter which is broadcast; (3) receiving a consideration for broadcasting commercial information approved for broadcasting by the Postmaster-General subject to such conditions as he may prescribe; and (4) (so far only as the licence of the Postmaster-General is required) from using for broadcast purposes without payment, concerts, theatrical entertainments, or other broadcast matter given in public in London or in the provinces.

With the provision that when required by the Postmaster-General the company shall discontinue working between any hours which might interfere with the working of Government wireless, or any other licensed undertaking, the B.B.C. are given permission to work any of the stations at any hour on any day.

What Dealers Will Pay.

Dealers who trade in wireless apparatus exclusively of British manufacture are to be entitled to become members of the company without being required to make the deposit of £50 under the old agreement. The deposit of £50 paid by existing members is to be returned. The sums to be payable by members to the company are as follows:—On each crystal set, 1s.; on each microphonic amplifier without using valves, 5s.; on each crystal set and one valve, 11s.; on each crystal set and two valves, 18s. 6d.; on each one-valve set, 10s.; on each two-valve set, 17s. 6d.; on each set adapted for more than two valves, a further sum for each additional valve-holder of 5s.; on each low-frequency valve amplifier (per valve-holder), 5s. No sum shall be payable on telephone earpieces, loud-speakers and valves.

The agreement sets out in detail the two forms of licence to be issued—the broadcast licence, at a charge of 10s. per annum, and the constructor's licence, for which 15s. per annum is to be charged. The Postmaster-General retains the right to discontinue the issue of the two types of licence at the beginning of 1925, and issue only one type at a fee of 10s. per annum. Of the 10s. licence, 7s. 6d. is to be paid to the company and of the 15s. licence 12s. 6d. If the income of the company from all sources during the extended period shall be more than sufficient to provide a broadcasting service and a reserve fund to meet depreciation, and to pay 7½ per cent. per annum of the company's subscribed capital, the proportion of each licence fee payable to the company shall be reduced and the surplus income surrendered to the Postmaster-General.

If the company supply a satisfactory broadcast service and erect additional stations where the Postmaster-General may reasonably consider them to be necessary, no other person is to be granted a licence or authority to carry on broadcasting in Great Britain prior to January 1st, 1925. Where these conditions, however, are not carried out, the Postmaster-General reserves the right to grant licences to any other person to carry on broadcasting services in such areas, and to withhold from the company sums received for licences in such areas from the date of the commencement of a regular service by a new undertaker. The limits of such area are to be based on the receptive capacity of an ordinary crystal set.

Public Works Exhibition.

In connection with the Public Works, Roads and Transport Exhibition, which is to be held at the Royal Agricultural Hall, London, from November 22nd to 29th, a series of Conferences will be held. One of these has been arranged by the Incorporated Municipal Electrical Association for Wednesday, November 28th. Mr. S. E. Britton, the president of the Association, will take the chair, and the subject of discussion will be "Electric Strays," upon which a paper by Mr. C. Raphael will be read. On November 24th there will be a discussion on "Transport Work in the Salvage Department of the City of Birmingham," in which some interesting proofs of the reliability of electric vehicles and their freedom from serious breakdown will be given by Mr. James Jackson. Among the exhibitors will be:—John Yates and Co.; George Hatch, Ltd.; H. C. Slingsby; Electricars, Ltd.; Richard Hill and Co.; the Rawlplug Co.; the Horstmann Gear Co.; and Alloy Welding Processes, Ltd.

OBITUARY.

M. Leblanc.

As briefly recorded in our previous issue, the death of M. Maurice Leblanc, a director of the Hewittic Electric Co., and consulting engineer to the Société Anonyme Westinghouse, has deprived France of a prominent electrical and mechanical engineer, and our own Institution of Electrical Engineers of an esteemed honorary member. Although himself an enthusiastic inventor, M. Leblanc placed on record his opinion that to be an inventor one needed a strong leavening of philosophy to persevere at it, and offered Mr. Punch's famous advice to those about to choose such a career. After leaving the Polytechnic in 1878 he had some ten years' experience in engineering, first with the Compagnie des Chemins de Fer de l'Est, and later with a private enterprise. During this time he contributed a number of articles to "La Lumière Electrique," including "Etude sur la Transmission Electrique des Impressions Lumineuses"; "Longue Etude sur la Traction

THE LATE M. MAURICE LEBLANC.

Electrique" (in collaboration with M. Marcel Deprez); "Du Rôle de la Tension Superficielle dans les Phénomènes Physiologiques," and "Etude sur le Telephone Multiple." In 1888 he commenced research on electrical problems, the first of which was to discover a good a.c. motor. He designed a machine with revolving brushes, but this was not developed commercially, although many years later he expressed the opinion that it was the best that had been invented. After working for some time on the use of condensers in connection with a.c. motors, M. Leblanc studied, and claimed to be the first to produce, phase advancers. This invention was not generally taken up at first, as for various reasons the discovery appeared to be in advance of electrical practice at that time. It may be remarked, however, that when phase advancers came into general use Leblanc received little or no credit for their discovery. His other electrical researches included a good deal of important work in connection with various types of transformers, rotary converters, frequency changers, and compound alternators. In 1901 Mr. George Westinghouse purchased a number of his electrical patents for the Westinghouse Electric and Manufacturing Co. and the American General Electric Co. From that time, at the suggestion of Mr. Westinghouse, M. Leblanc interested himself particularly in mechanical engineering problems, and did some very useful work on condensers, rotary compressors, on the problem of domestic ventilation, and on the design and construction of automobiles for use on bad roads. In a *résumé* of his work, prepared for submission to the Académie des Sciences, he envied the lot of those who could devote all their energies to purely scientific researches, and bore this out by saying that he would have been prouder to have discovered the most unimportant phenomenon than to have made the most successful application of it.

W. J. Corse.

We regret to record the death, which occurred at his residence in Ford Park Road, Plymouth, last week, after a month's illness, of Mr. William John Corse, of W. J. Corse and Co., electrical engineers, Plymouth. Born in London 74 years ago, Mr. Corse first entered the Navy, and on retiring in 1880 set up in business at Plymouth as an electrical engineer, and was probably the first electrical contractor in that town. During his 40 years' business activity in Plymouth he carried out a number of important lighting contracts, among them being installations at the Naval Barracks at Devonport, Bull Point ammunition stores, and the "Western Morning News" offices. Later he interested himself in the application of electricity to the cinematograph.

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ELECTRIC TRACTION.

East Ham and West Ham Corporations are in favour of entering into arrangements with Ilford Council for through running of tramcars.

Keighley Corporation intends to apply for a Provisional Order authorising the use of electric trolley vehicles in place of the tramways.

Reading Corporation Tramways are relaying a large portion of their track at an estimated cost of £3 260. The cost is to be defrayed out of the reserve fund.

London County Council Highways Committee proposes to withdraw a certain number of four-wheeled tramcars from service, and to order 60 new bogie cars.

Manchester Tramways Committee has made an arrangement with the Post Office authorities under which letter boxes will be attached to late cars to the city on certain routes.

The Wrexham and District Transport Co.'s tramway system is to be extended from the present Rhos terminus to the corner of Broad Street and High Street, Rhos. The cost will be about £10 000.

Subject to the consent of the City of London Electric Lighting Co., the London County Council has been granted permission to fix signs on electric and gas light standards, indicating routes to the nearest tramway termini.

The opening of the London County Council's new tramway depot at Streatham Hill has drawn protests from traders, who complain of dislocation of traffic caused by trams stopping in the road to change over from the conduit to the trolley system.

Mr. Brodie, city engineer of Liverpool, stated recently that the Liverpool tramcars have too short a wheel base and are unsuitable for high speeds. The tramways manager, Mr. Priestly, is tackling the matter vigorously, and the result will be the production of a smoother-running vehicle with increased accelerating and braking powers.

Halifax Tramways Committee has received sanction to a loan for the reconstruction of the Hebden Bridge tram track. The Ministry of Transport has given consent to the laying of a double line of tramway on the Booth Town section of the tramways between the Punch Bowl Inn and Ploughcroft Lane, and has sanctioned a loan of £2 700 for carrying out the work.

An arrangement for mutual through running of London County Council and Croydon Corporation tramcars between the Victoria Embankment and Purley is suggested by London County Council Highways Committee. Portions of the Croydon Tramways track will require reconstruction, a physical junction of the two systems will have to be made at Norbury, and the track under the Norbury railway bridge will require lowering.

An experiment is being made by the Sheffield Corporation Tramways Department with a safety-first device which takes the form of an electric sign fixed to a tram standard stating that the car is going to diverge from the straight course at that particular point. The sign operates both day and night, being worked automatically by the action of the driver in manipulating the points. If the experiment is a success, similar devices will be installed in other parts of the city.

Fares, Receipts and Passengers.

Rotherham Corporation is giving the weekly transferable pass system a three months' trial on the tramways.

Wolverhampton Tramways Department is experimenting with a system of cheap return tickets on the tramcars on quiet days, as it is thought desirable to secure a better load factor, although the system has always paid its way, both on the overhead trolley system and on the Lorain surface contact system formerly used, in addition to relieving the rates to the extent of £47 000.

Electric Railway Items.

Approximately £976 000 is being spent on new rolling stock for the London tube railways.

An electric railway 70 miles long is to be constructed in Madeira to link the north and south parts of the island.

It is reported that the contract for the electrification of the Vienna municipal railway has been awarded to the Siemens-Schuckertwerke and the A.E.G.

The extension of the City and South London Railway to Morden and the connection of the line at its Euston end with the Hampstead Tube will make it the longest continuous tunnel in the world. The length will be 15 miles, or three miles more than that of the Simplon tunnel.

In order to improve the traffic facilities at the Shepherd's Bush station of the Central London Railway, the lifts will be superseded by two escalators, which have already reached an advanced stage of construction. These escalators will be carried down to the platform level, thus obviating the necessity of traversing long corridors, as at present.

The season tickets introduced by the Underground Electric Railways Co. of London in May last, which are available on train, omnibus and tramcar, are said to be entirely successful in connection with the Golder's Green Station, and similar tickets have now been introduced at Hammersmith, Ealing Broadway, Shepherd's Bush, Turnham Green, Walham Green, Putney Bridge and Northfields stations.

WIRELESS CHAT.

Phenomenal Growth of the British Radio Industry.

Some idea of the phenomenal growth of the British Wireless industry can be obtained from the fact that, while a year ago the Horticultural Hall was large enough to house the last wireless exhibition, it has this year been necessary to make use of the much larger space available at the White City. The displays at this exhibition, which are dealt with elsewhere in this issue, supplement preliminary notices published last week. At a luncheon following the opening of the exhibition, Mr. Guy Burnley, chairman of the National Association of Radio Manufacturers, referred to the failure of the Broadcasting Committee to make any recommendations in regard to protection against foreign competition. They might at least have examined the agreement, and, had they done so, he did not think they could have failed to recommend that the terms applying to broadcasting licences should remain. It was left to the Postmaster-General to solve the problem, and although the radio industry did not get all it deserved or all it thought it was entitled to, the general opinion was that the settlement arrived at was a satisfactory compromise of a very difficult problem.—Sir Laming Worthington Evans said the Broadcasting Committee had had a very difficult problem to deal with, and their general conclusions would be adopted without doubt, but not immediately. If the Committee thought that the licence should not be made a means of protection, even for a British industry, they were quite right to say so. They had not, he thought, given full weight to the existing contract, in which British manufacturers were entitled to protection by contract for another year at least. Fortunately, that would be a passing difficulty if the policy of the present Government was carried to a successful conclusion. The advisory committee to be appointed would in future take some of the burden off the Postmaster-General's shoulders. The demand for apparatus was bound up with the provision of good programmes. Referring to the growth of the industry, Sir Laming remarked that in March last 122 000 wireless receiving licences had been issued. By September the number had increased to 180 000. During October 298 000 people paid for licences, and the total number issued was now 492 000. This number should be doubled before the end of next year, and anything less than that would be a failure, either on the part of the manufacturers or on the part of the Broadcasting Co. The aim of the industry should be to instal a wireless set in every cottage in the land, and to make and keep it an all-British industry.

Wireless Telephony to Aeroplanes.

At the air demonstration given to Dominion representatives at Croydon aerodrome last Saturday, Captain S. Baker, Civil Aviation Traffic officer, described the organisation of aerial traffic and its control by means of wireless and other signalling systems. A demonstration of the methods employed in the daily routine of the aerodrome was given by means of the Marconi Company's aeroplane —which represented a commercial machine flying on the Continental air route—and two Marconiphone loud speakers arranged near the control tower in such a manner that the orders given to the aeroplane and the pilot's replies could easily be followed by the whole gathering. The machine was called up as it would be in the ordinary way when over one of the reporting points. On the pilot asking for a bearing, this was given, and the machine flew on that bearing until it reached the aerodrome. Directions for landing were then given as would be done if the ground were enveloped in fog.

Irish Broadcasting Developments.

It is reported that the Dail is to be asked for permission to establish a broadcasting station in Ireland. It will be recollected that negotiations have been proceeding for some time for the purpose of establishing an approved Irish broadcasting company, and that seven companies were in competition for the monopoly of broadcasting in the Free State. Three have dropped out, and the remainder have now combined as the approved Irish Broadcasting Co., with a capital of £30 000. Arrangements between the company and the Post Office are now being completed. The Post Office, states the "Freeman's Journal," will control the issue of business and have a representative on the board of directors, which include Messrs. W. Roche, P. Belton and T. Hempenstall.

Wireless News in Brief.

Sheffield's relay station is to be opened to-day (Friday).

Cork Chamber of Commerce has decided to recommend the necessity of erecting wireless installations for broadcasting on the Old Head of Kinsale and also on the Fastnet Lighthouse and Rock Island, Skibbereen, off the coast of Cork, with a view to the prevention of loss of life at sea, as well as for the benefit of the trade and commerce of the South of Ireland.

The final meeting of the Imperial Economic Conference passed a resolution affirming the importance of establishing as quickly as possible an Imperial wireless service, and urging that the various Governments should take immediate action to remove any difficulties now delaying the project. Mr. Hughes, ex-Premier of Australia, in a cablegram to the Empire Press Union, says: "Do everything possible to insist upon Post Office, which has killed every effort to improve communication with Australia for the past thirty years, granting licence without restriction."

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BUSINESS OPPORTUNITIES AT HOME AND ABROAD.

Contracts Open.

TYNE IMPROVEMENT COMMISSIONERS, November 12th.—Six or 12 months' supply of stores, including electrical accessories, lamps and carbons, iron and steel, ironmongery, rubber goods, varnishes, paints, oils, etc. Forms of tender from the Secretary, Berwick Street, Newcastle-on-Tyne.

BRISTOL DOCKS COMMITTEE, November 19th.—Re-wiring Liverpool Shed, The Grove, Bristol, for electric lighting. Specification from the Chief Engineer, Port of Bristol; deposit £2.

EDINBURGH CORPORATION, November 19th.—Five three-phase transformers. Specification from the Engineer, Electricity Dept., Dewar Place, Edinburgh.

HAVANT JOINT HOSPITAL DISTRICT BOARD, November 19th.—Electric light wiring and fitting of hospital. Particulars can be obtained at the Hospital.

WARRINGTON CORPORATION, November 19th.—Medium tension paper and lead-covered and rubber-covered cables. Specification from Borough Electrical Engineer; deposit £1 1s.

CHESHIRE LINES COMMITTEE, November 20th.—Twelve months' supply of telegraph materials, etc. Specifications from the Stores Superintendent, Warrington.

NEWCASTLE-UNDER-LYME CORPORATION, November 20th.—Supply and laying of about 500 yards of l.t. paper lead covered steel armoured distributor cable. Specification from the Borough Electrical Engineer.

BIRMINGHAM CORPORATION, November 21st.—Reconstruction of 700 yards solid double track and 3 000 yards wooden sleeper double track tramway. Specifications (£5 deposit) from the City Engineer.

MANCHESTER CORPORATION, November 21st.—Electrical plant for Elm Street cold stores. Specification from Superintendent Markets Dept., Town Hall, Manchester.

REIGATE CORPORATION, November 21st.—Electrically driven drainage pumps required in connection with electricity undertaking. Specifications from Mr. C. H. Wordingham, 7, Victoria Street, London, S.W.1, and 33, Brazennose Street, Manchester, on £1 1s. deposit.

DUNDEE CORPORATION, November 22nd.—Single core and three-core l.t. paper insulated and plain lead sheathed cable. Particulars from the General Manager, Electricity Dept., Dudhope Crescent Road, Dundee.

LIVERPOOL CORPORATION, November 23rd.—Tramway material, including rails and fishplates (schedule No. 1), fishbolts (No. 3), tiebars (No. 3), copper bands (No. 4), etc. Forms from the City Engineer.

DUNDEE CORPORATION, November 26th.—Wiring 332 houses at Fairbrothers' Fields. Specification from City Treasurer's Office, Lord Edward Street, Dublin, on £1 1s. deposit.

PRESTON CORPORATION, November 26th.—Two 1 500 kW rotary converter equipments (specification R.P.S.6); h.t. and l.t. switchgear (R.P.S.7); and h.t. cables (R.P.S.8). Specifications, etc. (£2 2s. deposit each), from the Town Clerk. Additional copies of specifications, 10s. per copy (not returnable), from Mr. J. A. Robertson, 20, Brazennose Street, Manchester.

TYNE IMPROVEMENT COMMISSION, November 30th.—20-ton hydraulic crane, with accumulator and electrically-driven force pump. Specification from the General Manager, Bewick Street, Newcastle-on-Tyne; deposit £1.

LONDON COUNTY COUNCIL, December 3rd.—About 3 400 tons (or, alternatively, about 5 100 tons) steel girder tram-rails, lipless track rails and renewable guard rails, with fastenings. Specification from Chief Engineer, Old County Hall, Spring Gardens, S.W.1; deposit £2.

EDINBURGH CORPORATION, December 4th.—Twenty top-covered tramcar bodies, 32 tramway trucks, and electrical equipment for cars. Specifications from the Tramway Manager, 2, St. James' Square, Edinburgh.

ST. PANCRAS (LONDON) BOROUGH COUNCIL, December 6th.—Vertical electric motor-driven condensing water pump, capable of dealing with 750 000 gallons per hour. Specification from the Electricity Office, 57, Pratt Street, Camden Town, N.W.1, on £1 deposit.

PORTHCAWL (GLAMORGAN) URBAN COUNCIL, December 15th.—Provision of electricity supply undertaking. Particulars from the Clerk to the Council.

BELFAST GUARDIANS, December 18th.—Schemes for centralised heating and lighting plant in Institution buildings. Further information from the Clerk, Workhouse, Belfast, on £5 5s. deposit.

Overseas.

JOHANNESBURG MUNICIPALITY, November 19th.*—Cables.

EAST INDIAN RAILWAY CO., November 21st.—Electric overhead travelling cranes. Specification from the Secretary, 73-76, King William Street, London, E.C.4, on £1 1s. deposit.

INDIA STORE DEPARTMENT, November 29th.—Switchboard cable (schedule No. 7) and v.i.r. insulated wire (No. 8). Forms from India Store Department, Branch No. 11, Belvedere Road, Lambeth, London, S.E.1.

* Particulars from the Department of Overseas Trade.

AUCKLAND ELECTRIC POWER BOARD, November 24th.*—Transformers and accessories.

CAPE TOWN MUNICIPALITY, November 29th.*—Transformers.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, November 20th.*—Protectors for telephone apparatus.

COMMONWEALTH OF AUSTRALIA, November 23rd (London).—Telephone and telegraph apparatus (V209). December 1st (Australia).—Telephone and telegraph apparatus (V.673). December 12th (in London), or December 15th (in Australia).—Cable terminal boxes (S.A. 676). December 17th (London).—Cable terminal boxes (S.A. 674). January 3rd (London).—Telephone and telegraph apparatus (T. 415). Tender forms, etc., from the Supply Officer, Australia House, Strand, London, W.C.2.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS, November 28th.*—Motor generator. December 5th.*—Transformers for White Bay power house. December 19th.*—Transformers for Meek's Road sub-station. February 6th.*—Equipment of two sub-stations. February 27th.*—Motor generator sets.

VICTORIAN ELECTRICITY COMMISSION, December 15th.—Four 1 000 kVA single phase transformers and spares. January 19th.—Transformers, switchgear and accessories for sub-station B. Specification (Nos. 23/145 and 24/2) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO, December 27th.* Electrical supplies, including cable, wrenches, insulating compound, lamp shades, also rubber belting, ironmongery, etc.

VICTORIAN ELECTRICITY COMMISSION, December 19th.*—Fibre for insulators. January 3rd.*—Aluminium steel cored cable and accessories.

SYDNEY CITY COUNCIL, January 7th (in Australia).*—Electrically driven coal unloading and conveying plant at Darling Island power houses. January 14th (extended from November 19th.)—Stepdown transformers (Contract 758).

VICTORIAN RAILWAYS COMMISSION, January 9th (in Australia).*—Spring coiling machine with electric motor and taper rolling machine with electric motor. (Contract 36 659.)

Tenders Accepted.

HALIFAX.—F. S. Jackson, electric light fittings, £15 7s. 6d.

FAVERSHAM RURAL COUNCIL.—H. S. Tett and Co., electric light wiring at Beacon Hill Hospital, £24.

MAIDSTONE CORPORATION.—Brush Electrical Engineering Co. 3 000 kW Ljungstrom turbine, £16 030.

HASTINGS CORPORATION.—Guild of Engineers (London), electric light wiring at St. Clement's Caves, £198.

NORTHAMPTON CORPORATION.—Brush Electrical Engineering Co., top cover for three tramcars, £240 each.

MALVERN URBAN COUNCIL.—Ferguson, Pailin Ltd., switchgear for extensions to electricity works, £1 027 14s.

POST OFFICE STORES DEPARTMENT.—Metropolitan-Vickers Electrical Co., 12 months' supply of "Cosmos" vacuum lamps.

GREAT INDIAN PENINSULAR RAILWAY.—Consolidated Brake and Engineering Co., vacuum brake equipment for 77 electric coaches.

H.M. OFFICE OF WORKS.—Metropolitan-Vickers Electrical Co., portion of contract for nine months' supply of "Cosmos" vacuum lamps.

LONDON COUNTY COUNCIL.—H. J. Cash and Co. (lowest tender), wiring Millbank School, £385 (recommended). Two other tenders received; highest £441.

ALUMINIUM CORPORATION.—Armstrong, Whitworth and Co., two Pelton wheels, each 7 500 H.P., and remodelling an old Ganz wheel to increase output to 1 800 H.P.

BELGIAN POST AND TELEGRAPH DEPARTMENT.—Ateliers de Constructions Electriques de Charleroi, supply and laying of telephone cables, 1 200 000 Belgian francs.

LONDON COUNTY COUNCIL.—Park Royal Engineering Works, (lowest tender), single and double pole track panels and test panel £375 10s. Six tenders received; highest £704.

HAZELGROVE AND BRAMHALL URBAN COUNCIL.—Glover and Co., cables and services, £21 747 9s. 2d.; Ferranti, Ltd., meters, £728; Ferguson, Pailin Ltd., sub-station switchgear, £565.

METROPOLITAN WATER BOARD.—Gwynnes Engineering Co., repairs to centrifugal pumping engines, Barn Elms Works, £108; Anglo-Swedish Electric Welding Co., repairs to boiler at Lee Bridge Works, £63 (both recommended).

SWEDISH RAILWAYS ADMINISTRATION.—Allmaenna Svenska Elektriska Aktiebolaget, electric fittings for five transformer stations in connection with the conversion of the Stockholm and Gothenburg Railway to electric traction, kr. 2 540 000.

LONDON COUNTY COUNCIL.—Cutting Bros. (lowest tender), d.c. motor generators, £80 12s. 6d. Six tenders received; highest £110 7s. 3d. Crypto Electrical Co. (lowest tender), a.c. motor, generators, £100. Seven tenders received; highest £216 8s.

SUNDERLAND GUARDIANS.—Reid, Ferens and Co., transformer station and mains, £963 13s. 6d., wiring central area, £606 10s.; wiring east block, £311 14s.; and motors, £320 15s. Watson, Norrie, Ltd., wiring Havelock Tower, Cottage Homes, etc., £256 11s.

DOUGLAS CORPORATION.—Ruston and Hornsby, two 6-cylinder Ruston vertical cold starting oil engines, 660 B.H.P., at £12 049; taking out existing horizontal engines and replacing by two 4-cylinder vertical oil engines, 440 B.H.P., and rewinding two existing dynamos, £2 250.

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COMPANY NEWS.

Meetings, Reports and Dividends.

CAWNPORE ELECTRIC SUPPLY CO.—An interim dividend of 3 per cent. has been declared on the ordinary shares.

BARCELONA TRACTION, LIGHT AND POWER CO.—A dividend of 1¾ per cent., less tax, on the six per cent. first mortgage bonds is announced.

QUEBEC POWER CO.—£300 000 6 per cent. 30-year mortgage sinking fund debenture stock has been issued during the week at 95 per cent.

SIEMENS BROS. AND CO.—A dividend of 10 per cent. on the 01 per cent. cumulative preference shares for the year ended June 30th last is announced.

FOLKESTONE ELECTRICITY SUPPLY CO.—A dividend for the half-year at the rate of 8 per cent. per annum, tax free, has been declared on the ordinary shares.

COUNTY OF SOUTHLAND (N.Z.) ELECTRIC POWER BOARD.—£750 000 5 per cent. £100 bonds at 99 per cent. have been issued during the past week.

ELECTRIC CONSTRUCTION CO.—Out of the profits for the year ended March 31st next an interim dividend at the rate of 6 per cent. per annum, less tax, has been declared on the ordinary shares.

AGAR, CROSS AND CO.—After providing for debenture interest, losses on exchange and probable loss caused by expropriation of portion of company's property by the Argentine Government, a final dividend of 6 per cent., making 11 per cent. for the year, has been declared.

CALLENDER'S SHARE AND INVESTMENT TRUST.—At the meeting yesterday (Thursday) the shareholders adopted the report and the dividend of 8 per cent., less tax, for the year to August 31st last. The amount carried forward, after provision for dividend and for redemption fund and debenture interest, is £11 503.

OFFICIAL QUOTATIONS.—The Stock Exchange Committee has ordered 283 809 £1 six per cent. cumulative preference shares of the English Electric Co., $17 283 900 capital stock of the American Telephone and Telegraph Co. and 249 640 £1 ordinary and 200 000 7 per cent. £1 preference shares and £20 913 6 per cent. debenture stock of the Argentine Light and Power Co. to be quoted in the Official List.

AMAZON TELEGRAPH CO.—After providing for income tax, debenture interest and sinking fund, the Amazon Telegraph Co.'s accounts for the year ended June last show a deficit of £6 197, which has been met out of general reserve. Unfortunately, business in the Amazon has not yet revived, and the exchange rate has fallen from an average of 7½d. to an average of 6$\frac{5}{64}$d. or 6·075 per milreis, the lowest record for the year being 4¾d.

ERINOID, LTD.—In moving the adoption of the directors' report, which was abstracted in our issue of November 2nd, the chairman, Mr. A. Binnie, said he was glad to say the business, which had been depressed when the figures for the first half of the year were got out, had now picked up again. The sales for October were the best for over three years. After Mr. Binnie had discussed the *pros* and *cons* of free trade and protection, the gist of his argument being that a commodity such as Erinoid would have a fairer chance of competing with foreign articles under a moderate degree of protection, the report was adopted and the dividend approved.

CAPE ELECTRIC TRAMWAYS.—Although the number of passengers carried during the past year (32 094 580) shows an increase of 810 664 over the preceding year, the receipts fell £5 817, due to reduction in price and increase in number of monthly tickets. Reductions in expenditure, however, have enabled the profit to be more than maintained. The gross profit was £84 621 8s. 8d., and after providing for debenture interest and redemption of debentures the credit balance was £64 338 7s. 1d., of which £20 000 is placed to reserve. A final dividend of 3 per cent., making 6 per cent. for the year, tax-free, is recommended. New rolling stock is in course of manufacture.

ALUMINIUM CORPORATION.—At the meeting last week the directors' report was adopted and a dividend on the preference shares at the rate of 7 per cent. per annum approved. The chairman, Mr. K. M. Clark, said all possible progress was being made with the scheme for a second and larger pipeline, penstock reservoir and power house at Dolgarrog, and it was expected that this large addition to their output of electrical energy would be in operation by the end of March. During the present year the company would supply to the North Wales Power Co. over 5 000 000 kWh and during the coming years a much larger quantity. The Power Company had been appointed the authorised undertaker for the whole of North Wales and part of Cheshire and for the first few years it would draw the major portion of its supplies from Dolgarrog.

MONTEVIDEO TELEPHONE CO.—Viscount St. Davids, presiding at the meeting last week, made further references to the ad-referendum agreement with the Uruguayan Postmaster-General for the sale to the Government of the company's business in Uruguay. The purchase price was fixed at $700 000, and if the company had not been so unfairly treated by interference in its management three years' profits would have sufficed to pay that price. As stated in the report (abstracted in our October 26th issue), the Postmaster-General has so far refused to complete the contract. Under the Government decree in 1922, the company reinstated the strikers, and had to pay them £3 546 in wages for the period during which they had refused to work, and during which they had done damage to the property necessitating an expenditure of £8 070. The report and dividend were approved.

New Companies.

B.D.C. (MORLEY), LTD.—Cap., £4 000. Electrical and motor engineers. Reg. office: Town End Garage, Town End, Morley, Yorks.

W. BROWN AND CO. (ENGINEERS), LTD.—Cap., £5 000. Mechanical and electrical engineers. Reg. office: 208A, St. Vincent Street, Glasgow.

M.S.L., LTD.—Cap., £500. Merchants and manufacturers of electrical, mechanical and general supplies, etc. Reg. office: 56, Holborn Viaduct, London, E.C.

A. E. TRIBE AND CO., LTD.—Cap., £1,000. Electrical, motor, and general engineers, etc. Solicitors: C. R. Enever and Co., Broad Street House, London, E.C.

GODFREY SALMON, LTD.—Cap., £500. To carry on the business of engineer formerly carried on by G. Salmon, at 33, Grafton Street, Tottenham Court Road, London, W.1.

CARLISLE, WILES AND CO., LTD.—Cap., £7 000. To acquire the business of manufacturers of special electric steel now carried on at Iona Steel Works, Penistone Road, Sheffield, as "Carlisle, Wiles and Co."

KINGSTON AUTOMOBILES AND ELECTRIC, LTD.—Cap., £1 000. Electrical and mechanical engineers, makers of electrical, wireless, and radio apparatus, etc. Reg. office: 35, Surbiton Road, Kingston-on-Thames.

KNOWSLEY ELECTRICAL CO., LTD.—Cap., £15 000. Electrical engineers and contractors, manufacturers of and dealers in railway, tramway, electrical, magnetic, and other apparatus, etc. Reg. office: 1, Commercial Buildings, 17, Water Street, Liverpool.

HEED AND SNOWDEN, LTD.—Cap., £500. Electrical and mechanical engineers, manufacturers of and dealers in electrical, magnetic, telegraphic, telephonic, and other appliances and apparatus, etc. Reg. office: Exchange Buildings, Tithebarn Street, Liverpool.

H.T.C. ELECTRICAL CO., LTD.—Cap., £2 500. To acquire the business now carried on at 2A, Boundaries Road, Balham, London, as H.T.C. Electrical Co., and to carry on business of manufacturers of and dealers in drawn wire, electric cabling, and electric lamps, wireless apparatus, etc.

ELECTRONIC DEVICES, LTD.—Cap., £6 000. To adopt an agreement with J. R. Robertson, to introduce, operate, exploit, and deal with inventions, etc., relating to apparatus for recording and reproducing optical images and sound vibrations, electronic valves for controlling mechanisms at a distance through wireless and other waves, etc. Reg. office: Kingsway Chambers, 44–6, Kingsway, London, W.C.

POWER AND TRACTION FINANCE CO. (POLAND), LTD. (Public Company).—Cap., £100 000. To seek and secure openings for the employment of capital in Poland and elsewhere. To institute, carry on, finance, etc., trading, financial, industrial, manufacturing, mining, and other businesses, works, contracts and operations, etc. Specific powers are taken to acquire or construct and work electricity works, transport and carrying undertakings, etc. Reg. office: Queen's House, Kingsway, London, W.C.2.

METAL & CHEMICAL PRICES.

TUESDAY, November 13th.

		Price.	Inc.	Dec.
***Copper*—**				
Best Selected ..	per ton	£66 0 0	£3	—
Electro Wirebars ..	„	£69 0 0	£4 10s.	—
H.C. Wire, basis ..	per lb.	9⅞d.	⅛d.	—
Sheet	„	10 $\frac{3}{16}$d.	$\frac{3}{16}$d.	—
***Phosphor Bronze Wire* (*Telephone*)—**				
Phosphor Bronze Wire, basis	per lb.	1s. 1⅞d.	¼d.	—
***Brass* 60/40—**				
Rod, basis	„	7½d.	—	—
Sheet, basis ..	„	10d.	—	—
Wire, basis	„	10d.	—	—
***Pig Iron*—**				
Cleveland Warrants	per ton	£5 5 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 6	—	—
***Lead Pig*—**				
English	„	£32 15 0	5s.	—
Foreign or Colonial	„	£31 2 6	£1 2 6	—
***Tin*—**				
Ingot	„	£217 5 0	£8 15s.	—
Wire, basis	per lb.	2s. 10d.	1d.	—
Aluminium Ingots ..	per ton	£120 0 0	—	—
Spelter	„	£33 7 6	2s. 6d.	—
Mercury	per bottle	£9 15 0	—	5s.

***Sulphur* (Flowers)**—Ton £8 os. ***Sodium Chlorate*—Per lb. 2½d.**
„ (Roll-Brimstone)—„ £8 os. ***Sulphuric Acid* (Pyrites, 168°)**
Copper Sulphate.. „ £25 per ton, £7 10s.
***Boric Acid* (Crystals)**. „ £48 ***Sodium Bichromate*.—Per lb. 4½d.**
***Rubber*.—Para fine, 1s. 0½d.; plantation 1st latex, 1s. 2⅜d.**

The metal prices are supplied by British Insulated & Helsby Cables, Ltd, and the rubber prices by W. T. Henley's Telegraph Works Co.

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MUNICIPAL FINANCE.

Further Results from Electricity Undertakings.

The Ipswich electricity supply accounts for the year ended March last show revenue £82 187, compared with £83 488 in the previous year, working expenses, £44 873, against £55 480, and gross profit £37 313, against £28 007, and, after providing for income tax interest and repayment of loans, the net profit was £10 800, compared with £4 564 for the previous year. Energy sold was 5 750 151 kWh (against 4 906 830 kWh). Working costs were reduced from 2·16d. to 1·417d. per kWh, a decrease of practically ½d. Coal cost per kWh was reduced nearly 50 per cent., due to reduced price of coal and the use of more economical plant. The two 3 000 kW Brush-Ljungstrom turbo-alternators have worked very satisfactorily. The installation department and showroom continue to make satisfactory progress, the orders showing an increase from £11 559 to £11 789 for the year. Maximum load increased from 3 213 kW to 3 517 kW, due largely to the showroom and propaganda work. The business done in connection with electric vehicles also continues to improve. Consumers increased from 3 003 to 3 544, and the connections from 11 940 to 13 349.

Hackney's Progressive Policy Justified.

The accounts of Hackney (London) electricity department for the year ended March 31st show total income £157 080, compared with £168 763 in the previous year, expenditure £70 412, against £87 564, and gross profit £86 668, compared with £81 199. After payment of loan charges, bank interest and contribution to superannuation fund, the net profit was £34 132, compared with £32 733. The income of the sales department was £11 884, against £12 229, but notwithstanding this reduction there was a profit of £52, compared with a loss of £164. There seems to be no doubt that the department's enterprising policy in regard to the sales department and propaganda work generally is beneficial to the undertaking as a whole, as the kWh sold last year, 18 582 376, showed over a million increase, and were more than in any previous year, not excepting the war years, in which there was an abnormal increase in the power demand. The maximum demand last year was 394 kW (273 kW) d.c., and 11 200 kW (11 000 kW) a.c., and the load factor was 18·29 (17·65) per cent.

The Bury (Lancashire) electricity undertaking has participated in the fairly general reduction of costs during the past year, the reduction of generating costs in the case of Bury being from 1·126d. to 0·644d. per kWh, while the total costs fell from 1·489d. to 1·014d. Although the fuel consumed increased from 21 635 to 23 918 tons, the average price dropped from 37s. 5d. to 19s. 10d., a decrease of 47 per cent, and the quantity of fuel used was reduced from 3·33 lb. to 2·78 lb. per kWh. Revenue was £88 038, compared with £94 721, generating costs were £53 173 (£70 564), and total costs £83 783 (£93 292), leaving net profit £4 255 (£1 429); 17 927 295 (13 211 883 kWh were sold exclusive of traction, and 19 823 173 (15 030 223) inclusive. Maximum load was 8 130 kW (6 441 kW) and load factor 27·8 (26·6) per cent. A 6 000 kW turbo-alternator has been installed and set to work, and a 10 000 kW set is on order.

Large Saving on Coal at Wimbledon.

The accounts of the Wimbledon electricity department for the year to March last show revenue £99 964, compared with £87 359 in the preceding year, working expenses £47 239, against £59 200, and total costs, including capital charges, £71 262, against £81 465, the net profit being £28 701 (£5 894). Cost of fuel per kWh sold was 0·699d., compared with 1·541d., and wages at the generating station amounted to 0·265d. (0·448d.) per kWh sold; the kWh generated were 7 871 110 (5 831 262), and sold 6 156 683 (4 277 808); consumers connected increased from 8 867 to 10 654. Maximum demand was 3 600 kW, compared with 2 725 kW, and load factor 19·52 (17·92) per cent.

The revenue of the Rochdale municipal electricty department for the year ended March 31st was £185 317, the gross profit £56 227, and the net profit £11 547, and these good results were obtained in spite of a reduction in the average price obtained per kWh from 2·058d. to 1·396d. The kilowatt-hours sold were 30 894 047, compared with 21 622 008 in the previous year, and consumers connected increased from 2 041 to 3 058—a record increase. The overall reduction of prices to consumers during the year was 32 per cent. Steps have been taken to deal with the progressive demand by means of a further bulk supply of 8 000 kW from the Lancashire Electric Power Co.

The receipts of the Weymouth electricity department for the past year were £27 665, compared with £29 467 in the previous year. Working and general expenses were £17 324, against £22 810, leaving gross profit £10 341 (£6 657). After provision for capital charges, etc., the net profit was £4 631 (£1 948). Consumers increased from 1 568 to 1 697 and maximum load from 631 to 713 kW. Load factor was 21 (21·4) per cent. Energy sold increased from 1 173 056 to 1 311 702 kWh.

At Portsmouth the revenue increased from £123 756 to £133 636, the gross profit from £37 790 to £50 535, and the net profit from £15 740 to £23 973. Energy generated was 7 683 100 kWh of which 6 190 000 kWh were sold. Maximum load was 4 700 kW. £10 000 has been voted for relief of rates.

Carlisle Corporation's electricity supply revenue increased from £53 470 to £55 848, gross profit from £14 937 to £23 988 and net profit from £579 to £5 813, although the average price obtained dropped from 2·18d. to 1·88d. per kWh. Total costs were reduced from 2·15d. to 1·68d; the kWh generated were 8 893 570 (against 7 565 774) and sold 7 133 889 (5 886 680). Motors connected aggregate 7 425 (6 813) H.P. Maximum load was 3 983 (3 561) kW.

The accounts of the Borough of Cheltenham electricity undertaking for the year ended March, 1923, show revenue £55 497, gross profit £26 661 and net profit £7 515. Maximum supply demanded was 2 169 kVA. Sales of energy amounted to 2 974 354 kWh, compared with 2 310 726 in the previous year.

Municipal Tramway Accounts.

Salford Corporation tramways show a net profit of £42 458 for the past year, compared with £7 573 in the preceding year. This net profit is considerably higher than that of any other year since the commencement of the undertaking, with the exception of the year 1919, which produced the record figure of £42 672. The past year's increased profit was secured, in spite of a reduction in revenue from £564 226 to £536 350. After paying working expenses of £391 360, the gross profit was £133 315, against £106 174. The whole of the net profit is placed to depreciation and renewals fund. Passengers carried were 78 538 355, compared with 76 207 988 in previous year, and car miles run 6 279 656, against 6 085 439. Earnings per car mile were 19·257d., against 21·235d. and working expenses, including power, were 14·401d. The motor omnibuses earned £16 659, and after providing for working and general expenses there was a surplus of £2 106 to carry to credit of profit and loss account.

INSTITUTION NOTES.

Assistants' prizes for 1923-4 will be awarded by the Institution of Heating and Ventilating Engineers as follows:—The Lamby Premium (10 guineas) for the best paper dealing with heating generally; the Sirocco Premium (10 guineas) for the best paper dealing with fan engineering and the general application of fans, air washing, air conditioning, dust and fume removal; and the Preston Premium (5 guineas) for the next best paper on any subject included above.

The prospectus of the evening classes of the Northampton Polytechnic Institute, Clerkenwell, contains detailed information of the work carried on in the electrical engineering and applied physics department. Courses in electrical engineering are arranged to give general practical and theoretical instruction to those training as electrical engineers. The subject has been divided into six courses.

A general discussion on electrode reactions and equilibria will be held by the Faraday Society meeting at the Institution of Electrical Engineers on Monday, November 26th. The first session of the meeting will extend from 3 to 5 p.m., and will deal with "Conditions of Equilibrium at Reversible Electrodes." Sir Robert Robertson, President, will preside, and the introductory address will be given by Dr. E. K. Rideal. Among the speakers will be Professor Biilman, of Copenhagen, who will read a paper on "Some Oxidation and Reduction Electrodes and their Importance to Organic Chemistry." After an interval for tea, the meeting will devote itself to the consideration of "Irreversible Electrode Effects, including Passivity and Overvoltage." Prof. F. G. Donnan, Vice-President, will preside over this session, and the introductory address will be given by Prof. A. J. Allmand. At the conclusion of the meeting, a dinner will be held at the Holborn Restaurant, to be followed by an informal conference. Members of the Institution of Electrical Engineers, the Chemical Society and the Physical Society have been invited to attend this discussion. Others interested should apply to the Secretary of the Faraday Society, 10, Essex Street, London, W.C.2, from whom a full programme may be obtained.

The Home Magazines.

The "Home" magazines for November are rather disappointing from the electrical point of view. Miss Mary Gwynne Howell is to be congratulated on her "good house-keeping" article in "The Ideal Home" in which she calls attention to the advantages of the electric iron in the home. She rightly stresses the fact that the electric iron is not an extravagant and expensive piece of equipment, and that even if it were, the time, labour and economy made possible by its use would be well worth the extra cost. The advantages of ironing large flat articles such as sheets by means of a roller ironer are also mentioned. This magazine also contains an article on the subject of installing and maintaining electric bells. The information is accurate and useful, but no mention is made of the fact that cells require filling with water at intervals, and that if anything goes wrong it is well to look first for the simple rather than the more complicated faults. "Homes and Gardens" contains a short article on "Glitter in Electrical Fittings," which, though mostly illustrations, shows the artistic and effective results which can be obtained from the use of the modern equipment which is now being turned out for this purpose.

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COMMERCIAL INFORMATION

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

KEENE (WILLIAM J.), LTD., 10, North End Road, Golder's Green, electrical engineers. £10 18s. 7d. October 2nd.

RELIANCE RADIO SERVICE, 283, St. John Street, E.C., merchants. £21 6s. 8d. September 25th.

Receivership.

LOWTH AND SMITH, LTD. T. Forster, of 28, Deansgate, Manchester, was appointed receiver and manager by Order of Court dated July 24th, 1923 (Notice filed November 1st).

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

GROOME (J. A.), LTD., London, N.W., electrical engineers.—Registered October 22nd, £100 debenture; general charge.

INTERNATIONAL ELECTRIC CO., LTD., London, N.—Registered October 25th, £70 500 debentures; general charge. *£63 360. January 10th, 1923.

KALGOORLIE ELECTRIC POWER AND LIGHTING CORPORATION, LTD., London, E.C.—Registered October 24th, Trust Deed dated October 12th, 1923, securing £150 000 debenture stock; general charge. *£150 000. August 2nd, 1923.

ORFORD ELECTRIC LIGHT AND POWER CO., LTD.—Registered October 19th, £7 500 debentures, present issue £100; general charge. *£1 150. July 31st, 1922.

Private Meeting.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

MORGAN AND TAYLORS RADIO ELECTRIC, LTD., 122, Wellington Street, Cardiff. Creditors met recently at the offices of Clarke, Dovey and Co., 31, Queen Street, Cardiff, when a statement of affairs was presented which showed liabilities of £3 920 against net assets of £1 982, or a deficiency of £1 938. It was reported that a conference of creditors had already been held, when an offer of a cash composition of 5s. in the £ was put forward. That offer was refused and the creditors decided to accept 10s. in the £, but as the latter was not forthcoming the company went into voluntary liquidation, appointing Mr. S. E. Clutterbuck to act as liquidator. This was confirmed by the meeting, and a committee of the principal creditors was appointed. The following are creditors: Auckland and Son, £250; British Thomson Houston Co., Ltd., £78; Concordia Electric Wire Co., £80; Clarke and Co., Ltd., Manchester, £63; Edison and Swan Electric Co., £175; Engineering Equipment (1919), Ltd., £85; General Electric Co., Ltd., £31; India Rubber and Gutta Percha and Telegraphic Co., Ltd., £376; Ingranic Electric Co., Ltd., £60; Metropolitan-Vickers Electric Co., Ltd., £59; McMichael, Ltd., £200; Siemens Bros., £165; Sterling Telephone Co. (Cardiff), £87; Siemens and English Electric Lamp Co., Ltd., £85; Western Electric Co. Ltd., £837.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Companies Winding-up Voluntarily.

CARDIFF ELECTRIC AND WIRELESS SUPPLY CO., LTD. T. Howard Coath, Andrews Buildings, Queen Street, Cardiff, accountant, appointed liquidator. Meeting of creditors at the liquidator's office, November 24th, at 3 p.m. Claims by November 14th.

RADYR ELECTRIC CO., LTD. H. W. C. Evans, 4, Park Place, Cardiff, appointed liquidator.

Bankruptcy Information.

M'NAUGHTAN, Robert Vallance, electrical engineer, 5, Gordon Street, Paisley. Estates sequestrated November 8th. Meeting to elect trustee and commissioners Monday, November 19th, 12 noon, at the George Temperance Hotel, 3, Gauze Street, Paisley. (Edinburgh Gazette.)

Bankruptcy Proceedings.

BARLOW, Alfred James, trading as BARLOW BROS., electrical engineer, 9, Brunswick Place, City Road, London. The public examination of this debtor was held last week, statement of affairs showing liabilities £1 834 (£1 705 expected to rank), and estimated net assets £1 427. Debtor said that for some 8 years before December, 1911, he was employed by electrical and general engineering firms. In that year he began business on his own account as a general and electrical engineer, with a capital of about £250, trading under the style of Barlow Bros., at 9, Brunswick Place, E.C. He continued the business until April last when he filed his petition in consequence of his chief creditor having obtained a judgment against him. According to the trading accounts there was a gross profit for the period ending June 30th, 1922, of £1 698 with a net profit of £31 and a surplus at that date of £1 279. The figures as at December 31st following were gross profit £3 476, net profit £1 988 and a surplus of £2 997. Asked to account for the disappearance of that surplus so rapidly the debtor explained that it was due to the different figure attached to the value of his stock. A certain firm refused to take delivery of some goods and as he was unable to realise them elsewhere he knew that they were then of no value. They had previously been included in his balance sheet at top figures but he had later to admit to himself that they were worth practically nothing. He began to realise that he was insolvent when the goods in question were refused. In February last creditors were pressing him and he then realised that if he were called on to do so he would be unable to pay all of them in full. He had since incurred debts amounting to £220 but he had hoped all along that trade would revive.

GORDON, Malcolm Thomas Birch, electrical and general merchant, lately 20, Western Broadway, King Street, Hammersmith, W. This debtor was last week granted an immediate discharge subject to paying a judgment for £5. The Official Receiver, who opposed the application on two statutory grounds said that the ranking liabilities were returned at £806 while the assets had realised £7 9s. 2d. In May, 1915, the debtor in partnership began business as dealers in portable electric lamps, trading under the style of the TELAX CO. at the above address. In November, 1915, the firm's chief suppliers discovered that the debtor's partners were two of their employees and in consequence discharged them and ceased to supply any more goods to the partnership. Owing to that the business declined and the partners withdrew. In February, 1916, the suppliers again agreed to supply the debtor with goods and he then carried on business as THOMAS GORDON, being successful until April, 1919, when the lighting restrictions were removed. He continued to trade until the following December when his chief suppliers took back stock to the value of £700 and in March, 1920, he filed a declaration of inability to pay his debts.

MODERN ELECTRICAL SUPPLY CO., LTD., 7 and 9, Whitecross Place, Wilson Street, Finsbury Square, E.C. In this compulsory liquidation the Official Receiver has issued a summary of the company's statement of affairs. This shows the position as at November 6th, 1922, the date of the voluntary liquidation, and it discloses liabilities £9 426 of which £4 450 are expected to rank, and assets £4 975, of which £106 are required to meet preferential payments and £4 868 the claim of the debenture holder which amounts to £5 000. There are accordingly no assets available to meet the claims of the unsecured creditors, which amount to £4 319, while in relation to the shareholders a total deficiency of £7,383 is shown. The Official Receiver observes that the company was formed in August, 1921, to acquire the business of electrical engineers formerly conducted by G. F. A. Stone and G. A. Davenport, at 14, High Street, Pinner. In January, 1922, the company bought for £250 the goodwill and assets of the Kent Coast Electrical Co., of 85, High Street, Broadstairs. The purchase price was duly paid to the vendor and immediately afterwards the business was transferred to Mr. Whittle, the governing director, who advanced altogether £8 150 to the company, and who, on November 6th appointed a receiver on his behalf. Mr. Stone who has acted as a director says that in his opinion the failure of the company is attributable to the fact that pending the licensing of broadcasting it bought for cash large quantities of wireless instruments which it was unable to dispose of owing to the prolonged negotiations for the issue of licences during which time the public were warned to avoid making use of such instruments until licences had been granted. The Official Receiver has no reason to disagree with these views but he has not yet completed his investigation of the circumstances attending the company's transactions with the Kent Coast Electrical Co.

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PATENT RECORD.

Specifications Accepted.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

203 381 C. L. BROWN and S. H. HEYWOOD AND CO. Electrical controllers. (2/6/22.)
203 382 P. FREEDMAN. Electric arc devices. (2/6/22.)
203 396 BRITISH THOMSON-HOUSTON Co. and R. D. GIVEN. Controllers for electric circuits. (7/6/22.)
187 202 E. HABANN. Thermionic tubes. (14/10/21.) (Addition to 182 105.)
203 420 BRITISH INSULATED AND HELSBY CABLES and F. MERCER. Rendering of line capacity of telephone cables uniform. (14/6/22.)
203 427 WOOTTON, C. A. Electrical fuse and switch contact clips and cable blocks. (17/6/22.)
203 446 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Wireless signalling systems. (28/6/22.) (Addition to 192 346.)
203 447 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Electric transformers. (29/6/22.)
203 451 C. K. CHANDLER. Wireless receiving apparatus. (1/7/22.)
203 452 R. MARR. Electric fuse. (16/4/23.)
203 460 H. W. COX. Electrical switches. (6/7/22.)
203 463 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Electric heating devices. (7/7/22.)
203 465 D. R. DAVIES and METROPOLITAN-VICKERS ELECTRICAL Co. Electric switches, circuit closers and the like. (7/7/22.)
183 836 R. ERBAN and A. MADLE. Devices for the transmission of electric currents between relatively movable solid conductors by means of liquid conductors, particularly amalgams. (20/7/21.)
203 489 L. LODGE and LODGE-COTTRELL, LTD. Safety device for use with electrical precipitation apparatus. (8/8/22.)
203 494 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Terminal connections for electrical apparatus. (11/8/22.)
203 507 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Automatic switching apparatus for electric distribution systems. (22/8/22.)
203 510 SIEMENS BROS. AND Co. and C. R. RIBER. Electrically-heated soldering irons. (24/8/22.)
203 517 H. P. P. REES. Receiving apparatus for wireless signalling. (1/6/23.)
203 552 A. RENAUDIN. Protectors for the connecting ligatures of suspended insulators. (6/10/22.) (Addition to 186 632.)
203 555 W. A. COATES and METROPOLITAN-VICKERS ELECTRICAL Co. Electrical switchgear. (7/10/22.)
203 556 W. F. WINTERLING. Clockwork-actuated electric switches. (9/10/22.)
203 564 G. J. SPOHRER. Electric motor-driven compressors. (23/10/22.)
203 566 HYDROLOID, LTD. (EXPORTINGENIEUR FÜR PAPIER UND ZELLSTOFFTECHNIK GES.). Manufacture of paper-insulated electric cables and paper therefor. (25/10/22.)
203 585 ROLLS-ROYCE, LTD., and F. H. ROYCE. Electrical ignition apparatus for internal-combustion engines. (18/11/22.)
203 595 MADSEN, F. H. Multiple-way selector electric switch. (8/12/22.)
203 602 WAYGOOD-OTIS, LTD. (OTIS ELEVATOR Co.). Electrically-controlled lifts and the like. (18/12/22.)
203 634 F. H. EELES. Luminous electric signs. (28/3/23.)
201 525 M. P. PEDERSEN and N. F. PRASS. Electric incandescent lamps. (28/7/22.)
178 090 FORGES ET ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE JEUMONT. Rotary Converters. (5/4/21.)

Applications for Patents.

October 29th.

27 015 WESTERN ELECTRIC Co. Electron discharge devices. (27/11/22, U.S.)
27 016 LORD EGERTON OF TATTON. Tuning devices for wireless telegraphy, etc.
27 019 F. M. LENNARD and V. G. STEER. Electrically-heated cushions, etc.
27 029 G. UNTERBERG. Push-button switch for electric-starting motors. (6/8/23, Germany.)
27 034 A. D. WIDSTRÖM. Heat accumulating electric ranges. (17/11/22, Sweden.)
27 044 H. V. JAMES. Electric controllers.
27 045 H. V. JAMES. Stopping devices for electric motors.
27 046 B. D. L. MOGRIDGE. Means for cooling thermionic valves.
27 050 KARTRET SWITCHGEAR Co., C. J. BARKER and J. H. COLLIE. Electric fuses.
27 053 AKT.-GES. BROWN, BOVERI ET CIE. Anodes for vacuum discharge apparatus. (8/11/22, Germany.)
27 055 S. A. KUKEL. Production of alternating currents. (28/8/23, Germany.)
27 058 BRITISH THOMSON-HOUSTON Co., L. GRIFFITHS and A. P. YOUNG. Magneto-electric machines.
27 062 OLDHAM AND SON and G. H. DARBY. Miners' electric lamps, etc.
27 063 JOHNSON AND PHILLIPS and W. H. JOHNS. Loud speakers for wireless telephony.
27 066 AUTOMATIC TELEPHONE MFG. Co. Telephone systems. (23/12/22, U.S.)
27 068 JOHNSON AND PHILLIPS and H. J. G. WEBB. Wiring systems for electric lighting.

October 30th.

27 096 G. BARBER and T. HOUGH. Bayonet joint connections for electric lamps, etc.
27 100 MIDLAND ELECTRIC MFG. Co., W. L. BARKER and W. G. H. COX. Electric fuses and switches.
27 129 W. BARCLAY. Vapour lamps.
27 130 W. BARCLAY. Commutators for ignition apparatus.
27 148 F. FAY. Multi-pole electric junction boxes.
27 168 G. T. ROWELL. Crystal detectors.
27 171 K. H. HAWKINS. Crystal rectifiers.
27 175 R. HOWE-GOULD. Wireless telephony. (3/11/22, South Africa.)
27 176 T. L. JONES. Headbands for telephone receivers.
27 181 METROPOLITAN-VICKERS ELECTRICAL Co. Activation and synthesis of gases.
27 182 E. Y. ROBINSON. Vacuum electric tube devices.
27 183 C. F. HAINING. Lead-in device for aerial and earth wires.
27 217 J. M. BLAIR and W. W. CLEMESHA. Wireless communications.
27 236 AUTOMATIC TELEPHONE MFG. Co. Telephone systems. (17/5/23, U.S.)

October 31st.

27 238 B. F. SHORTT. Grids for wireless valves.
27 241 J. BAKER. Electric contact make and break mechanism for magnetos, etc.
27 246 C. T. COLBERY. Crystal holders for wireless reception.
27 247 F. H. and C. HEWSON. Condenser for wireless receivers.
27 270 A. R. RUTHERFORD and A. N. HADDOW. Carrier for electric lamp shades, etc.
27 319 WESTERN ELECTRIC Co. Acoustic horns. (28/3/23, U.S.)
27 320 E. H. SHINN and G. NESS. Control device for d.c. motors.
27 343 METROPOLITAN-VICKERS ELECTRIC Co and K. BAUMANN. Elastic fluid turbines.
27 344 L. and H. E. M. BARLOW. Galvanometer, relay telephone oscillagraph, etc.
27 349 W. CRUICKSHANK and F. W. FRANCIS. Storing and counting electric impulses.
27 350 F. SCRACE. Electric impression switch.
27 363 GENERAL ELECTRIC Co., LTD. Starting electric luminous discharge lamps and tungsten arc lamps. (4/5/23, Germany.)
27 370 F. C. B. CHASE. Electric light fittings.

November 1st.

27 383 G. BARBER and T. HOUGH. Adaptors for thermionic valves, etc.
27 391 H. BREARLEY. Electrodes for furnaces.
27 396 W. B. COLBROOK. Aerial for wireless receiving apparatus.
27 400 D. CARLAW AND SONS. Electrically operated counting mechanism, etc.
27 420, 27 421 and 27 423 J. SCOTT-TAGGART. Electric signalling systems.
27 427 NALDER BROS. AND THOMPSON, A. REYROLLE AND Co., and B. H. LEESON. Relays.
27 446 E. C. W. EVANS. Inductance coils and formers therefor.
27 454 METROPOLITAN-VICKERS ELECTRICAL Co. Supports for motors driving spinning machinery. (3/11/22, U.S.)
27 480 AKT.-GES. BROWN, BOVERI ET CIE. Vacuum-light sleeve insulators for leading electrodes through walls of metal vessels. (3/11/22, Germany.)
27 482 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Electric switches.
27 486 W. MECKE. Radio headgear.
27 489 RELAY AUTOMATIC TELEPHONE Co. and G. E. SHKLOVSKY. Electric switching apparatus.
27 491 R. F. DRURY. Wireless systems.
27 494 E. B. WILFORD. Controlling electric circuits.
27 501 AUTOMATIC TELEPHONE MFG. Co. and J. NIXON. Automatic switches for telephone systems.

November 2nd.

27 505 T. E. BETTS. Crystal detectors.
27 506 W. U. PEARSON. Tubular formers for windings of inductances.
27 509 R. N. DAWSON and F. K. WOODROFFE. Electric resistances.
27 522 WANDSWORTH ELECTRICAL MFG. Co. and E. T. DAVIES. Wall switch-boxes, etc.
27 524 W. A. CARTWRIGHT. Earphone carrier.
27 527 L. A. HACKETT. Wireless valve plugs.
27 529 J. H. BENNISON and F. PAPE. Device for letting down mica on commutators.
27 534 C. S. SOUTHIN. Headphones for telephony.
27 545 M. A. ADAM and R. BAILLIE. Dry cells, etc.
27 569 and 27 570 E. FULLER'S UNITED ELECTRIC WORKS and W. L. TOPPLE. Separators for batteries.
27 571 FULLER'S UNITED ELECTRIC WORKS and A. P. WELCH. Intervalve and telephone transformers for wireless circuits.
27 572 METROPOLITAN-VICKERS ELECTRICAL Co. Balancing machines. (21/12/22, U.S.)
27 573 METROPOLITAN-VICKERS ELECTRICAL Co. and J. W. YOUNG. Ventilation and costing of electrical machines.
27 573 F. AND A. PARKINSON and W. A. BENGER. Induction motors.
27 585 L. H. WADSWORTH. Variable electric resistances.
27 597 C. M. PAGE. Electric switches.
27 608 E. R. GRATE. Incandescent lamps.
27 609 SOC. ANON. ELECTRICITE ELECTROMECANIQUE. Three-phase rivet heater (11/4/23, Belgium.)
27 612 SOC. ANON. LUTECE-LUMIERE. Safety devices for electric networks, etc. (20/12/22, France.)

November 3rd.

27 635 H. J. C. FORRESTER (BORGFELDT AND Co.). Standards for electric light fittings.
27 644 S. COLLINSON AND F. COULTAS. Trolley shoes for electric traction, etc.
27 661 ELECTRICAL IMPROVEMENTS, LTD., and G. L. PORTER. Electric fuses.
27 672 V. FERRARI and C. FONTANA. Single-phase motors.
27 673 A. REVOLLE AND Co. and R. C. MINTON. Electric substations.
27 680 E. B. WILFORD. Electric jacks for raising and lowering dental chairs, etc.
27 681 BRITISH THOMSON-HOUSTON Co. and H. C. WHEAT. Portable electric lamp standards.
27 692 and 27 693 A. R. ANGUS. Devices for production and amplification of electrical oscillations for telegraphy, etc.

ARRANGEMENTS FOR THE WEEK.

Friday, November 16th (To-day).

THE INSTITUTION OF ELECTRICAL ENGINEERS (LONDON STUDENTS' SECTION).
7 *p.m.* At Savoy Place, Victoria Embankment, London, W.C.2. Opening Meeting. Lecture by Mr. C. F. Elwell on "The De Forest Talking Motion Picture."

THE INSTITUTE OF METALS (SWANSEA LOCAL SECTION).
7.15 *p.m.* In the Metallurgical Department, University College, Singleton Park. Lecture by Prof. T. Turner on "The Density of Alloys."

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION.
7.30. At Saint Bride Foundation, Bride Lane, Fleet Street, London, E.C. Paper by Mr. A. F. Berry on "How to Sell 'Heat,' and Problems relating to the Warming of Air."

THE JUNIOR INSTITUTION OF ENGINEERS.
7.30 *p.m.* At 39, Victoria Street, Westminster. Annual General Meeting.

Saturday, November 17th.

THE JUNIOR INSTITUTION OF ENGINEERS.
2 *p.m.* Visit to the Carriage Repair Depot of the Underground Railway, Acton Works, Chiswick.

Monday, November 19th.

THE INSTITUTION OF ELECTRICAL ENGINEERS.
7 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.2. Discussion on "Power in Telephone Exchanges." Opened by Mr. A. B. Eason.

THE INSTITUTION OF ELECTRICAL ENGINEERS (MERSEY AND NORTH WALES-LIVERPOOL CENTRE).
7 *p.m.* At the Laboratories of Applied Electricity, the University, Liverpool. Lecture on "Industrial Research, with special reference to Electrical Engineering Development," by Mr. W. Wilson.

Tuesday, November 20th.

THE INSTITUTION OF CIVIL ENGINEERS.
6 *p.m.* At the Institution of Civil Engineers, Great George Street, Westminster, S.W.1. Ordinary Meeting.

THE INSTITUTION OF ELECTRICAL ENGINEERS (NORTH-WESTERN CENTRE).
7 *p.m.* At the Engineers' Club, Albert Square, Manchester. Paper on "The Drive of Power Station Auxiliaries," by Messrs. L. Breach and H. Midgley.

THE ELECTRICAL SOCIETY OF GLASGOW.
7.30 *p.m.* In the Welfare Hall, St. Andrew's Cross Electricity Station, Pollokshaws Road. Paper on "Illumination" by Mr. W. E. Bush.

THE INSTITUTION OF ELECTRICAL ENGINEERS (EAST MIDLAND SUB-CENTRE).
6.45 *p.m.* At Loughborough College. Dr. C. C. Garrard on "Electric Control."

Wednesday, November 21st.

THE INSTITUTION OF ELECTRICAL ENGINEERS (WIRELESS SECTION).
6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, W.C.2. Lecture by Mr. R. C. Clinker on "A Dynamic Model of a Valve and Oscillating Circuit."

ASSOCIATION OF CONSULTING ENGINEERS (INC.).
7.30 *p.m.* At St. Stephen's Club, Westminster, S.W.1. Annual Dinner.

Thursday, November 22nd.

THE INSTITUTION OF ELECTRICAL ENGINEERS.
6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.2. Joint Meeting with the Société des Ingenieurs Civils de France (British Section). Paper on "The Electrification of the Midi Railway." (Postponed from November 15th.)

Friday, November 23rd.

BIRMINGHAM AND DISTRICT ELECTRIC CLUB.
7 *p.m.* At the Grand Hotel, Colmore Row, Birmingham. Paper by Dr. McKinnon on "Storage Batteries."

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THE ELECTRICIAN

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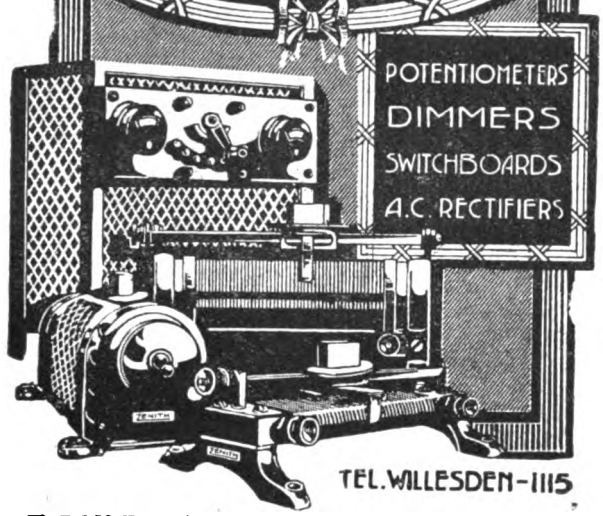

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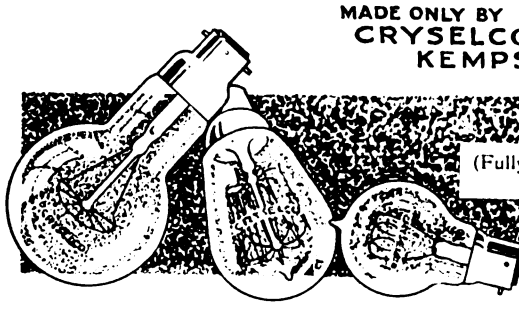

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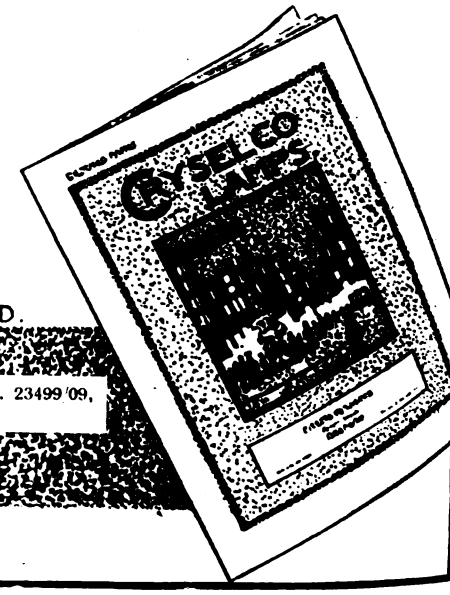

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OVERHEAD LINES.

In more than one recent Presidential Address and Annual Report to the Institution of Electrical Engineers reference has been made to the work that was being done to revise the regulations in force for the transmission of electricity by overhead lines. The preparation and promulgation of such regulations are of course among the duties of the Electricity Commissioners, but they, before making any alterations, wisely enlisted the aid of the Institution in the matter, and a Committee was appointed under the Chairmanship of Mr. E. V. Twiss, on which other public bodies were represented to obtain the views of the industry on the various factors involved. The result is a revised code which the Commissioners have adopted, and to which we referred briefly in our last issue. That such a revised code was necessary is obvious for two reasons. Both public and technical opinion have changed with regard to overhead transmission. The former no longer regards a pole line as an eyesore and a danger, while the latter realises that for main supply lines in the open country and for distribution in small villages and isolated towns its use has advantages, even if it is only a temporary expedient which may have to be discarded as the area grows in electrical importance. It follows as a corollary that overhead lines must be erected so that they are technically efficient, and so that they cause no danger to the public. At the same time, our knowledge being what it is and the conditions in different parts of the country being so varied, it is well that any regulations should be general rather than detailed, and that while taking all necessary precautions they should not "play too much for safety."

All these conditions seem to be adequately fulfilled by the new regulations. They are divided into two main parts, general and specific, the latter section being subdivided into regulations for pressures not exceeding 650 V direct current and 325 V alternating, and for pressures above those values. This is a departure from the old regulations which is an advantage from the economic point of view. The general regulations lay down that the conductors used may be of copper, aluminium or other approved material, that they shall comply with the B.E.S.A. specifications as regards elongation, breaking load and elasticity, or that the elongation for copper shall not exceed 1 per cent. per 10 in., the breaking load 24 tons per sq. in. and the Young's modulus 18×10^6 lb. per sq. in. The corresponding figures for aluminium are to be 4 per cent., 11 tons per sq. in. and 10×10^6 lb. per sq. in. These are new provisions. The minimum size of line conductor is now stated in terms of the breaking load, which is to reach a minimum of 650 lb. This, however, in the case of copper, corresponds to the old provision that the weight should not be less than 200 lb. per mile, the corresponding figure for aluminium being 147 lb. per mile. Line conductors are to be inaccessible though no minimum height is now stated, and precautions are to be taken to prevent contact between them and other wires. In the case of iron supports, precautions are to be taken against corrosion, and wooden supports are to be of oak, other hard wood, or red fir impregnated with creosote. These also are new provisions.

The greater knowledge of the properties of the materials used and of overhead lines *in situ* has doubtless caused a reduction in the factors of safety hitherto permissible, though this is partly accounted for by a reduction in the wind pressure assumed from 25 lb. per sq. ft. to 8 lb. per sq. ft. The latter pressure is equivalent to a wind of 50 miles per hour at right angles to the line at a temperature of 22 deg. F. with a radial covering of ice ¼ in. or ½ in. thick for low and high pressure lines respectively. These are extreme conditions which are seldom likely to be realised in practice. The factors of safety for iron and steel supports are now to be 2·5 instead of 6 and for wood and reinforced concrete 3·5 instead of 10. The factor of safety against overturning is to be 2·5. Modifications in these calculations are to be made in the case of A and H poles. Service lines are to be connected to line conductors at the points of support only and where they run alongside or across a carriage way are to be at a minimum height of 20 ft. This minimum height is also applicable for all lines working at voltages up to 66 000. It should be noted that the old regulations made no provision for ice and snow, and direct comparison of the present and former figures is therefore difficult.

For both low and high pressure lines precautions against breakage and leakage are to be taken by a suitable arrangement of earth wires, and, in the case of the latter, adequate means are to be provided to render any conductor dead, in the event of it falling, due to breakage or otherwise, and the earthing system is to be so arranged that when contact is made between a live conductor and earthed metal the leakage current shall not be less than twice the leakage current required to operate the devices which make the line dead. Where high pressure lines are erected along or across a public road or canal the wires are to be placed at an appropriate height and are to be provided

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with duplicate insulators or other means for ensuring that any line conductor falling shall be put to earth. Where the line crosses a road, railway or canal it is to be protected by both duplicate insulators and an earthing device or by duplicate insulators supporting duplicate conductors tied at intervals not exceeding 5 ft.

Though the revised code will not be retrospective; that is it will only apply to future overhead lines erected by authorised undertakers in Great Britain, it is to be hoped that where possible steps will be taken to bring existing lines into accordance with its provisions, especially as these differ so greatly from former practice. As we have already said the Commissioners have wisely avoided laying down the law on matters of detail, and, as it will be agreed that the general provisions promulgated are not onerous, they should therefore receive whole-hearted acceptance.

Current Topics.

The Prince of Wales on Electrical Development.

THURSDAY, November 15th, 1923, will always be a great day in electrical annals. On that date the PRINCE OF WALES attended a dinner of the British Electrical and Allied Manufacturers' Association and showed by his remarks, what is already common knowledge, that he is, as Lord DERBY happily expressed it, a remarkable asset to our nation. His speech, which we print in full on another page of this issue, is like a famous pronouncement of H.M. THE KING when PRINCE OF WALES, a message of cheer to the industry to which we belong, and it is a pity, considering both its matter and the manner of its delivery, that it could not have been broadcasted to every one connected with electrical development. The speech is of greater value in that His ROYAL HIGHNESS is no doctrinaire. He has travelled widely throughout the Empire and, as he said, owns property in it. When, therefore, he remarks that "to keep our Imperial position we must maintain the lead in electrical development similar to that which we undoubtedly held in the development of steam," he delivers a message which it would be folly to ignore. It is essential, to quote HIS ROYAL HIGHNESS again, that electrical development should be regarded not only from the viewpoint of the United Kingdom, but from that of the whole Empire, and that if it is so regarded our future as an industry is assured. This is a clarion call indeed; and we owe a debt of gratitude to the PRINCE for showing us our way so clearly. If we do not take the golden way that he indicates we deserve to sink into decay.

Better Communication Essential.

THE same point was made in a different way by Mr. AMERY in replying to the toast of "Imperial Trade and Resources," proposed by the PRINCE OF WALES. The three factors in true Imperial development were, he said, men, money and markets. To obtain the greatest efficiency from all these factors communication was necessary and in the development of those communications electricity must play a great part. The submarine telegraph had enabled the Empire to endure through a period of relative stagnation and would play a greater part in the coming period of active development. Except in the field of wireless our present inter-Empire communications leave nothing to be desired, but we want to see every obstacle removed and especially the means provided for international telephonic intercourse on the lines suggested by Mr. GILL. We are glad to learn that technically good work towards this end is now being done. But it is the duty of our Government, of whatever complexion it may be, to remove those political restrictions which, as we know to our cost, too often result in stagnation. We should like to add a word of praise on the way the B.E.A.M.A. dinner was organised. It was everything an electrical dinner should be, and so seldom is. It is a great pity more people could not have been present.

The Fynn-Weichsel Motor.

THE great advantages of three-phase generation, transmission and distribution are to some extent counteracted by the correlated existence of wattless power and by all the drawbacks that rise therefrom. These conditions have given rise to the great problem of power factor correction, many interesting solutions of which, both technical and economic, have been put forward. The latest contribution comes from Mr. VAL A. FYNN, who, as will be seen from an article which we publish on another page of this issue, has invented an alternating current motor which not only corrects its own lagging current, but can be designed to operate at a leading power factor. This of course has been done before, but Mr. FYNN claims that his solution has great advantages of simplicity and the results he gives seem to substantiate those claims. The Fynn-Weichsel motor, as it is called, consists of a judicious combination of a synchronous and an induction motor with a rotary converter so that it may be termed a synchronous induction motor.

Details of Design.

THE design required raised many problems which Mr. FYNN reviews and these were finally overcome by winding the primary winding on the rotor and connecting this to the line through slip-rings and also to a small commutator. In this way the armature reaction axis, the resultant field axis and the vector of the terminal voltage with respect to the brush axis can be controlled. The motor starts as an ordinary induction motor, and is brought into synchronism by an additional torque, being held in synchronism by a direct current excited by the machine itself until the synchronous part of the machine becomes overload. When this occurs, the induction motor part comes into action, the change over being quite smooth. The reverse action is equally satisfactory. Mechanically the machine is of nearly standard construction and electrically the main difference is that the rotor must be better insulated than the stator. We notice that in a local American paper, the motor is heralded as a factor in the revolution of the world, but Mr. FYNN rightly disclaims such exaggerations which are on a par with the further statement in the same paper that EDISON invented the dynamo. Nevertheless, we agree that the machine has ingenuity and merit, and should do much to improve the present unsatisfactory power factor situation. We shall await further information about it with interest.

Christmas is Coming.

ABOUT this time of year the young girl's fancy lightly turns to thoughts of Christmas presents; and human nature being what it is, the young man's fancy receives a push in the same direction. Children begin to talk about Santa Claus and drop hints of the broadest as to toys that they lack, while *paterfamilias* is inveigled into a corner after dinner to undergo a tactful but none the less effective capital levy. This is inevitable, but as WORDSWORTH has pointed out in another connection, one of the highest attributes of human nature is its capacity for turning "necessity to glorious gain." And the message for the electrical industry at this time of year is therefore: As Christmas presents have to be bought, see that those that are bought are electrical. To carry out this advice is not difficult. Electrical Christmas presents do not have to be distinguished by snow or holly, though decorative cartons can be used to further even this illusion. They are equally acceptable whether the climate is seasonable or unseasonable, and they have the attractiveness of novelty which no longer hangs about bedroom slippers or pearl necklaces. At the same time, if electrical presents are to be available in due quantity a selling campaign is necessary, and, as we advised last

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year, this campaign should begin for each Christmas not later than the day after the previous Boxing Day. This advice, we are glad to learn, has been taken by a number of electrical firms, and in a subsequent issue we shall give some account of the electrical presents that will be seen in the shops this year. For the moment the purpose of this note is twofold—to persuade those who have done nothing to begin and do something, if not for this year then for next; and to persuade all electrical engineers to give electrical apparatus for the presents they perforce will have to give. This is electrical development which everyone can undertake for themselves. By so doing they will set an example and give satisfaction, two things which should engender that self-complacent glow which is so necessary to the enjoyment of Christmas. The use of electrical apparatus in this country is still much smaller than it should be. Christmas forms an excellent opportunity for increasing it.

Developments in Illuminating Engineering.

MR. LEON GASTER, in his address at the opening meeting of the Illuminating Engineering Society on November 11th, was able to show that matters in this field have not been standing still during the vacation. An important event has been the appointment by the Department of Scientific and Industrial Research of a Committee with wide terms of reference to deal with various outstanding problems in lighting. The Home Office Factory Department also appears to be doing useful educational work on industrial lighting in conjunction with the Joint Industrial Councils of the leading industries. The report on this subject issued by the International Labour Department of the League of Nations is another indication of the interest taken in the subject abroad. The Report of the Committee on Progress in Lamps and Lighting Appliances reveals steady progress towards standardisation, though no very radical advances are recorded. The exhibits at the meeting, comprising high power gasfilled lamps, the new Pointolite outfit for alternating currents, a new headlight for motor cars and various devices utilising coloured light, also illustrate this tendency towards experiment and reveal substantial progress in detail.

Propaganda on Lighting.

THE keynote of Mr. GASTER'S address was the need for the greater propaganda in favour of good lighting. Since the Illuminating Engineering Society commenced its work, about fifteen years ago, the recognition of the value of good illumination amongst technical men has developed greatly, and it may fairly be said that the fundamental requirements are now well understood by lighting experts. There is plenty of information available on the right methods to be followed in lighting streets, schools, libraries, factories, etc. What is now needed is to bring this information before the large users of light, many of whom cannot understand technicalities, but would welcome information in a popular form. A useful step in this direction has been taken by some of the leading firms in the lighting industry in arranging periodical demonstrations, but it is important that such efforts should be made on a concerted plan. We are glad to note, therefore, that the Society is showing itself alert to the fact that the period of popularisation of illuminating engineering has now arrived. Amongst other steps suggested is the modification of the official journal so as to make it more readable to electrical contractors, managers of factories and others, and we note with interest that the next meeting of the Society is to be devoted to a discussion on "The Application of Illuminating Engineering in Practice."

Imperial Wireless.

As already reported in these columns, one of the last acts of the Imperial Economic Conference was to pass a resolution affirming "the importance of establishing as quickly as possible an efficient Imperial service of wireless communication" and pointing out that the Governments concerned "should take immediate steps to remove any difficulties which are now delaying the accomplishment of this." A warning against the subordination of public to private interests was also uttered. All of this is, of course, a direct criticism of the inaction of the British Government, a criticism which is rendered more weighty by their continued failure to reach agreement on ways and means, and by the delay which has thereby been caused in bringing this useful form of international communication into being. While the Dominions are either ready or in a fair way to be ready with their transmitting and receiving stations, in this country we are still arguing as we have been doing for the past twelve years. As the subject is of the highest importance not only to this country but to the Empire it may be useful to review the present position very briefly in the hope that by clearing our ideas some way out of the *impasse* may be found.

The Strategic Problem.

THE British Post Office stands out for Government ownership and operation. In that they are opposed by all the Dominion Governments and by the Marconi Co., who have made several offers from time to time to conduct the service under certain guarantees. The latest proposal is that the Government should operate one station and the Marconi Co. another, and that the traffic should be pooled between the two. The Marconi Co. insist, in our opinion quite rightly, that such an arrangement would only be workable if they can retain the management of their own business. And under guarantees on that point they are prepared to enter into a pooling arrangement. This was the position on October 19th, when the Marconi Co. wrote to the Post Office in that sense. But so far no reply to the letter has been received, and so the matter drags on. Were it not for strategic reasons, which are more important than the Dominion Governments seem to realise, we should prefer to see the whole service handed over to private enterprise. It has worked well in the case of the submarine cables. There is no reason why it should not be equally satisfactory in wireless. If, however, that is impossible or inadvisable the Marconi Co. or any other private enterprise should be allowed the greater bulk of the commercial traffic, the Government stations being kept in order for strategic purposes only, a purpose for which we sincerely hope they will not be required.

Electricity and Boxmaking.

A CORRESPONDENT points out the need for electrical engineers paying more attention to developments in the boxmaking trade. Electrically speaking, this is a comparatively unexplored field compared with other industries, and seems to be a case where the individual electric drive can be used with advantage to obtain cheaper and more efficient production. Electric lighting of course is better than gas, especially owing to the inflammable nature of the material, and owing to the necessity of accurate colour matching. It is pointed out moreover, that the illumination is often very bad and this is a matter which should certainly receive attention. On the power side corner cutters, slotters and scorers, can all be operated electrically, while heating can receive a useful application in connection with the glue stoves. The making of good glue requires a great deal of skill and at present, owing to the methods of treating employed, the product is often not all that it should be. The argument for the individual drive in box factories is similar to that which has often been advanced for the textile industry. The load is cyclic and intermittent, and apart from getting rid of belts and shafting the installation of one motor to deal with infrequent and peak loads is uneconomic. Another advantage is that it is safe, a factor of importance where female labour is largely used.

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SHORT CIRCUIT PHENOMENA.

A Complex Subject—Importance of Transient Currents—Influence of Effective Field Flux and Synchronous Reactance.

By G. L. B. METZ.

Problems are constantly presenting themselves to engineers at the present time where it is necessary to obtain the probable value of the short circuit current of a system or machine. It is the value that this current assumes which decides whether or not the apparatus in circuit is capable of functioning with safety under all conditions without a critical mechanical stress or temperature rise being reached.

So many and varying are the functions that operate at the time of short circuit that the subject is necessarily of a complex nature. A few of the more predominating features, however, are alluded to in this article, with the hope that they may prove of value. Before actually considering alternator short circuit characteristics, it is useful to notice exactly

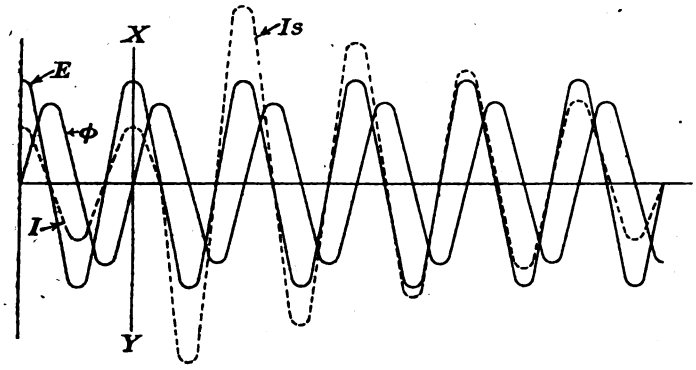

FIG. 1.

what occurs when an electrical circuit such as a coil, containing resistance R and inductance L (capacity negligible) is short circuited.

Suppose a voltage V be impressed upon this coil, this voltage will be used up in overcoming the impedance of the circuit as shown in equation (1),

$$V=Ri+L\frac{di}{dt} \quad . \quad . \quad . \quad . \quad . \quad (1)$$

and a magnetic flux φ will be produced about the coil. If the voltage be suddenly withdrawn from the coil without the characteristics of it altering in any way, as would occur in the event of the coil terminals being short-circuited, the current i and flux φ must eventually become zero. But since the magnetic flux represents stored energy it will not be given up instantly, but will gradually collapse from its initial value φ to zero, cutting the conductors it surrounds in so doing, and inducing in them a back e. m. f. which drives a current round the coil circuit and is eventually dissipated in the form of i^2R.

By equating equation (1) to zero :

$$Ri+L\frac{di}{dt}=0$$

Whence $$\frac{di}{i}=-\frac{R}{L}dt$$

$$\log i=-\frac{R}{L}t+\log C$$

$$i=Ce^{-\frac{R}{L}t} \quad . \quad . \quad . \quad . \quad (2)$$

When t, the time, is zero, the transient current equals the normal current, it is then evident in equation (2) that $i_o=C$.

Whence $$i=i_oe^{-\frac{R}{L}t} \quad . \quad . \quad . \quad (3)$$

Where i = Transient current.
i_o = Initial current.

These results tend to confirm that the current in the circuit immediately after short circuit is not zero, and that while no further external power is being supplied, a transient will appear set up by the stored magnetic energy contained in the circuit, and dying down from a value equal to maximum current at the instant of short circuit to zero according to an exponential law, and further, this transient current will flow for a time :

$$T=\frac{L}{R} \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

From the foregoing remarks it can be seen that if R, the resistance, be large, the duration of the transient will be small, that is, the magnetic flux will collapse suddenly, therefore a very high voltage will be produced. Should, however, the resistance be small, the transient will last for a much longer time ; the magnetic flux gradually decreasing, and the subsequent voltage produced being proportional to $\frac{d\varphi}{dt}$ will be correspondingly lower.

An interesting and well-known case may be cited, illustrating this fact. Suppose the field circuit of a generator to be suddenly opened ; the magnetic energy stored is high, the resistance in circuit is infinite (open circuit), therefore a dangerous voltage is produced which very possibly breaks down the insulation of one of the field turns and dissipates itself in this manner.

Bearing in mind the characteristics of this simple circuit, let us turn our attention to an alternator and consider the main factors governing the short circuit current. At the moment that short circuit occurs a current will flow which will be limited by the armature reactance. This reactance is produced by the armature current itself, and will therefore be instantaneous with the short circuit current.

Another factor will come into play with the increase of armature current, namely, the demagnetising effect or armature reaction ; as the armature ampere turns increase so they react on the field circuit. The field circuit represents stored magnetic energy, however, and will be slow to respond to any change of conditions having the characteristics of inertia. Therefore the armature interference will not be instantaneous with the short circuit current, but will gradually build up, following a transient which will be determined by the field constants.

It can be seen, therefore, that the short circuit current decreases from a high initial value proportionally to the effective field flux to a much lower constant value ; the magnitude of the initial current will be limited by the armature reactance only (neglecting external reactance), while the final

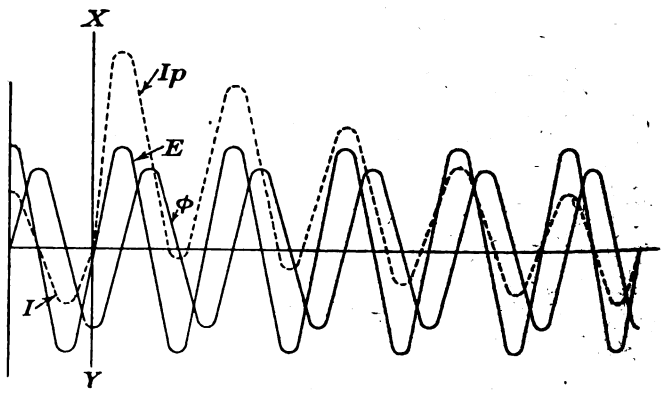

FIG. 2.

permanent short circuit current will be limited by the armature reactance plus armature reaction, which is really the synchronous reactance.

At this point it is interesting to remember that whenever a change of condition takes place in an electrical circuit where energy is stored, no matter how slight the change, a finite period of transition will exist : if the current flowing decreases, the magnetic field will decrease about the circuit, and the difference of flux which exists between the initial and final conditions will collapse, cutting the conductors of the circuit and producing therein an e. m. f., which will cause a transient current to flow and endeavour to resist the change of condition. Conversely, should the current flowing increase, the

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magnetic flux about the circuit will increase, again cutting the conductors and producing a back e. m. f. which tends to retard the change of conditions.

Referring to the information obtained when considering a coil possessing both resistance and induction on short circuit, or in other words undergoing a change of conditions, it will be remembered that an exponential transient was produced.

Now the field current of an alternator is a parallel case, and therefore will tend to resist a change of conditions in a similar manner, i.e. exponentially, and as the short circuit current of an alternator varies proportionally with the field flux and field current during the first few cycles, it will take the following form :

$$I = I_o - \frac{R}{L}t$$

When dealing with transients it is always advisable to separate them from the permanent effects with which they are combined, as the majority of complex problems are but the result of two or more simple phenomena appearing together. This rule will be followed in the further considerations of alternator short circuit characteristics.

In the case of an alternator, the permanent short circuit current may for convenience be considered as lasting during

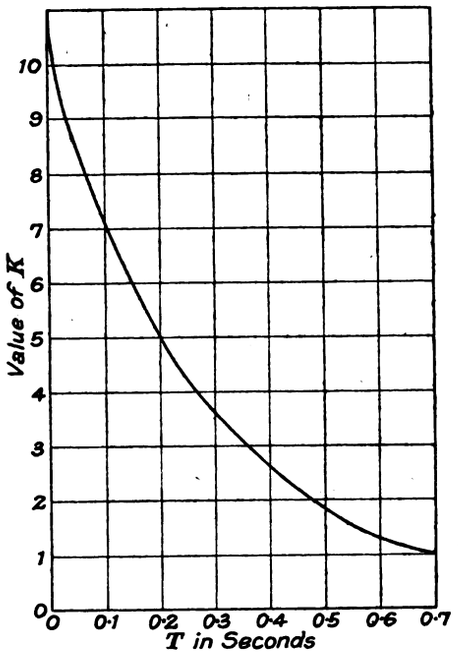

FIG. 3.

the whole period of transition, and superimposed upon it will be the transient characteristic, which will start at a high initial value and gradually die away.

Turning to the transient current which is superimposed upon the permanent short circuit current, a further reference to the field circuit must be made ; at the moment of short circuit an increase of field current must occur to support the flux against the demagnetising effect of the armature. This current is formed by the partial collapse of the flux at such a rate as to produce a voltage, which in turn produces the extra field current required, and maintains it throughout the transition period. The transient field current is fixed by the ratio of :

$$\frac{\text{Synchronous Reactance}}{\text{Armature Reactance}}$$

the value of which depends on the mutual induction of the particular machine under consideration. A figure of about 6 will be found quite general.

Suppose a figure of 6 be adopted for the mutual induction of a machine, then the field current of the short circuit current transient will start at a value which will be six times in excess of normal current, and if a voltage e be the constant field potential necessary to produce normal current, an additional voltage, $(6-1)e=5e$, will have to be induced in the field circuit by the magnetic flux to support the transient.

Now if a transient of duration $\frac{L}{R}$ induces the voltage e to induce the voltage $5e$, the duration of transient will be $\frac{L}{5R}$.

The property will, of course, duly affect the armature current, which is proportional to the effective field flux.

General Equations.

The general equations given below for obtaining the general form of the short circuit current of an alternator are based upon the assumption that the mutual induction of the machine is 6, which is quite a general figure. Certain problems, of course, will be greatly affected by the first momentary current, but will not be much affected by the permanent short circuit current.

When considering the suitability of apparatus to withstand the effects of a short circuit from a mechanical standpoint, it is the maximum stress likely to occur that has to be dealt with. This, of course, varies as the current squared, and will occur at the first alternation following short circuit. The effective short circuit current will be given by :

$$I = \frac{5E}{X} \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

Where I=value of short circuit current.
Where E=terminal pressure.
Where X=synchronous reactance.
Where 5=mutual induction of machine.

A problem involving temperature rise will, however, require a time function, and the effective short circuit current will be the average value of the permanent plus the transient effects for a given time t and will be of the form :

$$\frac{I}{T}\int_o^t 5Ie^{-\frac{5R}{L}t} + I.dt.$$

The two equations obtained do not allow for the transients which take place in the armature circuit, slowing up the prime mover, and various minor effects, but illustrate the general form of the current quite well.

Effect of Position of Voltage Wave.

Before advancing any deeper into the subject it is of interest to notice the various phenomena that occur due to the position of the voltage wave at the instant of short circuit, as this has a very important and perhaps unexpected effect on the short circuit current.

Considering the two extreme cases when short circuit occurs at the instant (*a*) when the voltage is passing through its maximum value (*b*) when the voltage is passing through zero. In Fig. 1 E represents the voltage wave, φ the flux wave, and I the full load current of the machine. If a short circuit takes place at the instant given by the line $X\ Y$, the flux lagging 90 deg. behind the voltage is zero, and as on short circuit the resulting current is in phase, or nearly so, with the flux, the short circuit may similarly be considered as zero at this instant.

The short circuit current would therefore pursue its normal course corresponding to the actual running conditions of the machine, and it would be disposed symmetrically on either side of the zero axis, gradually and symmetrically dying down from a high initial value to the permanent short circuit value. This current is shown by the curve *Is* in Fig. 1.

On account of the presence of the full load current, however, which has a definite value at the instant denoted by $X\ Y$, the short circuit current must initially start from that point, and the wave will therefore be unsymmetrical, depending upon the ratio between full load and short circuit currents with due regard to these relative power factors.

If, on the other hand, the short circuit occurs at the instant marked by $X\ Y$ in Fig. 2, a very different state of affairs is obtained, though the underlying theory is the same as that already described. At this instant the voltage is zero and the flux a maximum in the negative direction, so that the initial short circuit current should also be at its negative maximum value. Actually this cannot occur, as the short circuit current cannot instantly attain the value corresponding to the position and value of the flux wave, but must start from a value corresponding in sign and magnitude to the normal current already in the circuit at the particular instant under consideration. During the first cycle immediately following short circuit the full pressure is generally active in producing abnormal short circuit currents, and in order to maintain the pressure during the first half-cycle the short circuit currents must vary from a maximum negative to a maximum positive, that is, the total change is twice that occurring when a short circuit takes place at maximum voltage and zero flux. This abnormal current wave shown by *Ip* in Fig. 2 therefore commences from

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the value of the full load current at the instant X Y, and from this point rises to a value approaching twice that obtained with a symmetrical short circuit.

This is the so-called doubling effect, but due to certain characteristics of the machine the initial short circuit current wave does not reach quite the double value.

This highly abnormal wave is of course unsymmetrical but dies down rapidly, eventually giving the same symmetrical current distribution as when the short circuit takes place at the instant of maximum value.

The importance of this doubling effect will be appreciated when it is realised that the maximum mechanical stresses that come into play under such circumstances vary as the square of the current, and will therefore be increased fourfold, and every part of the electrical circuit involved will be called upon to withstand this additional stress.

Referring to the heating effects, these will also be modified in a similar manner, but as the doubling effect is only evident on the first few alternations depending upon the magnitude of L and R, the equation cannot be doubled throughout, but must follow the simple transient law, that is, to change in an exponential manner. It would be hardly possible to give a mathematical expression covering this last characteristic, and by far the simpler plan is to construct a curve which will give a value K, usually known as the damping constant, which takes care of both the exponential transient, that is L and R, the mutual induction of the machine, and the doubling effect, giving them all as a function of the time. In Fig. 3 the damping constants have been assumed as such that a short circuit current will fall to approximately half its initial value after the first 10 cycles.

Making use of the damping constant K, equation 5 may then be written: $Iav = IK$ . . . . . (7)

The formulæ given in this article are not intended for actual use in practice as an oscillograph should always be used for that purpose; but rather to illustrate the reasoning set down.

Those interested and wishing to make a serious study of this subject would be well advised to refer to an excellent paper read before the Junior Institute of Engineers, February, 1923, by Mr. S. A. Stigant.

Electrically Heated Floors.

Electrically heated floors have been introduced into Swiss dwelling houses by the Electra A.G. of Wädenswil. It is pointed out in the "Schweizerische Bauzeitung" that floor heating is best suited to rooms fitted with stone or concrete floors and mosaic flooring. The heater coils are placed within iron pipes which are embedded in the flooring, at suitable distances apart, but closer near the windows than in the middle portion of the room. When the floor is built up of concrete beams with thick webs, the pipes are placed in the recesses between the beams and are packed in these recesses with fine gravel. The concrete is covered with a layer of plaster on which the stone slabs or planks are placed. When the floor contains wooden beams the space between the beams is filled with concrete, when the pipes have been fixed, the wood itself being covered with a layer of gravel lest the structure become too rigid. Between the lower surface of the floor and the concrete containing the heaters an air space is left to prevent radiation downward. That a considerable amount of concrete is wanted for the installation is considered advantageous in so far as the concrete stores the heat, so that the current may chiefly be turned on during hours in which it is hardly wanted for lighting. The coils are drawn into the pipes like cables and are built up in links to retain flexibility. It is mentioned that the heaters are mostly fitted with two resistance coils, to be coupled in series or in parallel or to be used singly; this is preferable to providing special switches for separate heaters.

Frequency Changing Economics.

At present Washington is supplied with electrical energy on the 60 cycle and 25 cycle alternating systems, while, in addition, direct current is used for traction and in a portion of the residential and business area. The total peak load will probably grow to 110 000 kW in 1932, as against 70 000 kW in 1922, of which 18 000 kW was the 60 cycle lighting load. The 60 cycle load is growing rapidly, and is at present supplied through twelve frequency changers in five substations. It has been decided to change over the whole alternating system to 60 cycles, but the direct current energy required for lighting power and traction will continue to be supplied from 25 cycle generators through synchronous converters. The advantages of this course are stated to be an increase of 10 per cent. in the revenue producing load and the cable capacity, the elimination of frequency changers, lower first and operating cost of 60 cycle machinery, easier extension of the a.c. distribution system, greater adaptability and easier interconnection with other systems. An average saving of $60 000 per annum is estimated, which will more than pay for the cost of the conversion in ten years.

THE INSTITUTION AND THE INDUSTRY.*

By MAJOR H. B LL.

Previous to 1914 it was an oft-heard cry that the British electrical industry was stifled by reason of foreign competition, but this belief was not unanimous, because the electrical industry embraces so wide a field of operation that whilst development is taking place in some of its branches, depression might easily exist in others. If a change takes place in our present fiscal policy, the immediate effect must be beneficial, and there will be at once a greatly increased demand for British electrical manufactures. This and the stimulation given to other countries by the Great War will make it doubly incumbent upon us to apply ourselves with all our vigour to those problems in connection with our internal economy which will tend to increase our sphere of utility, our efficiency and the goodwill of others towards us.

Five years of hostilities and five years of industrial dislocation have disturbed the steady influx into the Institution of the requisite number of adequately educated students, and this state of affairs can best be remedied by ensuring that every entrant into the local ranks of the electrical profession shall become a student of the Institution.

The advantages derivable from membership of the Institution cannot be materially assessed, but in order to achieve the highest ideal and the greatest degree of *esprit de corps* such material advantages should theoretically be nil, and broad success will come the more readily if both intending candidate and sponsor clearly envisage this desirable principle.

In spite of an unprecedentedly long and severe period of industrial depression, the electrical industry has escaped more lightly than have other trades, probably owing to the greater employment of electricity for domestic purposes. An examination of the recent Report of the Electricity Commissioners is sufficient to demonstrate that the Electricity Acts of 1919 and 1922, although the subject of serious contention in their passage through Parliament, have resulted in very real and inestimable benefit to the electrical industry as a whole. Electrically Great Britain has awakened, and is now taking a place commensurate with her commercial greatness, while in point of fuel economy the British supply industry compares favourably with its transatlantic neighbour.

Two Stagnating Fields.

There are, however, two fields in which no great development has taken place. There is little difference between the electric tramcar of to-day and that of two decades ago, and opinion is divided as to whether it will evanesce, like its predecessors, the horse tram and the steam tram. The exact cause of its unpopularity is difficult to diagnose, but it is probably due to this absence of progression, coupled with the fact that traffic problems are now becoming so acute in even the smallest of towns that there is literally no room left for it. There is, however, still ample possibility for improvement in the trolley-car, while the present relative decline of the tram may bring in its wake a more intimate association between the electrical and automobile industries in the "electrobus."

On the other hand, the star of railway electrification appears to be in the ascendant, and signs are not wanting that electricity will not only take its place in the operation of all our denser suburban lines, but that main-line development is being planned.

Little real progress has been made in this country with electric ship propulsion owing to the depressed state of maritime transport. On the other hand, experience gained in the United States with electrically-operated battleships has been applied to a number of mercantile vessels, and it is satisfactory to note that the last three electrically-propelled vessels were built, engined and electrically equipped entirely in this country.

The London Underground Railways are now operating the heaviest train service in the history of the companies. During the morning and evening rush hours, 167 trains pass through Charing Cross station hourly, 100 through Piccadilly Circus and 114 through Oxford Circus. The District Railway holds the record of 80 trains per hour—both ways on the section of line between Mansion House and Sloane Square. During the morning and evening peak, seating accommodation is provided for 250 000 passengers.

*Abstract of the chairman's Address of the North Midland Centre of the Institution of Electrical Engineers.

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INSULATION FAILURE.

The Relation Between Insulation Resistance and Dielectric Strength.

By F. FERNIE.

The theory of Dr. Karl Wagner, in which he crystallised the more or less prevalent ideas as to the heating of a dielectric being the cause of its breakdown, has been further tested and amplified by Messrs. Hayden and Steinmetz in a recent issue of "Electrical World," under the heading "Insulation Failure—a Pyrolectric Effect."

If this theory is to be accepted, it points to the much greater importance of insulation resistance measurements on a dielectric than has generally been assigned to them. Accepting the theory, the ideal dielectric, failing an infinite resistivity, would be one with a temperature coefficient such that its resistivity increased with temperature. An essential part of the theory is that the leakage current through a dielectric is concentrated in some one thread or filament of the insulation, which becomes heated up. This explains the curious zig-zag passages which the arc or spark is sometimes found to have taken, when a dielectric is broken down. When a dielectric built up of layers of material is ruptured, the arc sometimes, after piercing one or two layers, will be found to have travelled horizontally between two layers, for some distance, before piercing the next layer. Also, when breaking down bricks of composite material the arc hardly ever goes by the shortest path through the brick, but takes a much more devious route. Wagner's theory would presumably explain the phenomena by saying that the arc has followed the leakage current. Whilst the theory seems to apply very well to some insulations, it seems a little difficult to apply it universally. For example, on looking up a (perhaps rather ancient) Cablemakers' Handbook, we find a table showing the variation in insulation resistance of impregnated paper cables with temperature. This table shows that the I.R. at 60 deg. F. must be multiplied by 0·5405 to get the value at 70 deg. F., and by 2·183 for the value at 50 deg. F. For an insulation with a temperature coefficient of this kind, Wagner's theory must obviously apply. But it is certain that all dielectrics do not behave in that kind of way.

No Cumulative Heating Effect.

Consider, for example, an impregnated cloth recently tested by the writer. Samples of this were heated in an oven and their I.R. resistance measured at intervals. Once the samples were thoroughly dry their insulation resistance showed no alteration until a temperature of 130 deg. C. was reached, when they began to darken in colour and their conductivity suddenly rose.

Now a particular thickness of this material breaks down at a voltage of approximately 1 500 V, and, moreover, if a voltage slightly in excess of this be suddenly applied, the breakdown is practically coincident with the closing of the switch. There is, consequently, no question of a time element entering into the breakdown. There can be no cumulative heating, such as Wagner's theory demands; and it becomes necessary to assume that some filament of the insulation instantly increases in temperature from, say, 20 deg. C. to 130 deg. C.—a jump of 110 deg. C. It must behave like the filament of a glow lamp when its supply switch is closed.

Now insulation resistance measurements, on the area of the sample enclosed between the breakdown electrodes, give a value of the order of 150 megohms. The writer attached one terminal of the I.R. testing set to a plug off a resistance box and went over the whole surface of several samples, bit by bit, with the plug, and was unable to find that any one spot gave an appreciably lower resistance than the average. Suppose the lowest insulation resistance of any one filament to be 150 megohms (seeing that the parallel resistance of all the filaments composing the sample amounted to 150 megohms, the individual resistance of one filament could not be less and should be greater), then the Ohms law current, with 1 500 V through this single filament, would be 0·01 mA. Would this current be enough to heat it up to 130 deg. C.? If the time be assumed to be 0·5 secs., the heat developed by 0·01 mA flowing through 150 megohms for 0·5 secs. would be 179×10^{-5} calorie, approximately. If the filament be assumed to be 0·1 in diameter, to go straight through the material from electrode to electrode, and to have a specific heat of 0·188, then the heat required to raise it 110 deg. C. is approximately 206×10^{-7} calorie. If these assumptions are only approximately correct, it follows that a filament having an I.R. = 150 megohms may easily develop enough heat in a fraction of a second to become sufficiently conducting to break down. A point to be noticed is that a dielectric should have a high specific heat.

A corollary of Wagner's theory deduced by Hayden and Steinmetz is that solid insulation does not puncture when the maximum gradient at some one point exceeds the critical value. This conclusion seems contrary to experience, for the writer has himself several times seen and repeatedly heard of partial punctures of an insulation.

Value of High Insulation Resistance.

The foregoing points to the value of high insulation resistance as being necessary for high dielectric strength. Ordinary measurements of I.R. merely indicate the amount of moisture or other conducting impurity present. Wagner's theory indicates that, impurities being eliminated, a very high I.R. value, such as can only be measured on a very sensitive galvanometer, ought to be aimed at.

If the importance of I.R. values be accepted, it is of interest to inquire into their exact meaning. If electrical conduction be defined as a flow of electrons and/or ions, a dielectric might be defined as a substance in which a potential gradient causes *no* flow of electrons or ions. But since the values of specific resistance given in text-books for even the best insulators are less than infinity, it follows that there is, as defined above, no such thing as a true dielectric. It may, however, be guessed that the traces of conductivity found in the best insulators are due to impurities, and that the problem of producing the perfect dielectric is perhaps one of ultra-purification. Thus the writer maintained an uni-directional E.M.F. in series with a galvanometer, across a piece of varnished cloth, and the galvanometer deflection, which started at 70, fell in about 105 hours to zero, indicating that the moisture bridges, which probably constituted the initial conductivity, had broken themselves by their own movement, leaving an actual dry varnish conductivity approaching zero.

It may easily be shown that the I.R. of wood measured with the grain is lower than across the grain, and the same thing is probably true of all fibrous materials. The writer has attempted to prove it with paper or card, and although it is a difficult and unsatisfactory experiment to make, still the results tended to show that the I.R. along the fibres was of the order one-third the value obtained across the fibres. The value of a double layer of paper, where any fibres that may happen to lie at right angles to the length of the paper are very unlikely to coincide in the two layers, is thus evident. The whole theory points to the value of paper insulation, as providing an effective breaker of possibly conducting bridges, chains or filaments; the value of paper for insulating purposes other than cables is not perhaps fully realised. A paper by Mr. T. H. Harris, read before the South African Institute of Electrical Engineers, gives eloquent testimony to the value of paper insulation on transformers.*

The importance of a high value of I.R. is so much at variance with previously accepted views of its value that perhaps Wagner's theory should be received with some reserve: it is possible that an electronic or physical explanation of the capacity current in a condenser would point to an entirely different explanation of dielectric breakdown. Fleming and Dyke † have suggested that there are in a dielectric, amongst others, electrons, which are, under the action of an impressed electric force, elastically displaced from a position of equilibrium. Suppose the force were great enough to displace such electrons beyond their elastic limit?

Books Received.

"Atoms and Electrons." By J. W. N. Sullivan. (London: Hodder and Stoughton). Pp. 185. 2s. 6d. net.

"An Introduction to the Study of Alternating Currents." By Albert E. Clayton. (Longmans, Green and Co.). Pp. 296. 10s. 6d. net.

* For abstract, see THE ELECTRICIAN, vol. xc, p. 675, June 22nd, 1923.

† "Journ. I.E.E.," vol. xlix, p. 337.

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THE FYNN-WEICHSEL MOTOR.

A Machine with Inherent Power Factor Correction and Characteristics of an Induction Motor.

By VAL A. FYNN.

The Wagner Electric Corporation, of St. Louis, has just announced the marketing of the so-called Fynn-Weichsel motor, and it may be of interest to readers of THE ELECTRICIAN to have some first-hand preliminary information in regard to it. I am preparing a full description for early publication.

This new polyphase motor presents a series of interesting technical features, and possesses operating characteristics which are quite remarkable. The machine has all the desirable features of the well-known polyphase induction motors, such as high starting torque, ample overload capacity and simplicity of design, coupled with a power factor control which permits the designer, and if need be the operator, to adjust the motor's power factor to suit the most exacting requirements. These desirable results were brought about in a manner which, mechanically speaking, is surprisingly simple. The new motor is a judicious combination of a synchronous and an induction motor with a rotary converter, and may be aptly designated as a "synchronous induction motor." The novel features are applicable to single as well as to polyphase motors, subject to such modifications as the well-known differences between these two classes of motors would naturally call for. Simple as the solution has proved to be, it has

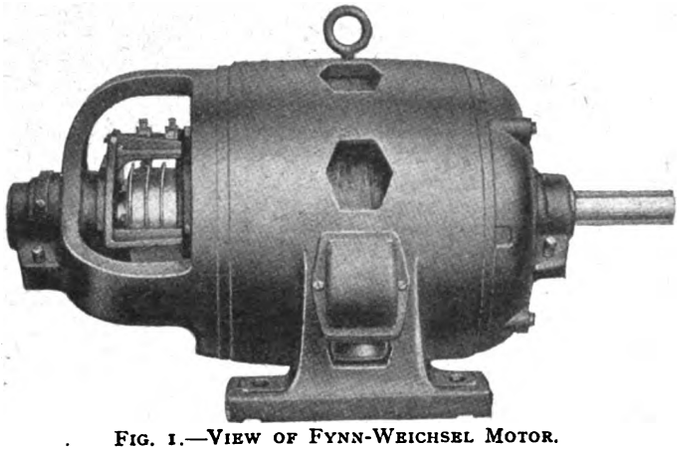

FIG. 1.—VIEW OF FYNN-WEICHSEL MOTOR.

nevertheless involved the study and the solution of a number of rather perplexing problems.

Synchronous motors are invariably built with defined polar projections and a large air-gap; induction motors are inseparably associated with extremely small air-gaps and a field structure without defined polar projections. Since the machine was to have the starting torque and the overload capacity of the induction motor, it was necessary to use a stator and rotor construction with an induction motor air-gap. Having adopted this type of magnetic circuit, the first problem was to find means whereby it could be made to yield an acceptable weight efficiency when operated as a synchronous motor. Impossible as this appeared, it was finally accomplished. The next serious impediment to progress was the necessity of providing means whereby the machine could be brought into step with a torque in excess of the full load torque, and this bridge was also safely crossed. There remained the question of automatic power factor control within acceptable limits, and the elimination of the abrupt breakdown of the synchronous motor known as "falling out of step." Both of these requirements were satisfactorily filled, the second proving rather easy.

Very luckily one and the same feature proved capable of taking care of more than one requirement, and after a process of combination and simplification the present very simple arrangement of parts was arrived at. The machine as now built carries a primary winding on the rotor connected to the line by means of slip-rings and also connected to a small commutator (see Fig. 1). The stator is provided with starting and operating windings, the latter being connected to the commutator. To ensure good commutation, the commutator voltage is low. In this way it has been found possible to control positively the motions of armature reaction axis, resultant field axis and the vector of the terminal voltage with respect to the brush axis in what may also be described as a "self-excited synchronous induction motor."

A detailed description of the machine and of the reactions which take place in it must be postponed to a later occasion, but it will be of interest to dwell shortly on the results actually obtained in practice. That, after all, is the all-important consideration. The appended curves (Fig. 2) were secured from one of the motors as now built, and speak for themselves. No adjustments of any kind were made during this test.

The machine starts exactly like a polyphase induction motor of any known design. It can be fitted with a squirrel cage of high or low resistance or with a winding in which resistances can be inserted at starting. Before the induction motor torque reaches zero an additional torque is developed, exceeding the full load torque by almost any desired amount. A value of 50 per cent. above that of the full load torque is easily reached, and readily brings the motor into synchronism. The machine is held in synchronism by a suitable d.c. exciting current generated in the machine itself and until such time as the synchronous motor part of the machine becomes overloaded. As the synchronous motor "breaks down," the induction motor action automatically steps into the breach and the machine continues to operate as an induction motor. The transition is quite smooth and not readily detected by the casual observer, and when the overload disappears the motor quietly slips back into synchronous operation.

The power factor can be adjusted to suit widely varying conditions. It can be made to hover near unity at all but the very light loads, say from one-quarter load up, or it can be set for unity at full load and made leading at all lighter loads.

It is well to remember that as long as this machine operates at unity or a little below unity power factor, it works as a motor only and at maximum efficiency. When it is adjusted to take leading current it does duty as motor and as condenser, and performs, on the side, a function which is generally performed by special and costly apparatus. The Fynn-Weichsel motor can do duty as a condenser at all loads below the normal without sacrifice in the full load efficiency, and without overheating or complication of any sort. The weight efficiency of this motor is somewhat better than that of a corresponding polyphase slip-ring motor.

It appears to me that this machine ought to find a ready market and prove a boon to central station and consumer alike. There is no radical departure from well-tried mechanical constructions, and the motor should not give any more trouble than a corresponding slip-ring machine. The fact that the primary is located on the rotor merely means that the better insulation must be transferred from the stator to

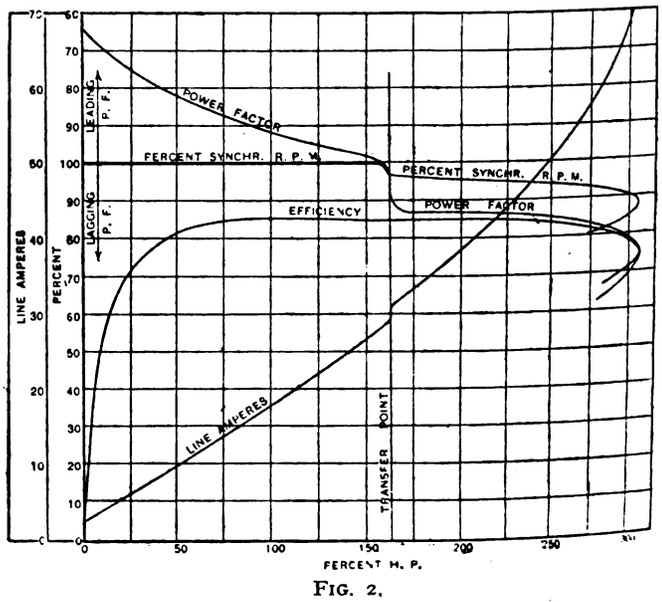

FIG. 2.

the rotor, and even at that the machine is considerably easier to insulate than a d.c. machine of equal terminal voltage.

The motor was invented and patented by me, the United States patents are owned by the Wagner Co., and to them belongs the credit of having displayed the aggressiveness necessary to put a new device on the market. The company has naturally done a great deal of work in this connection, and the designs for this line of machines have been prepared by the company's engineer, Mr. Hans Weichsel.

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AUTOMATIC TELEPHONE PROGRESS.

Details of the New London County Hall Installation.

The new Hall of the London County Council, which was recently opened by H.M. the King, is the nerve centre of a number of offices and departments some of which are housed in the building itself, while others are scattered over London. As is well known, the Council's activities include the supervision of such matters as education, housing, drainage, and tramways, for the efficient conduct of which easy and efficient intercommunication is necessary. This, of course, is obtained by telephone—in fact, by the Strowger automatic system which connects some 650 different departments in the building, and by an associated manual switchboard which gives communication with outlying departments and subscribers.

The entire equipment has been manufactured and installed on behalf of the British Post Office Telephone Department by Automatic Telephone Manufacturing Co. As this automatic telephone installation constitutes the largest exchange of its kind in the Empire, some details may be interesting to our readers.

The exchange operates on what is known as a three-digit basis. In other words, every telephone number within the building consists of three digits, those below 10 being preceded by two, and those below 100 by one nought. The act of calling any number entails three successive movements of the dial attached to the telephone in use by the calling party. This manipulation by the finger-tip, however, occupies six seconds only. Assuming the called party to be disengaged the response is immediate, and in the event of an engaged line a distinctive audible signal is at once heard in the receiver at the calling station. Clearing at the conclusion of a conversation follows the replacement of the receiver upon the switch-hook and is instantaneous; the line, therefore, being immediately available for another call. With the Strowger automatic telephone system secrecy is assured, and it is impossible for a third party to interrupt or to listen-in to a conversation already in progress.

For the purpose of obtaining connection with the public telephone exchange system an eight-position manual switchboard has been installed as a complement to the automatic installation. The function of this switchboard is to transfer the telephone traffic, incoming from and outgoing to the public telephone system of the metropolis, and to this end the switchboard is equipped with sixty outgoing and fifty incoming junctions. In view of the extent of this external traffic, special arrangements have been made, and generally the operation is as follows:—

Calls between automatic stations are, of course, completed automatically. Calls for the outside telephone system are obtained by dialling "O." This causes an individual line lamp at the manual board to glow, the automatic switches at the same time being released. The operator answers and completes the call over the outgoing junction in the usual manner. Calls coming from the outside telephone system are received at the manual board and are completed by the operator in a multiple of the automatic lines which is extended to the manual switchboard; the operator thus has direct access to all automatic stations without using the automatic switching equipment. Night service keys on two of the manual positions provide means for extending thirty of the automatic telephone stations through to public exchanges for night service, thus dispensing with the need for night operators at the Council's manual board. The equipment is of the latest type, with rotary line switches and covered type selector and connector switches, a general view of which is shown in the accompanying illustration (Fig. 2). No separate line intermediate distributing frame is provided, but similar facilities are given by the "Unit" type intermediate distributing frame or cross-connecting rack, which is mounted on the top of the individual units.

Naturally the current required to operate an automatic exchange of this capacity is considerable, and the power plant for furnishing the requisite energy consists of one motor generator set rated for an output of 45 A at 60 V, the motor operating on the 460 V power supply. There are two 25-cell storage batteries associated with this generating plant, together with small rotary convertors for the provision of ringing current.

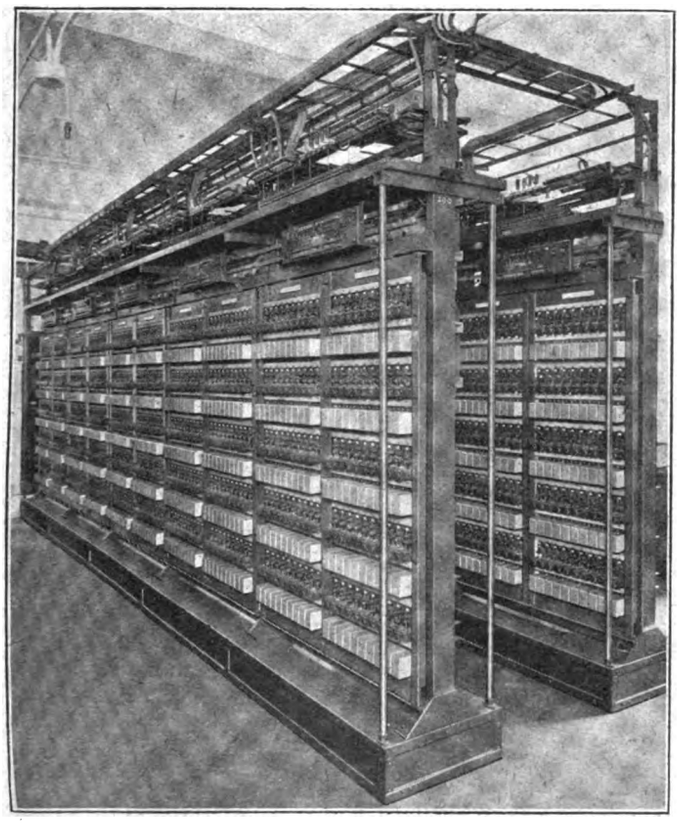

FIG. 1.—VIEW OF THE ROTARY LINE SWITCHES AT THE LONDON COUNTY HALL AUTOMATIC EXCHANGE.

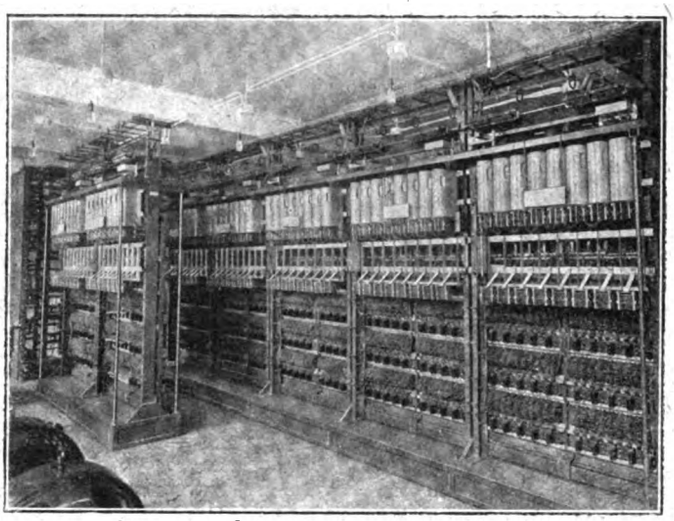

FIG. 2.—VIEW OF THE COVERED TYPE SELECTOR SWITCHES AT LONDON COUNTY HALL AUTOMATIC EXCHANGE.

A Useful Technical Index.

The Institution of Electrical Engineers have issued a ten years' index to the "Journal" covering the years 1912 to 1921 on Vols. 48 to 59, both inclusive. The index is published by E. and F. N. Spon, and is priced at 10s. 6d. A key showing the number of pages contained in each part of the journal reveals some interesting information. In 1912 six issues of the journal were published, containing an aggregate of no less than 1 796 pages. This fell slightly in 1913 and considerably to 795 pages in 1914, when, however, fourteen issues were published. But at this time, it will be remembered, the size of page was largely increased. Low-water mark was reached in 1918 when 544 pages contained in eight issues were published. This, however, was to some extent counteracted by the 958 pages (332 in two supplements) published during the next year, while even in 1920 the output was just over 900 pages. The information given is clearly set out and should be found most useful for reference purposes.

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GRID-FILAMENT CONDUCTIVITY.

Its Nature and Effect on Amplification—A Practical Application to Loud Speakers.

By F. M. COLEBROOK, B.Sc., D.I.C., A.C.G.I., National Physical Laboratory.

In a recent article in THE ELECTRICIAN it was pointed out that in order to obtain the best results from a thermionic valve of the ordinary small receiving type, when used for either high or low frequency amplification, it is necessary to ensure that it is operating somewhere about the middle of the straight part of a suitable characteristic. The writer indicated that in general these conditions are best fulfilled by the use of an anode potential of about 100 V in conjunction with a grid potential of about —2 V.

A very elementary knowledge of the physics of the thermionic valve will suffice to support the above statement. There is, however, another reason why this combination of a fairly high anode potential with a small negative grid potential is preferable to what appears to be a commonly accepted practice at the present time—namely, as low an anode potential as possible and zero or even a small positive potential on the

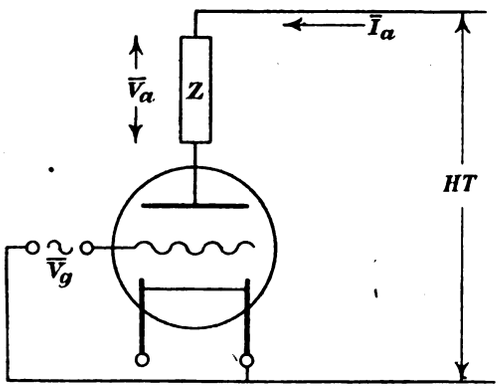

FIG. 1.

grid. This reason is to be found in the destructive effect of grid-filament conductivity on amplification.

In order to make clear the nature and magnitude of this effect it will be necessary first of all briefly to review the fundamental principles of valve amplification.

Assuming that the valve is operating under correct conditions—that is, over the straight line region of the characteristics concerned—it is well known that the relation between V_a, V_g and I_a, which are respectively the instantaneous values of *changes* in the anode potential, the grid potential and the current flowing in the anode, circuit can be represented very approximately by the equation

$$I_a=(V_a+\mu V_g)/R_i$$

The constants R_i and μ which occur in the above are often described as the internal resistance of the valve and its voltage factor respectively. Their values in the case of an ordinary small receiving valve are something of the order of 50 000ω for R_i while μ may be anything from 5 to 10.

The changes V_a, V_g and I_a will in general be more or less complicated functions of time. For simplicity, however, we will consider only periodic functions, such as might occur for example, in the amplification of a musical note, and, also for the sake of clearness, we will consider only the fundamentals of these periodic changes. The results so obtained will be qualitatively similar to those of the more general case.

Vectorial Analysis.

The assumptions made above permit the employment of vectorial notation. Putting $\mathbf{V}_a$, $\mathbf{V}_g$ and $\mathbf{I}_a$ for the rotating vectors whose projections on a constant time axis represent the actual instantaneous magnitudes of V_a, V_g and I_a the fundamental equation becomes

$$\mathbf{I}_a=(\mathbf{V}_a+\mu\mathbf{V}_g)/R_i.$$

In the case illustrated in Fig. 1.

$$\mathbf{V}_a=-Z\mathbf{I}_a.$$

We have, therefore

$$(R_i+Z)\,\mathbf{I}_a=\mu\mathbf{V}_g.$$

Comparing this last result with the circuit shown in Fig. 2 it will be seen that, as far as current and potential changes are concerned, the latter is electrically equivalent to the actual valve circuit shown in Fig. 1.

We see from the above that the applied grid potential produces across the anode circuit impedance Z a fall of potential $\mathbf{V}_a$. Thus we have an amplification of potential represented by the expression

$$\frac{\mathbf{V}_a}{\mathbf{V}_g}=\frac{\mu}{1+R_i/Z}.$$

In practice Z is made as large as possible compared with R_i, so that the value of the above is very nearly μ. In multi-stage amplification the potential $\mathbf{V}_a$ or, in the case of a step up transformer coupling, some small multiple of it, is applied to the grid of the next valve, where a still further magnification of potential is obtained, and so on to the last valve, where the magnified potential is applied to some form of receiving or recording apparatus.

Difficulty of Practical Realisation.

Stated in this way the whole process appears to be remarkably simple. No one, however, who has had actual experience with amplifiers will need to be assured that many difficulties stand in the way of the realisation in practice of the above theory. At radio frequencies these are due for the most part to inter-electrode and other stray capacities, but even at audible frequencies there is another limiting factor, the nature and magnitude of which appears to be insufficiently realised. It is with this factor—namely, grid-filament conductivity—that the present paper is concerned.

This conductivity in the case of an ordinary small receiving valve is not constant, but varies from almost zero at zero grid voltage to about 1/20 000 reciprocal ohms at +2 grid voltage onwards. In this case the grid-filament resistance remains approximately constant at about 20 000 Ω from +2 to +10 grid voltage. It is important to realise that the above figures refer to what may be called the slope conductivity—i.e., $\delta I_g/\delta V_g$. This quantity and not the actual value of the grid current divided by the actual magnitude of the grid voltage is the appropriate measure of the conductivity in the present instance, since we are concerned throughout with the relation-

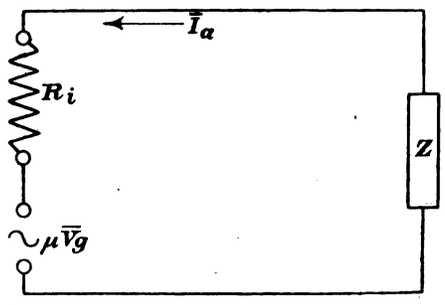

FIG. 2.

ship between small changes of current and potential. The slope conductivity will in general be larger than the true conductivity as defined by Ohm's law.

What will be the effect of this grid-filament conductivity in one valve on the amplification produced by the valve which precedes it in a multi-stage amplifier?

The Nature of the Effect.

To illustrate the nature of the effect we will consider the scheme illustrated in Fig. 3. Z being at present quite undefined, this may be regarded as part of either a tuned anode circuit or a resistance capacity coupled amplifier. With slight modifications the results deduced will apply also to the case of a transformer coupled amplifier, though this latter will be referred to later on.

Disregarding all details irrelevant to the theory, as for instance, the grid condenser and grid leak combination, the only function of which is to maintain the grid of the second valve at some definite mean potential with respect to the filament, then the circuit shown in Fig. 4 is, as far as current changes are concerned, electrically equivalent to the actual amplifier circuit. The resistance shown as R_g in the diagram

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is the grid-filament resistance of the second valve. It will be seen from the equivalent circuit that this resistance R_g is actually a shunt on the anode impedance of the preceding valve. Though a very simple case is here considered the result is a perfectly general one. Whatever type of amplifier is used its operation will ultimately depend on an impedance in the anode circuit, and whatever type of coupling is used the effect of grid-filament conductivity will be to lower the effective value of this impedance and hence of the amplification obtained.

To illustrate the order of magnitude of the shunting effect we will consider a numerical example based on actual valve characteristics. Before doing so, however, it will be necessary to reduce to scalar form the vectorial expression obtained above for the amplification in terms of the anode impedance and the constants of the valve—i.e.,

$$\frac{\mathbf{V}_a}{\mathbf{V}_g}=\frac{\mu}{1+R_i/Z}$$

Putting

$$Z=R+jX$$

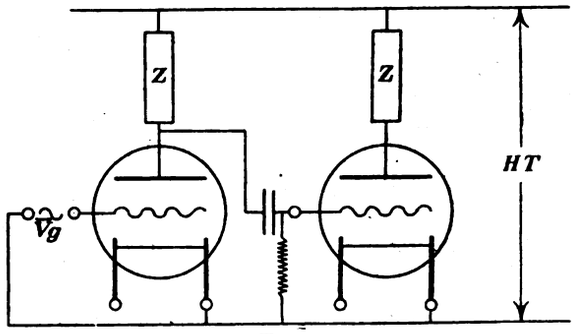

FIG. 3.

we have

$$\frac{\mu}{1+\frac{R_i}{Z}}=\frac{Z}{Z+R_i}\mu=\frac{R+jX}{R+R_i+jX}\mu$$

$$=\frac{\{R\,(R+R_i)+X^2\}+jXR_i}{(R+R_i)^2+X^2}.$$

Writing V_a and V_g for the amplitudes or scalar magnitudes of $\mathbf{V}_a$ and $\mathbf{V}_g$ it is easily seen that the magnification of amplitude given by the above is

$$\frac{V_a}{V_g}=\frac{\sqrt{\{R\,(R+R_i)+X^2\}^2+X^2R_i^2}}{(R+R_i)^2+X^2}\mu$$

Now let $\mu=10$, $R_i=50\,000\ \omega$, $R_g=20\,000\ \omega$, $R=10^4$ and $X=10^6$. Considering first the ideal case in which $R_g=\infty$ we have

$$\frac{V_a}{V_g}=\left\{\frac{1}{36\times10^8+10^{12}}\sqrt{\{6\times10^8+10^{12}\}^2+10^{12}\times25\times10^8}\right\}10$$

$=10$ correct to 1 per cent.

Now consider the effect of allowing the grid potential of the succeeding valve to reach such a value that grid-filament conductivity becomes operative. This means that the anode impedance Z is shunted by R_g. Writing Z^1 for the modified value of the anode impedance we have

$$\frac{1}{Z^1}=\frac{1}{Z}+\frac{1}{R_g}$$

Therefore $$Z^1=\frac{R_gZ}{R_g+Z}$$

$$=\frac{R+jX}{R+R_g+jX}$$

The separation of this expression into resistance and reactance components gives

$$Z^1=R^1+jX^1$$

where

$$R^1=R_g\left\{1-\frac{R_g\,(R+R_g)}{(R+R_g)^2+X^2}\right\}$$

$$X^1=X\frac{R_g^2}{(R+R_g)^2+X^2}$$

In the case we are considering

$$X^1=4/10^4 \text{ approx.—}i.e.,\ X^1 \text{ is negligible.}$$

and

$$R^1=R_g\,(1-6/10^4) \text{ approx.}=R_g \text{ approx.}$$

Thus Z is practically reduced to R_g—*i.e.*, 20 000ω, so that the amplification produced by the valve is now only

$$\frac{\mu}{1+\frac{R_i}{R_g}}=\frac{10}{1+2\cdot5}=2\cdot85$$

We see, therefore, that in this instance the effect of grid-filament conductivity is to lower the amplification from approximately 10 to 2·85.

Distortion in Loud Speakers.

It may be thought that the foregoing example is too extreme to correspond with any actual practice. This is by no means the case. The writer has found by actual measurement that the amplitude of the oscillating potential on the grid of the last valve of a multi-stage low frequency amplifier may reach several volts, particularly when the load in the anode circuit is a loud-speaking telephone; 5 to 7 V would not be an exceptional value in such a case. If, therefore, the mean potential of the grid is zero, as it often is in amplifiers in which the importance of grid-filament conductivity has been overlooked, then during one-half of the oscillation the valve conditions will be well inside the range we have considered, leading not only to greatly reduced amplification, but also, which may be even worse, to considerable distortion. This last factor may partly account for some of the unpleasant distortions produced by "loud-speakers" used in conjunction with low frequency amplifiers of unsatisfactory design.

It will be seen that the important practical case of the low frequency transformer coupled amplifier has not been considered in detail. The writer has recently been engaged on the measurement of the effective impedance of the primary and secondary windings of such transformers under varying conditions of frequency and load. The results obtained indicated that the action of the low frequency transformer is much more complex than might appear at first sight. The distributed capacities of the windings and the capacity coupling between them, together with the varying behaviour of the iron core, take the matter beyond the scope of ordinary mathematical analysis. It appears, however, that there is in general a step-up of potential in the secondary, though not of the magnitude that would be calculated from the ratio of turns. There can be no doubt, however, that the presence of a comparatively low resistance shunt across the secondary due to grid-filament conductivity, will materially reduce the

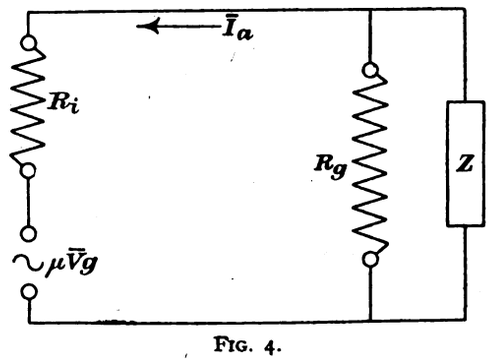

FIG. 4.

potential operating on the grid, and unless the mean grid potential is maintained at a suitable negative value, the efficiency of the amplifier, both from the point of view of amplification and distortion, will be very greatly impaired.

The practical conclusion to be drawn from the above can be stated thus. When a thermionic valve is used for amplification the anode and grid potentials must be such as to fulfil two separate conditions: (1) The representative point must remain inside the straight line region of the valve characteristics during the operation of the valve; (2) the grid must be given a negative potential such that the maximum value of the oscillating potential applied to it will not raise its total potential above zero.

Special endeavours are now being made to attract foreign buyers to the British Empire Exhibition, and letters in nine languages are being sent to prospective visitors. All communications relating to the E.D.A. display should be addressed to the Director of the Association, 15, Savoy Street, London.

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HOW TO SELL HEAT.

Mistakes in Selling Electric Fires—Eliminating Ordinary Fireplaces—Efficiency of Radiant Heat.

At the Salesmanship Conference of the British Electrical Development Association, held on Friday last, Mr. A. F. Berry (British Electric Transformer Co.) read a paper on "How to Sell Heat." Major H. Richardson presided.

Mr. BERRY remarked that the whole of the electrical energy was convertible into heat energy and nothing else. There was no taint in electrically-cooked food through the absorption of products of combustion, because there was no combustion in the oven itself. For electric furnaces, fires, irons, medical appliances, etc., this purity of the heat was invaluable, and he did not think that those selling heat and heating appliances realised its all-importance. The terrible increase of cancer and diseases affecting the internal organs was probably due to the fact that tarry and other products of combustion were absorbed into the human system far more than was the case in the days before combustion took place in the oven itself. This was confirmed by the fact that cancerous growths had long been known to occur most frequently in industries connected with tar products.

Individual Heating Needs.

After commenting upon the adaptability, convenience, safety and cleanliness of electrical apparatus, and the need for striving after low first cost as well as reliability and efficiency, he referred to the necessity for considering the individual needs of the purchaser of heating appliances. Heat was required in different wave lengths. For some purposes the long wave length, or black heat, was most convenient, and for others the high temperature and shorter wave lengths, or red heat. In most cases we could not do better than radiate heat in still shorter wave lengths, thus imitating more nearly the effect of the sun's rays. The more nearly we could approach that which evolved life the better.

He was appalled at the manner in which electrical fires were often shown to customers. He imagined a picture dealer trying to sell to a customer an empty frame, which was equivalent to offering an electric heater without switching it on. That was precisely what was done all over the country every day with regard to electric fires.

In trying to sell heat we must be very careful in mixing the fires and effects. We were so often supplying the public's demand which had been created by the advertisements of manufacturers and others for electrical heating and cooking appliances that we could rarely claim to be *selling* fires as distinguished from offering to *supply* them.

The practice of some engineers of leading themselves and others to suppose that 2 kW would heat one room, 3 kW another, and so on was fallacious. In the better types of fires, in which roughly 50 per cent. of the heat was in convected form and 50 per cent. was radiated, it depended on design as to whether the people in the room got a great deal of benefit from the convected heat or none at all. More often than not the convected heat went straight up to the ceiling.

As to the extraordinary value of electrical heating from the health-giving point of view, he said that from childhood to old age there was better use to be made of electrical heating than had yet been proclaimed or even fully realised. He was surprised to find that 25 W properly applied to the body gave an effect that 2 500 W in an ordinary radiator could not well compete with.

Capt. J. M. DONALDSON argued that electric fires should not be put into the ordinary fireplaces. In a house built recently, the total cost of which was £1 500, something like £80 had been saved through having no fireplaces in bedrooms. Some people objected that the first cost of heating electrically was high, but this objection could be overcome by using only two or three portable fires and carrying them to the rooms in which they happened to be required at any time. An advantage which electricity had over gas or coal fire heating was that it was always possible to know how much it cost per hour.

Mr. W. RILEY urged upon manufacturers the necessity for educating the public by advertising, and of including always an illustration of the apparatus, with a list of its salient points.

Mr. W. R. RAWLINGS advocated the warming of a house up to a certain point by coke or anthracite, combined with electric fires in each room. The practice of carrying fires about was undesirable, because people did not trouble to use them. Primarily, radiant heat was wanted, convected heat being of little use in a house. He appealed to supply undertakings to provide electricity cheaply for demonstration purposes. If contractors could get it at ½d. per kW they would make a fine splash, but at 2½d. per kW they could not be expected to turn on 30 or 40 kW in a showroom.

Mr. W. A. GILLOTT appreciated the fact that Mr. Berry had not referred to cost, but was endeavouring to sell the idea, and expressed the view that if we all endeavoured to sell an idea we should reach the ultimate goal more quickly than by telling consumers that a fire would cost so much per hour. If we showed what a fire would do cost would have little bearing on the sale. If a customer wanted to know the cost of heating by electricity it could be taken for granted that, for general domestic heating, where it was used freely, 400 kWh per annum per kW installed was a fairly safe figure to adopt.

Mr. C. NAPIER PRENTICE agreed that radiant heat was most efficient in the majority of cases. Custom was a difficult thing to break down, and it was not easy to get people to block their chimneys when the electric fires were placed in the ordinary fireplace. To overcome the difficulty of supplying demonstrators with electricity at a low rate, he suggested that they should be charged the ordinary rate, and given as a bonus a certain proportion of the current used, a practice which he had found effective.

Mr. L. L. ROBINSON said that a chimney was useful for ventilation, and that it was not necessary to close it; he had a fire of the camouflaged coal variety, which threw radiant heat across the room, and it was quite satisfactory. He also used small fires below the windows to warm the cold air coming in, and had found that ever so little heat under the windows saved the use of a greater amount of heat in other positions. With 200 W under the desk in his office he was satisfied with 0·5 kW in the fire, and by adopting that method he could do with 700 W what he had done before with an average of 2 kW. As to hot water, with thermostatically-controlled heaters, with which the current was switched on when the temperature of the water fell to 150 deg., and switched off when it reached 180, the radiation losses from a 20-gallon tank were fairly serious, nearly 0·5 kW, but if the temperature were limited to a maximum of 150 deg. the radiation losses were negligible. To prevent damage, he hoped somebody would evolve a thermostat with a working range electrically from 130 to 150 deg., which would not mind being boiled. In his own flat he had six rooms, each of which could be lit in two ways—brilliant lighting and cosy-corner lighting—every room had an electric fire as well as apparatus for draught correction under the windows, and there was constant hot water supply; the cost was only 11s. per week.

Use of Small Fans.

Mr. S. T. ALLEN (Wolverhampton) said he believed the impression among doctors was that electric heating dried up the atmosphere, and the industry had to meet that. He had used a 3 kW heater with a small fan, which spread the convected heat all over the room. This made an enormous difference to the comfort of the room in a short time, and he urged that further experiments should be conducted on those lines.

London's Electricity Supply.

On July 24th last a report by a special committee on the question of the appointment of a Joint Electricity Authority and other proposals for the reorganisation of electricity supply in London came before the London County Council. The heads of agreement with the companies comprising the London Electricity Joint Committee (abstracted in our issue of July 27th) were approved by the L.C.C. on July 31st. The London Electricity Supply (Nos. 1 and 2) Bills promoted by the London Electricity Joint Committee (1920), Ltd., to legalise the heads of agreement referred to, provide amongst other things, for the transfer of the powers of purchase of all or any of the undertakings of the London companies as to which powers of purchase were conferred on the London County Council by the Acts of 1908 and 1910, and of the powers of purchase of any other undertakings now belonging to any of those companies; for the transfer of the undertaking of the Joint Committee to any joint electricity authority by or under any scheme or Order made by the Electricity Commissioners under the Electricity (Supply) Act, 1919, for any district, including the county of London and determined by any scheme or Order so made; and to prescribe the terms of any such transfer.

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POWER FACTOR CORRECTION.

The Utilisation of Asynchronous-Synchronous Motors—Reducing Cost of Feeder Extensions.

The present day development of electricity supply and the increasing use of alternating current transmission has necessitated as a subsidiary problem the improvement of the power factor of the system so that undesirable wattless current may be eliminated from the network. There are several ways in which this may be effected, and which is the best is a matter of opinion. The employment of synchronous motors has at least the advantages that correction is combined with useful work, and the introduction by the English Electric Co. of an asynchronous-synchronous motor which combines the high starting torque characteristics of the induction motor with the property of the synchronous machine of running at unity power factor is therefore of interest.

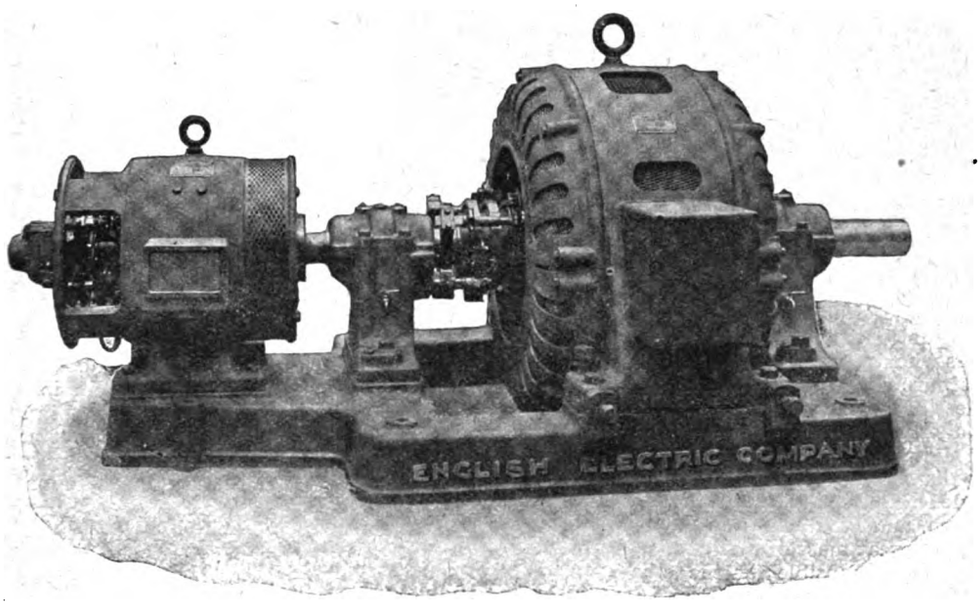

Fig. 1.—An English Electric Asynchronous-Synchronous Motor.

The application of this machine in connection with power factor correction should be very wide. As it runs at unity or leading power factor it may be used to correct the power factor on a low load-factor system, thus reducing the cost of feeder and sub-station extensions in many cases. As a rule when the asynchronous-synchronous motor is not required for correcting much lagging current of other plant, a unity P.F. motor is the most advisable, as its efficiency is higher than when rated for leading power factor and a cheaper machine can be made. The addition of unity power factor motors considerably improves the power factor of the system —e.g., on equal kW load of 0·70 P.F. plant and 1·0 P.F. plant, the resultant P.F. of the aggregate load will be 0·90.

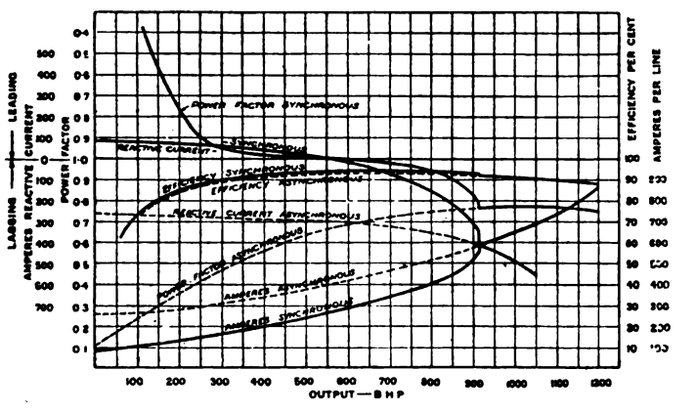

Fig. 2.—Performance Curves of English Electric Co.'s Asynchronous-Synchronous Motors.

In comparison with induction motors, synchronous machines are suitable for medium and large outputs for continuous running where no speed regulation is required, as in the case of pumps, ventilating fans, compressors, line shafting, etc., and show great advantage in cases where a direct connected slow-speed drive is desirable, but the adoption of a direct connected motor is handicapped by inferior performance.

On the other hand, the asynchronous-synchronous motor has the important advantage over the salient-pole type of synchronous motor of possessing a high starting and synchronising torque. The available starting torque with a salient-pole synchronous motor is proportional to the resistance of the squirrel-cage damper winding and is therefore roughly proportional to the slip. Increase of slip, however, reduces the amount of inertia against which the motor will synchronise. Moreover the salient-pole machine is usually synchronised on reduced voltage, which has the double effect of increasing the slip and reducing the synchronising power available. It is evident, therefore, that the asynchronous-synchronous motor is superior to the salient-pole type for synchronising against load or inertia, as it is always designed with a small slip and synchronises on full voltage.

The performance curves for a 550 H.P. motor are shown in Fig. 2. This machine is designed to run at unity power factor at full load at a speed of 428 revs. per min. on a three-phase, 50 cycle, 1 000 V circuit. It will be noted that the reactive current is leading below full load. Fig. 1 is an illustration of a 110 H.P. asynchronous-synchronous motor made by the company. It runs at 375 revs. per min.

CORRESPONDENCE.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

SALE OR RETURN.

[To the Editor.]

Sir,—From the manufacturer's point of view sale and return is not good business; and, generally speaking, if he can offer the right goods at the right price he does not find it necessary to resort to this method. From the point of view of the trade buyer, the system is equally unsound, as he fills his showroom with goods on "sale or return," but they are not the goods he would have selected had he gone to the market with a free hand and bought outright.—We are, etc.,

Sterling Telephone & Electric Company, Ltd.,
(Guy Burney, Managing Director).

London.
November 13th.

THE DOUGLAS CONTRACT.

[To the Editor.]

Sir,—Our attention has been drawn to a note under the heading of "Tenders Accepted" in The Electrician of November 16th, which gives the impression that it has been decided to take out the two existing horizontal engines at the Douglas Corporation Power Station, and to replace them with two 4-cylinder vertical oil engines of 440 H.P. each. Would you kindly note that while it is true that the Corporation have accepted our recommendation to add two additional 600 B.H.P. 6-cylinder vertical cold starting oil engines, there is no intention at the moment of replacing the existing engines. —We are, etc.,

Handcock and Dykes,
Consulting Engineers to Douglas Corporation.

London,
November 21st.

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THE CAPITAL LEVY.*

Effect on Small Businesses—A Typical Trader's Balance-Sheet.

By SIR ERNEST J. P. BENN.

Among the several threatening clouds upon the political horizon there is none which is likely to burst with more disastrous effects upon trade and industry than the Capital Levy, still a leading plank of the Labour and Socialist platform. If it can be shown, as I believe to be possible, that the Capital Levy would simply land this country into the sort of trouble that is now common in Europe, it is not too much to hope that the Labour Party will expunge the proposal from its programme.

Effects of a Levy.

When thinking of a Capital Levy, the average voter calls to mind some well known millionaire, pictures fat bank balances, and feels, as we all feel, that after all no particular calamity would fall upon society if the excesses of riches which we see around us were removed from it.

But the Capital Levy is not quite so simple as it appears to the average elector, and my present purpose is to examine the proposal from the point of view of the ordinary business man, and endeavour to trace its effect not only upon him and his business, but upon all those others who are associated with or dependent upon him. For that purpose I have secured, and I publish below, the balance sheet of an average business man. I have called him William Maker, for it is obvious that I cannot give him his real name. I have omitted the odd pounds and shillings and pence, for there is no virtue in such details. I have very slightly amended the account here and there to make it of general application, and I publish it as a fair sample of the balance sheets of the great mass of middle class traders, men who in the bulk are responsible for the greater part of the trade of this country :—

WILLIAM MAKER.
BALANCE SHEET.

LIABILITIES.	£	ASSETS.	£
Trade creditors ..	14 095	Furniture and fittings	1 000
Mortgage on freehold ..	7 000	Stock:	
Bills payable	2 000	Finished goods ..	10 000
Liability to bank on customers' bills discounted as per contra	5 000	Materials	2 000
		Plant and machinery ..	2 500
Vendor's account, £20 000		Investments	1 000
Paid for business, £10 000 cash and £1 000 a year		Work in progress ..	2 000
		Sundry debtors ..	17 500
Balance at date ..	8 000	Customers' bills, discounted as per contra	5 000
Interest at 6 per cent...	480	Personal property ..	1 500
Balance	20 175	Freehold premises ..	10 000
		Life insurance (£10 000) surrender value ..	3 000
		Cash on current account	1 250
	£56 750		£56 750

A Typical Case.

William Maker is a typical small manufacturer. We will suppose that he is making shirts and ties, some of those sundry items in every-day comfort which mean so little in politics and so much in human well-being. His figures speak for themselves. He does a trade of £100 000 a year, or £2 000 a week. His expenditure may be divided, roughly, into £500 a week on materials and £1 500 a week on wages and other outgoings. He does not directly employ £1 500 worth of labour : some of his wages are paid through others from whom he buys material or partly-finished goods. He makes an income of £3 000 a year, which amounts, as will be seen, to 3 per cent. upon his turnover, or 30 per cent. upon his original capital of £10 000. His figures show that he is investing £1 000 a year of this income in his business, gradually paying off his debt to the vendor. With the other £2 000 he lives in a London suburb in a house rated at £150, which he holds upon a seven years' lease. He is the owner of a two-seater motor-car, he has two children at boarding school, and in one way and another is absolutely committed to the expenditure of the £2 000 which he draws every year from his business. He is, in fact, a typical member of the *bourgeoisie*. He is probably actuated by that motive of gain to which the Labour Party objects so strenuously. But these are questions into which it is not necessary, for my present argument, to enter. I am merely concerned to state quite briefly the actual facts of the present position so as to discover what would happen in the event of a Capital Levy.

Mr. William Maker, as will be seen from his balance sheet, is worth just over £20 000. That is the figure at which his estate would be valued for death duties, and the Capital Levy as proposed by the Labour Party would require him to pay £3 000† towards the reduction of the National Debt. How is he to do it ? What steps can he take to discharge this liability ? How could the State secure from this wealthy £20 000 man its just due of £3 000 for the public good ? That is the question to which I invite an answer, having regard to all the facts set out in the balance sheet above.

William Maker, like so many of his class, is trading up to the very limit of his credit. His balance sheet shows that he paid £20 000 for the business which he owns, but that, having only £10 000 of his own, he was able to secure the business for half cash and half in annual instalments of £1 000, the vendor's risk in this connection being covered by a life insurance policy on Mr. William Maker which is duly entered in his account. Mr. Maker, therefore, began his present business career on a £20 000 basis, of which only £10 000 was cash, thus succeeding, as so many others do, in making his money go as far as possible.

An Impossible Position.

It will be noticed that he is taking all the credit that he can and giving all the credit that he must. His cash in hand at the date of his balance sheet was not sufficient to meet his requirements for the following seven days, so that he is not overburdened with loose money. If a liability of £3 000 were added to those which he already has to shoulder, some other of his creditors, the mortgagor of the freehold, or the bank, would undoubtedly demand a reduction in their advances.

He cannot raise the money by selling his furniture and fittings as they are wanted in the business. He is already raising all he can day by day in the sale of stocks. That money belongs, as the balance sheet shows, to his creditors, and unless they are duly paid he will get no more stocks to carry on his business. Plant and machinery is of course not available for this purpose. His investment of £1 000 consists of money which he has advanced to a smaller manufacturer of a special line of goods which is essential to his business. By financing this man he has been able to introduce improvements into his stock lines which are much appreciated by his customers. His only hope of getting back his £1 000 investment is by small annual payments, but he does not really look for that : his investment was made with a view to the general convenience of the business. At all events, it cannot be liquidated for the purpose of the Capital Levy.

His biggest asset consists in his book debts and bills, which amount, as will be seen, to £22 500. But it will be noticed that he already collects these as rapidly as is humanly possible. Where a customer wants more credit than Mr. Maker is willing to give, he draws a bill on him, and has done so to the extent of £5 000, the whole of that money being borrowed from the bank on the security of these bills. It is therefore obvious that the Capital Levy cannot be squeezed out of the "Sundry Debtors." His personal property, the next item on the account, is the figure for which his household goods are insured, and it is not suggested, even by the Labour Party, that he should part with these in order to pay the levy. The freehold premises, it will be noticed, are mortgaged up to the hilt, and no financier would be willing to put up another sixpence on their account.

*By arrangement with "The Times."

† The actual figure on an estate of £20 000 given in the Labour Party's schedule would be £2 800. It will be noticed, however, that Mr. Maker takes no account in his balance sheet for the goodwill of his business, which would probably be valued at £10 000, thus making the demand upon him for Capital Levy much more than the £3 000 suggested.

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Mr. Maker has been fortunate in securing a mortgage rather above the two-thirds limit which is generally imposed. The life insurance, as previously mentioned, is held by the vendor as security for debt, and cannot therefore be made to produce the Capital Levy. There is, in fact, no way on the figures in which Mr. Maker can produce £3 000 to the order of the tax collector.

This balance sheet may be in the nature of an eye-opener to some of those who are so ready to discuss the finances of the wealthy. Here is a man who is truly worth £20 000, and who yet has not in hand enough cash to meet the requirements of the next seven days, and is living from hand to mouth in a condition of financial stringency. But—and I speak from a very wide experience of the trading class as a whole—Mr. Maker's position is really typical. It is a mistake to suppose that commerce and industry are carried on by big corporations and millionaires. These people get all the limelight, but they represent only a fraction of the total of British commerce.

Mr. William Maker's position is difficult, but perfectly sound. He owes nobody anything in the socialist sense. There is no "mere money owner striding in front," as Marx would say. As an enterprising man he has made his money go as far as it would, with the result, as shown by his figures, that he is the centre of £100 000 worth of activity per annum, the whole of this huge business resting upon the foundation of an original capital of £10 000. Mr. Maker is merely an ordinary serious, energetic man, who thinks it right to trade and sets about to do as much of it as he can.

If Labour really does rule, and if the Labour Party does what it says it will, Mr. Maker will get a demand for the payment of £3 000. It makes no difference for the purpose of my argument whether the money has to be paid in one sum or in three annual instalments. There is one way, and only one way, in which Mr. Maker can discharge his liability, and I set it out in the fullest detail for the benefit of every student of the subject. If Mr. Maker will himself undertake part of the duties which would normally fall to his executors, he can pay the £3 000, always assuming, and this is a point to which I will return presently, that everybody else is not trying to do the same thing at the same time.

Halved Trade not a Solution.

I set out below a revised balance sheet, in which I have shown the results if William Maker were to *halve his trade.*

WILLIAM MAKER HALVES HIS TRADE.

BALANCE SHEET.

LIABILITIES.	£	ASSETS.	£
Trade creditors ..	7 047	Furniture and fittings ..	1 000
Mortgage on freehold ..	7 000	Stock:	
Bills payable	1 000	Finished goods ..	5 000
Liability to bank on customers' bills, discounted as per contra	2 500	Materials	1 000
		Plant and machinery ..	2 500
Vendor's account, £20 000		Investments	1 000
Paid for business, £10 000 cash, and £1 000 a year.		Work in progress ..	1 000
		Sundry debtors.. ..	8 750
Balance at date ..	8 000	Customers' bills, discounted as per contra	2 500
Interest at 6 per cent.	480	Personal property ..	1 500
Balance	20 175	Freehold premises ..	10 000
		Life insurance, £10 000, surrender value ..	3 000
		Cash on current account	8 952
	£46 202		£46 202

I have divided in two all those items on both sides of the account which refer to trading, purchases and sales, and produced the result which would develop if Mr. Maker determined from a given date to do exactly half the trade that he is now doing. The account speaks for itself. Mr. Maker's credit balance or capital value would of course remain at £20 000, the figure upon which he is to be levied. But instead of his wealth being in stock and book debts a much larger proportion of it would be in cash, and he would have the available funds out of which to pay the levy.

This second balance sheet leads to quite a number of interesting reflections. It shows, for instance, that William Maker could relieve himself of his chronic anxiety in the matter of cash by doing a much smaller business. At present every asset he possesses is only a margin, and he would be in a much safer position if he did not strain his credit to the extent that he is now doing. His income would of course be less, unless he were able to get larger profits on the smaller business, but he would be running far less risk.

But let there be no misunderstanding as to what this really means. To pay the Capital Levy, William Maker would not be able to reduce his business all at once. He would have to do it by degrees. He could not, for instance, cut his stock in half. What he would do would be to decline to buy for some months, and thus throw all his suppliers out of work. With half the business he would of course require half the staff, and his wages as well as purchases would have to be reduced considerably. He would, during the transitional period, be a seller and not a buyer, and could not, in fact, afford to buy from anybody. Sooner or later he would have to move into smaller premises, and must therefore sell his freehold or find a tenant for half of it, in either case weakening the property market and throwing builders out of work. He would, of course, have to reduce his personal expenditure, and that would mean moving into a smaller house and selling his motor car; and these are the smallest results of his endeavour to raise the amount of the Capital Levy.

Weakness of the Argument.

I assume, and this is of course the fatal weakness of the whole argument, that William Maker is the only man in a similar position trying to raise the amount of his Capital Levy In fact, of course, everybody else would be doing the same thing at the same time, and it is certain that William Maker would be unable to make the sales necessary to reduce his stock, because other people would be declining, just as he is declining, to buy. The result of his action, coupled with similar action by others like him, would be to cause a severe panic in his market, and employment and values and everything else upon which the general security depends would vanish and collapse.

If the Labour Party cares to argue that William Maker is no good to society, and that we should be better without this class of person, then the Capital Levy is the best way to enforce that argument, but it is important that the voter should know exactly what is meant by a Capital Levy and should not be allowed to go to the poll under the impression that the National Debt could be reduced this way, or that anything but disaster can come from the proposal.

The credit system is developed in this country to an extent unknown elsewhere, and the results of tampering with it would be proportionately greater than those which we have seen on the Continent. The Capital Levy, or even the serious threat of it, in Great Britain would cause a collapse with resultant suffering and disaster unparalleled even in the gloomy records of the last few years.

ELECTRICAL BENEVOLENCE.

The annual Festival Dinner of the Electrical Trades Benevolent Institution was held at the Trocadero Restaurant, on November 14th, Sir Philip Nash, the president, in the chair.

Proposing the toast of the Institution, Sir Philip Nash laid stress on the importance of the part which the electrical industry must play in the future of the world, pointing out that at present the industry was but a child, although its growth and expansion had been phenomenal. The Electrical Trades Benevolent Institution was, he said, worthy of the support of all engaged in the industry. If, however, the Institution was to render adequate assistance in deserving cases it was essential that their invested funds should be very largely increased. This was particularly necessary in regard to pensions—a direction in which the Committee wished very much to increase their activities.

The chairman's appeal for subscriptions was supported by Mr. Dane Sinclair, who felt that the Benevolent Institution should not confine its attention to deserving cases only, but should not fail also to assist any who had fallen as the result of temptations which had perhaps not been placed in the way of those present.

A vote of thanks to the Chairman was proposed by Mr. J. Y. Fletcher, who spoke of Sir Philip's distinguished record, and particularly of his work during the War. Mr. Fletcher, in supporting the chairman's appeal for funds for the Institution, laid particular stress on the numerical weakness of the Institution. He calculated that there must be certainly not less than 200 000 people engaged in the industry and suggested that it would be a very happy state of affairs if only one-quarter of these were to subscribe 10s. per annum.

During the course of his response the Chairman announced that as the result of a collection which had been made that evening the total amount received before and during the dinner was now £1 244 8s. 6d., which Mr. Fletcher had kindly offered to make up to £1 250.

In conclusion Mr. F. V. O. Hawes, the secretary, was complimented on his work for the Institution. Mr. Hawes remarked that with few exceptions the Institution was not sufficiently well-known in the provinces, and suggested the establishment of local advisory committees.

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THE B.E.A.M.A. DINNER.

The Prince of Wales Present—His Views on Electrical Progress and British Enterprise—The Empire's Water Power Resources.

The dinner of the British Electrical and Allied Manufacturers' Association which was held at the Connaught Rooms, London, on November 15th, was attended by about 700 guests, including the Prince of Wales, the Rt. Hon. L. S. Amery (First Lord of the Admiralty), representatives of the Dominions Overseas, of the British Empire Exhibition, of engineering institutions, and of bodies connected with trade promotion both in the electrical industry and elsewhere. The Earl of Derby, president of the Association, was in the chair.

Mr. B. LONGBOTTOM (Chairman of the Council) read a number of messages from representatives of B.E.A.M.A. firms in the British Dominions expressing their loyalty to the Prince and their wishes for the success of the gathering.

The Prince as Exhibition President.

Lord DERBY, in proposing the loyal toasts, said they welcomed the Prince of Wales as president of the British Empire Exhibition, which all of them should do their best to make a gigantic success. The association had organised an electrical and allied engineering section in the Palace of Engineering and the World Power Conference at which over forty countries would be officially represented. His Royal Highness had the happy knack of being able to enjoy himself and yet never miss a duty. He knew he was expressing his feelings when he said that the Prince enjoyed his pleasures the more because he had done his duty. The Prince was a remarkable asset to our nation, and by our nation he did not simply mean the islands in which we ourselves lived, but those great nations beyond the seas where he was as popular, if that were possible, as he was in this country.

The PRINCE OF WALES, who was received with great enthusiasm, the whole gathering rising to its feet with prolonged cheers, in reply, said: I am particularly grateful to you for having coupled my name with this toast, which is really that of the Queen, and I thank your chairman for his very kind words. I feel more entitled to accept your reception of this toast as the president of the British Empire Exhibition than as Prince of Wales, and I take this opportunity of congratulating the association and thanking you for the great part you are taking in the exhibition. I confess that I was somewhat dismayed after accepting your kind invitation to dine with you when it occurred to me that it might involve my having to resume my studies of electricity. I thought I had left them behind me more than ten years ago. I say this to show that I have studied electricity, and that I have not forgotten all about it. And from what I remember I am not at all surprised at the comforting assurance that no one knows all about electricity. In spite of the great recent progress in the knowledge of electricity, we still are in the position of a child watching a thunderstorm; we know little compared with what is still to be known. So, gentlemen, I can take it, I think, that you do not expect me to speak to-night as an electrical expert, and that you will forgive no reference to ohms and amperes, and allow me to confine my remarks to generalising in scientific matters.

British Electrical Enterprise.

In this region of general discussion I think that anyone who has given the slightest thought to the history of electrical development has been struck by the fact that, throughout the nineteenth century, although British science has been responsible for a remarkable advance in the knowledge of the subject—names like Kelvin, Davey and Faraday occur to my mind—British manufacturers have hardly kept pace with these discoveries, and in a great many cases, while we in this country were responsible for the inventions, foreign countries reaped the benefit of their exploitation. But I think we can claim that we changed all that during the Great War, when British energy and enterprise brought this Empire into the front place as regards electrical manufacture. We most certainly owe a great debt to the scientists and manufacturers and the workmen who tackled the big problems with which they were faced in 1914—problems they not only faced, but surmounted successfully. And I think the nation can take the Great War as a lesson, and firmly make up its mind never again to let us fall back or behind in the matter of electrical development. The age of steam has passed away; the age of electricity dawns; and to keep our Imperial position we must maintain the lead in electrical development similar to that which we undoubtedly held in the development of steam.

In this respect I am glad to be reminded by the words of the toast which I am about to propose, "Imperial Trade and Resources," that these words make it possible to look at our electrical development not merely from the viewpoint of this United Kingdom, but from that of the whole Empire. If our thoughts had to be kept within the limits of this kingdom we might have to face the rather uncomfortable conclusion that our material resources, while great for the era of steam, are not nearly so great for the era of electricity. In water power I am afraid we have not the same potentialities as other countries of a more mountainous character, but if we extend our view, as we have the right, and, in fact, as it is our duty to extend it, from the United Kingdom to the Empire as a whole, we find that overseas there are enormous resources in water power, and consequently in cheaper production of electrical energy. In the great Dominion of Canada, electrical energy has been greatly developed; in fact, the possibilities of its extension are almost without limit, and in another part of the Empire, in far-away Tasmania, I understand that excellent beginnings have been made to utilise the water power of their lakes for the generation of electrical power, and I am sure that after the cables that have been received from the association's branches from Overseas, they will not be backward in developing their resources in this direction. It seems to me clear that if Great Britain continues to show the same energy and resources which have been shown in the past by scientific manufacturers and the workers in this industry, and gives the world the lead in new inventions and the practical application of the best of their machinery, the Empire will lead the world in the age of electricity just the same as it did in the age of steam. I give you the toast of "Imperial Trade and Resources."

The Great Problem of Empire.

The Rt. Hon. L. S. AMERY, in responding, said that the British Empire covered every climate, and contained wealth beyond compute of those things which needed only the energy and skill of men to convert them into terms of human welfare. Nor could anyone say we were lacking in that master-sense—human resource. Our people had shown themselves, in peace and in war, capable of the greatest things. We had the resources, and we had the power, will and ability to convert these resources into terms of wealth and happiness. What struck any one who looked at the Empire was the uneven distribution of the two parts of our resources—human and material. There we had fourteen millions of square miles of the richest country in the world; here we had fifty millions of people huddled together in one little island off the coast of Europe. How to marry the human capacities of our people to the boundless resources of our common heritage was one of the great problems of the Empire. Men, money and markets formed an inseparable trilogy in the problem of Imperial development, and without touching upon the particular methods necessary to bring all these factors into play, we had to keep in mind that these three factors must come into play if we were to get true Imperial development. Communications were the groundwork of all civilisation and all trade, and in the spread and development of communications electricity was bound to play, in the future as in the past, a very important part. The Empire of to-day existed largely because of the submarine cable. Politically and commercially, the submarine telegraph had enabled the Empire to endure through a long period of relative stagnation into what he believed was now going to be one of active development. In that period we wanted every form of communication to enable the people of the Empire to move freely to and fro, and to keep in touch with each other.

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Electric Light & Power in Guernsey.

(From a Correspondent.)

Guernsey stands out from the other Channel Islands in the possession of a flourishing electricity supply company. The original concession was granted to Edmundsons Electricity Corporation in 1898, but was subsequently taken over by the Guernsey Electric Light and Power Co., and supply commenced in 1900. Guernsey, of course, can hardly be described as a highly industrialised area, though it has its local industrial interests. The conditions under which a supply concern operates are exceptional. It operates under Island Law, and is thus free from many of the vexatious legislative enactments and limitations that operate in England. There is no obstacle to its undertaking wiring or supplying lamps and motors, so that it can handle jobs completely and expeditiously.

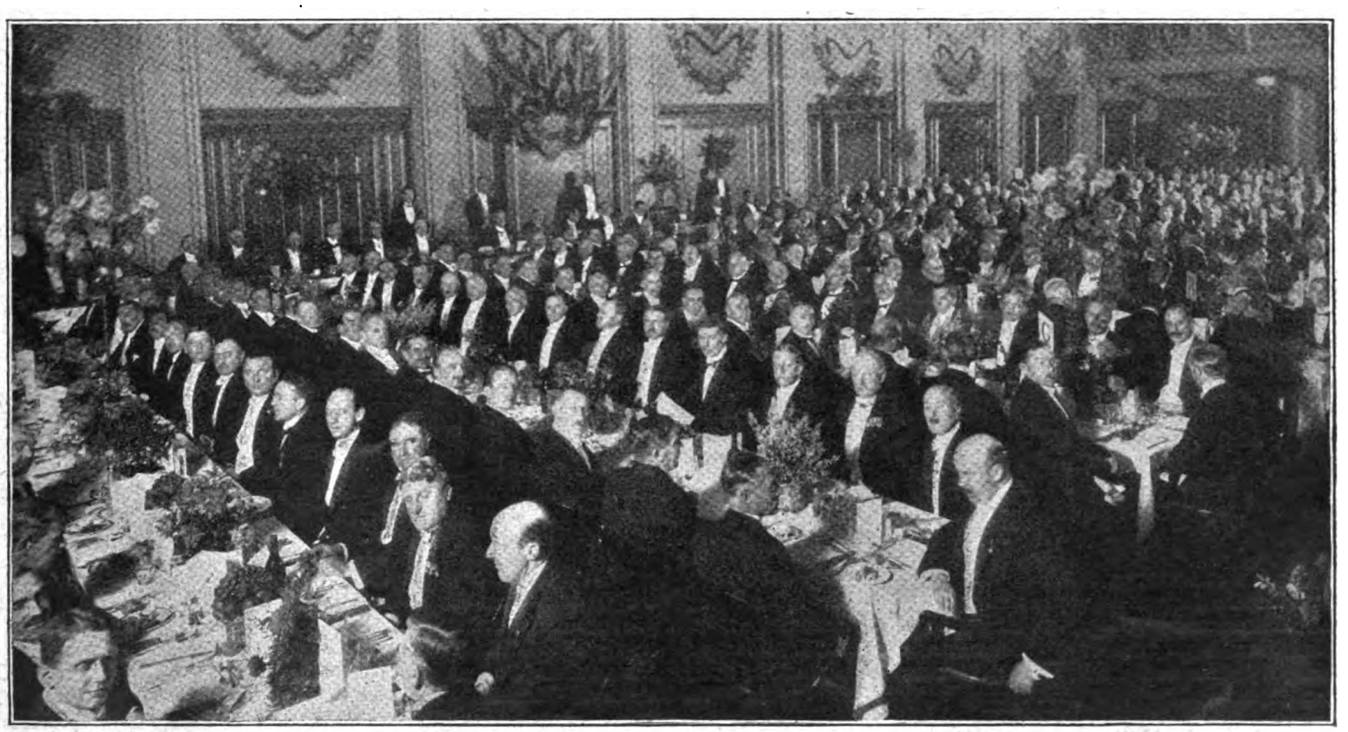
The supply is derived from two main generating stations, "Les Amballes" supplying St. Peter's Port and environs, and "St. Sampson's" supplying St. Sampson's and Vale Parishes, which may be regarded as the chief industrial centre. The total plant has an aggregate capacity of 3 445 H.P., and has passed through several interesting stages of development. At present both stations contain internal combustion engines consisting of National vertical gas engines and M.B.D. Diesel oil engines. Les Amballes was originally a steam-driven station, but this system was discarded in 1911. St. Sampson's station is situated conveniently close alongside the quay, and has ample accommodation for coal and oil storage. A pipe-line runs from the storage tanks to a berth on the quay, so that crude oil can be supplied in bulk from tank steamers. The composite nature of the plant has decided advantages, as the gas-engines can be kept working throughout the day's run at practically full load, while the oil plant deals with the peaks.

As may be imagined the lighting load is the chief feature, but there is a substantial power load, chiefly in the St. Sampson's district, for cranes, air-compressors and machines for breaking stone in the famous granite quarries. A visit to these quarries is instructive. The giant steel jaws by which the granite is crushed is operated by 75 H.P. d.c. motors, and the impression is received that the demands on the latter must be severe. However, in practice it is found that the motors stand up to the load without undue wear and tear. There is also a useful pumping load in connection with the tomato-growing industry—one of the most lucrative trades of Guernsey. A large section of the flatter portion of the island is occupied by glass-houses and the innumerable small windmills which serve to pump up water from below have an odd effect. But the larger concerns are finding it advantageous to substitute electric pumping for this source of power.

The Guernsey electricity supply is also interesting for the original enterprising effort to operate at 2 500 V direct current with three automatic sub-stations—a project that seems strange in a small island, approximately triangular, whose three sides are only 6½, 7 and 9½ miles long. However, the method was not a success, and was discarded after about 10 years' working. The present system is d.c. three-wire 420/210 V, and some outlying districts are supplied by three-wire boosters. The maximum load on the feeders last year was 1 305 kW. In this year, the most successful in the history of the company, 2 343 000 kWh were generated. The greater part of the population is massed in the townships of St. Peter's Port and St. Sampson's, and the treatment of outlying areas is something of a problem, as it would not ordinarily pay to run mains specially for these scattered houses. In some cases the problem has been solved by the assistance given by the States for the laying of a cable for supply to some special works or buildings, after which connection of adjacent consumers becomes feasible. One interesting point is the running of a special main to supply the lighthouse at St. Martin's point, where the lights can be controlled electrically from the harbour.

Consumers are supplied on a simple contract system which is stated to have proved very popular. The lighting load has developed considerably of late, though there are still many houses where electricity is not yet installed. The company has a well-equipped showroom, and its display at the local Exhibition was attractive and up to date. Guernsey is also to be congratulated on an efficient and inexpensive telephone system.

The writer desires to make mention of the courtesy of Major F. B. Hills, the engineer, manager and secretary of the company, who was kind enough to show him over the power-stations as well as to introduce him to some of the most charming views on the island. The Royal Hotel, where the writer was hospitably entertained, is electrically lighted throughout, and is also said to possess the only electrical lift in the island. Thanks are also due to the hospitality of the Guernsey Chamber of Commerce and to the Southern and Great Western Railways, who did everything possible to promote our comfort on the journey.



Fradelle & Young.

Guests at the Dinner of The British Electrical and Allied Manufacturers' Association.

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MERCHANDISE TO SELL & PROFIT BY.

"Period" Fires.

It is a pity that Electric Heating and Hardware, Ltd., have issued their catalogue of fires so late in the season, as it illustrates several good designs which should find a place in showrooms for this winter's trade. Their No. 564 fire, shown on page 583 (Fig. 1), is built to a Jacobean design. It is true that the public has been surfeited with "reproduction" domestic apparatus, but this particular fire has points which should raise it out of the rut. The fire can be supplied in a polished aluminium finish, or, what is more consistent with the design, an oak brown vitreous enamel. The fire is fitted with elements taking 2 250 W or 3 000 W at list prices of 95s. and 110s. respectively. These prices are for the oak brown finish, and the prices for polished aluminium are 115s. and 130s. respectively for the two capacities mentioned.

Packing of Braided Cables.

British Insulated and Helsby Cables, Ltd., have decided in regard to all sizes of braided cables up to 7/·029's inclusive, both CMA and NA, to abandon the present method of wrapping the coils with hessian, and in future eaoh coil will be packed in a separate circular cardboard box. These boxes have been manufactured to the firm's own ideas, and the design has been registered. The new containers, which are illustrated on page 583 (Fig. 2), possess several obvious advantages in use, and these advantages will doubtless prove to be good selling points. The coils in boxes will be just as convenient to handle as the present hessian lapped coils, as, owing to a circular hole which is provided in the centre of the box, one or more coils can easily be carried on a wireman's arm. It will be easy to get at the coil when required, it only being necessary to cut three tapes and then to lift the coil out of the box. This will do away with unwinding long lengths of hessian. The boxes will be distinctively printed in red and black, according to the colour of the cable, so that they may be picked out at a glance. If the whole coil is not used, the remaining portion can be put back in the box and kept in good condition. Each box will be clearly labelled with labels showing the size and grade or class of the cable, and this should prove very useful to anyone stocking the cables, as the particular cable required can be identified at once, and, in addition, the CMA or NA sealed label respectively will be round the coil as in the past. The boxes, which will not be charged for and need not be returned, will be ready for issue immediately.

B.T-H. "Spotlights."

We illustrate (Fig. 3, page 583) a spotlight projector manufactured by the British Thomson-Houston Co. The illustration is typical of both the "Baby" and the "Perch," the essential difference between the two being that the "Baby" is purposely limited to 250 W gasfilled projector lamps, whereas with the "Perch," lamps of 500 W and 1 000 W can be used; further, this latter size can be used with a telescopic floor standard. These spotlights are already familiar to the trade and our object in commenting on them now is to draw attention to the improvements which the manufacturers have embodied. Of particular interest is the alteration made in regard to colour media. In the past it has been the generally accepted practice to obtain colour effects with gelatine or similar material. The experience of the British Thomson-Houston Co. has been that if the apparatus is in regular service as a device for colour effects, the media fade and the maintenance figure for new pieces of gelatine is high; also they find that with gelatine screens, they are unable to guarantee the shades. As will be seen from our illustration, these glass media easily slip into the colour box which is fitted on the front of the spotlight; this feature is embodied in both the "Baby" and the "Perch."

A Better Quality Bell Indicator.

Very few contractors care to reflect on the money they have lost in service charges on bell installation jobs through installing cheap indicators; it is a mistake that many make, and for which there is no excuse. There are several reliable makes of both pendulum and mechanical patterns on the market, and, after all, reliability is all that is required of an indicator. We illustrate (Fig. 4, page 583) an indicator manufactured by the Sterling Telephone and Electric Co. It is a device which should appeal to contractors who are really concerned with the installation of reliable apparatus which will relieve them from expense in service charges after the installation has been carried out. Briefly described, the indicator, which is known as the "Gripit" pattern, has a patent mechanical replacement movement with a true safety locking device. It is impossible to bring the shutters down by vibration, movement or shock. Another feature worth mentioning is the compactness of design.

The Santon Electric Geyser.

A contribution is made to the solution of the hot-water problem by Santon, Ltd., in the small geyser illustrated opposite (Fig. 5). Its compactness will be appreciated when we mention that the overall dimensions are only 17 in. by 5¼ in. with a front to back measurement of 6 in. The manufacturers claim that the degree of heat can be regulated by the flow of water—boiling water being obtainable in twenty seconds—and a continuous flow is maintained so long as the water and current are on. Two gallons of boiling water can be obtained by the expenditure of one unit. Altogether this seems to be a reliable and useful piece of apparatus which will prove to be good merchandise to sell and profit by. The retail price is six guineas.

The Success of Standardisation.

It is the opinion of many that we shall slowly achieve success in standardisation of many classes of electrical apparatus, particularly such apparatus as is in every day demand, and, as a result, used in very large quantities. It is argued that, if manufacturers would concentrate on one design and achieved conformity with each other on all details, costs would be reduced very considerably. While the industry as a whole must necessarily proceed slowly with this theory, the Midland Electric Manufacturing Co. have adopted the policy of standardisation with many of their lines of switchgear, and the result of this policy is demonstrated by the low prices at which they are able to offer a high-class and well-built range of switchgear. "High class" is not the best appellation, but we use it for the want of a better expression. Perhaps it could be better expressed that M.E.M. switchgear is electrically and mechanically sound, and if these two fundamentals have been achieved nothing more is needed. Without in any way attempting to manufacture this new range of switchgear down to a price to meet the demand for a light and inexpensive range of switchgear the M.E.M. Co. have succeeded in producing apparatus at remarkably low prices. Our illustration of the double pole "Memak" switch (Fig. 6, page 583) will reveal its general features.

"Highlow" Fires.

Many contractors and retailers follow the plan of adopting a certain selection of fires in the early days of the season and do not show any other designs throughout the season. There is much to be said for such a plan, because it does enable the salesman to concentrate and to achieve turnover in these particular fires; further, it has the very desirable result that it increases the purchasing power of the buyer with the makers of the fires in question. There is, however, something to be said for the plan of displaying in the showroom several new designs of, say one maker, later on in the season. If the same designs are shown for many weeks on end there is a tendency for them to give the showroom a note of sameness, and salesmen naturally become a little weary of demonstrating them. Those who did not include in their selection a range of "Highlow" fires would do well to give consideration to the range which is illustrated in Archibald Low and Sons' catalogue No. E.C.1 023. Altogether there are sixteen fires in varying capacities, ranging from the popular and portable sheet metal fires, to the larger cast-iron designs. Fig. 7 (page 583) shows a fire of simple design fitted with a 1 000 W element and finished in bright black with brass or copper rosettes which will retail in a showroom at a price of 35s.

"Creda" Fires.

"The gas fire of to-day shows a much wider variety of styles and finishes than the electric, good as the latter may be. . . ." We are indebted to a contemporary for the comment, but surely it is difficult to reconcile the statement if one reviews the various designs of electric fires offered by manufacturers to-day. This is borne out particularly in the new season's fire catalogue just announced by the Credenda Conduits Co., Ltd. We show opposite (Fig. 8) a model the design of which is quite novel. The fire has a 3 000 W loading, and retails at 100s. in antique copper finish.

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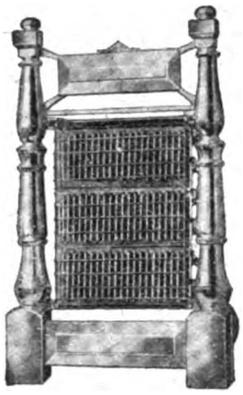

FIG. 1.—"PERIOD" FIRE.
BY ELECTRIC HEATING AND HARDWARE LTD.

FIG. 2.—NOVEL PACKING FOR CABLES.
BY BRITISH INSULATED AND HELSBY CABLES LTD.

FIG. 3.—SPOTLIGHT PROJECTOR.
BY THE BRITISH THOMSON-HOUSTON CO.

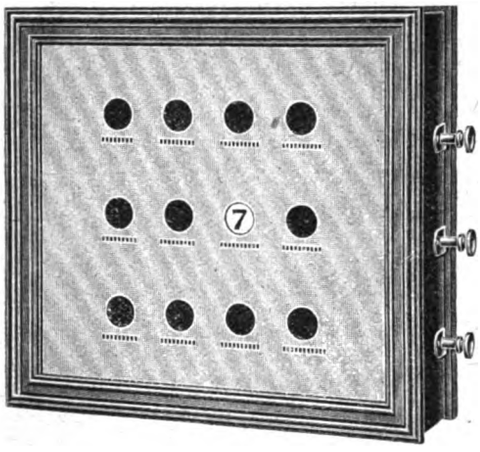

FIG. 4.—MECHANICAL REPLACEMENT INDICATOR.
BY THE STERLING TELEPHONE AND ELECTRIC CO.

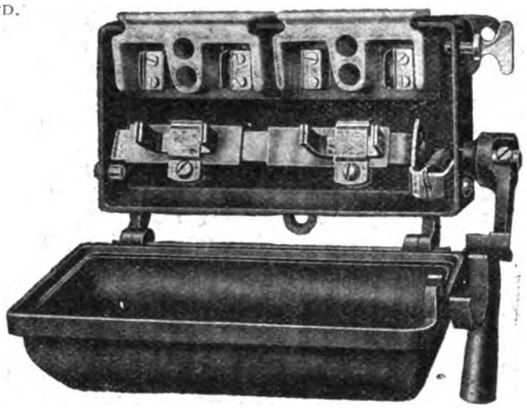

FIG. 6.—DOUBLE POLE "MEMAK" SWITCH.
BY THE MIDLAND ELECTRIC MANUFACTURING CO.

FIG. 5.—ELECTRIC GEYSER.
BY SANTON, LTD.

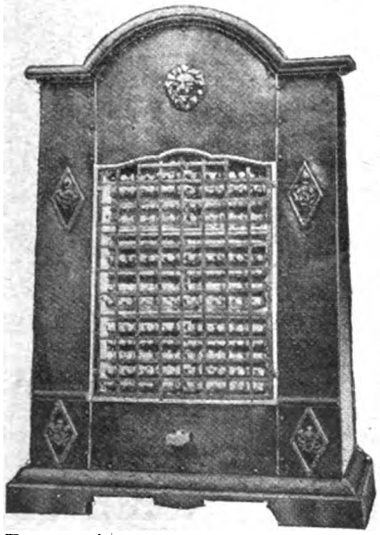

FIG. 7.—A SIMPLE "HIGHLOW" FIRE.
BY ARCHIBALD LOW AND SONS.

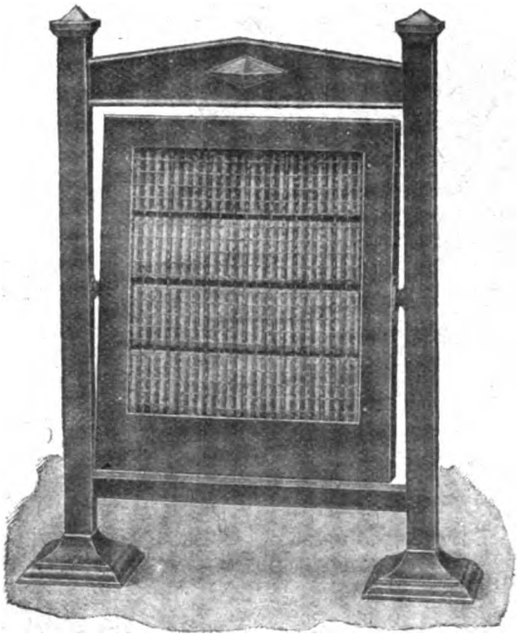

FIG. 8.—A NOVEL FIRE DESIGN.
BY THE CREDENDA CONDUITS CO.

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NEWS IN A NUTSHELL.

Light three-wheeled electric parcel delivery vehicles are being used by several Parisian shops.

Over 100 concessions for the development of water-power have been granted by the Italian Government.

The annual gross revenue of the American central station industry has more than quadrupled since 1913.

Serious drought in the South-Eastern American States is curtailing the generation of hydro-electric power.

Spanish imports of electrical machinery were increased considerably during the first six months of this year.

A new type of electric furnace developed by a Göttingen firm is said to enable temperatures up to 2 000 deg. C. to be reached.

On Thursday of last week, the plant at the Brighton Corporation electricity works failed for a period of about forty minutes.

Hull Corporation electricity works employees are threatening to strike if their demand for an extra penny an hour is not conceded.

Latest guarantees under the Trade Facilities Act include £1 500 000 to the North Wales Power Co. and £150 000 to the Tata Power Co.

Negotiations are proceeding between the Austrian Government and an Italian group with a view to expediting the Styrian water-power scheme.

Diesel-electric propulsion has been adopted for two big dredgers which are to be launched shortly for the Engineering Department of the United States Army.

Inquiries at the offices of Becos, Ltd., have failed to confirm the reported sale to the Ukrainian Government of electro-technical goods on a seven year credit basis.

We understand from Mr. F. Garside, the Aldershot borough electrical engineer, that the results from the recent electrical demonstration which lasted ten days were very satisfactory.

Fulham electrical workers, who came out on strike in support of the dustmen, have been presented by the Electrical Trades' Union with silver medals to commemorate their victory.

The most comprehensive electrical exhibition ever held in the Southern Hemisphere is to be held in Melbourne next September, under the auspices of the Electrical Federation of Victoria.

A comprehensive range of industrial electric vehicles is shown at the Commercial Motor Exhibition, which opened at Olympia, London, yesterday (Thursday). The exhibition remains open till December 1st.

An electrically-operated railway carriage door-locking device, invented by Mr. W. C. Dwyer, of Guildford, is designed to fit inside the door of each compartment and to be controlled by the guard by a switch in his van.

International electrical problems, including the exploitation of water power from water courses forming part of a basin situated in more than one country, are being considered by a League of Nations Conference at Geneva.

Halifax Electricity Committee has opened showrooms in Town Hall Street East. They take the form of a suite comprising a lounge, dining, bed and bath rooms, a model electric kitchen, a general showroom, and an inquiry bureau.

Some indication of the increased use of electrical plant in coal mines can be gathered from the fact that in 1913 the horse power of the electric motors installed in mines in England, Scotland and Wales was 628 097, compared with 1 240 174 H.P. in 1922.

Birmingham's "Civic Week" at the British Empire Exhibition at Wembley Park, 1924, has been fixed to take place at the beginning of June. The object is to demonstrate the mechanical and electrical engineering resources of the city. Mr. E. J. Jennings, secretary of the Electric Supply Department, is a member of the Executive Committee.

The Bournemouth Radio and Electrical Exhibition, which opened on Monday, is one of the most comprehensive wireless exhibitions held in the provinces. About forty firms are showing, and we learn that a great deal of business is being done in this area, which, it will be recollected, has only recently opened a broadcasting station. The exhibition remains open until November 26th.

Short time work has been introduced on a fairly large scale in the German electrical industry.

Blackpool's old power station at Bispham is to be converted into a branch library and reading-room.

American electrical exports in September totalled $5 925 529, an increase of $687 216 over September, 1922.

The Labour Party's "platform" includes the establishment of a national system of electrical power supply.

The Arabs of Palestine are opposing the Rutenberg scheme for harnessing the waters of the Jordan to generate electricity.

It has become a fashion in some parts of the country to instal electric light.—Mr. L. H. Thomas, before the Midland Junior Gas Association.

A questionnaire is being sent to members of the Federation of British Industries with a view to affecting a further interchange of electricity cost data.

A recent Government grant brings the total amount to be spent on Swiss railway electrification up to the end of 1928 to 470 million francs.

Heathfield Hall, Birmingham, the home of James Watt, with surrounding grounds, has been acquired by a syndicate for the erection of private residences.

Storage battery locomotive installations in mines in this country total twelve under the Coal Mines Act and three under the Metalliferous Mines Regulation Act.

The Southern Railway directors have consented to receive a deputation of the Brighton Corporation on the subject of the electrification of the main London to Brighton line.

"Senatore G. Marconi is the greatest man in the world," said Mr. E. G. Kellaway, in distributing prizes on Monday to members of the Marconi Messengers' Educational Classes at King's College, London.

To popularise the domestic use of electricity, Paisley Electricity Department is holding an electrical exhibition this week. A model shop window display is a prominent feature of the exhibition.

It is understood that the marine type of Still engine has now been completed, and is about to undergo tests before the Marine Oil Engine Trials Committee of the Institutions of Mechanical Engineers and Naval Architects.

It was stated at a meeting of the Scottish Centre of the Institution of Electrical Engineers that only 14 000 out of 250 000 dwelling houses in Glasgow had electricity installed. The *per capita* consumption was 130 kWh a year.

An order has been made for the restoration of Letters Patent No. 125 084, April 4th, 1918, granted to André Blondel for "Improvements in or relating to the application of oscillographs and other galvanometers to radio telegraphy."

The London railways and surface transport undertakings carry as many people in seven weeks as were transported during the whole of 1890, said Lord Ashfield, in opening the Hendon extension of the London Electric Railway on Monday.

Damage estimated at between £400 and £500 was caused by a fire which was discovered last Saturday night in a wooden building used as a pattern store by Mavor and Coulson, Ltd., electrical engineers, 47, Broad Street, Mile End, Glasgow.

A copy of a draft agreement for the construction and exploitation of a telephone system in Syria and the Lebanon is available for inspection at the Department of Overseas Trade (Room 52), 35, Old Queen Street, London, S.W.1.

The Christiana correspondent of the F.B.I. states that the lowest British quotation for a recent tender for the supply of cables for the municipality was 1 000 000 kroner, the lowest American was more than double that figure, and the lowest German offer was 760 000 kroner.

During the first seven months of 1923 the total electrical power generated in the U.S.A. was 31 992 126 000 kWh against 26 235 078 000 kWh generated in the corresponding period of 1922. Of the total, 20 056 450 000 kWh were generated by fuel power and 11 935 676 000 kWh by water power.

In response to a desire expressed by users of electric cable to be supplied with a cable intermediate in area between the standard sizes of 0·75 sq. in. and 1 sq. in., the members of the Cable Makers' Association are now manufacturing and listing, as a C.M.A. standard size, a cable of 0·85 sq. in. area (127/·093).

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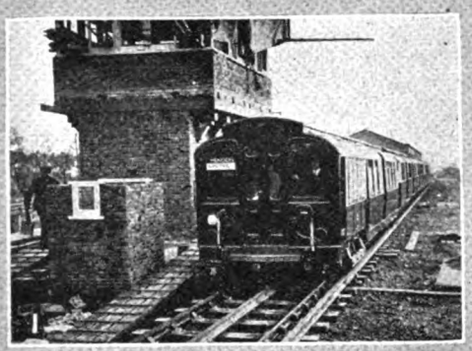

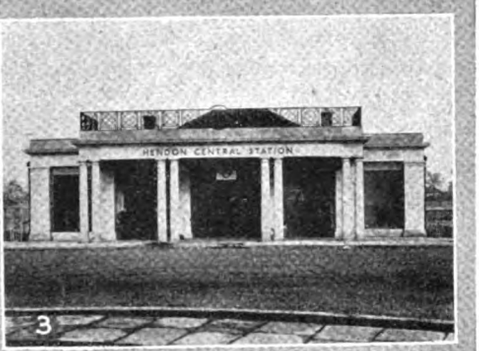

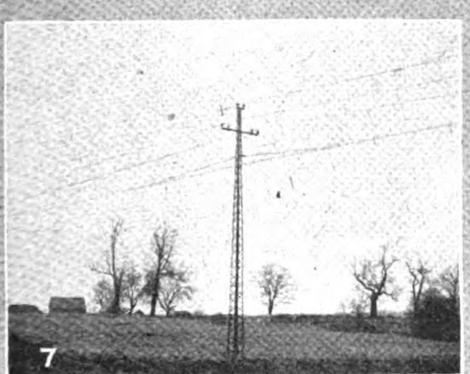

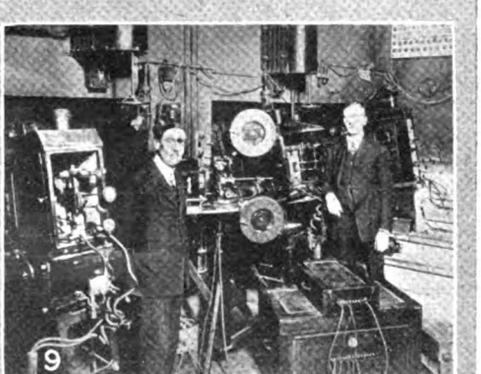

ELECTRICAL NEWS IN PICTURES.

1.—The first train entering Hendon on the London Electric Railway extension on Monday, p. 590.

2.—Mr. W. A. Chamen, general manager of the South Wales Electrical Power Distribution Co., has been elected President of the South Wales Institute of Engineers.

3.—This view of the Hendon terminus of the London Electric Railway, opened on Monday, shows how beauty and utility can be combined, even in railway stations.

4.—A recent portrait of Dr. R. A. Millikan, who has been awarded the Nobel Prize for Physics for 1923.

5.—Some of the guests at the Festival Dinner of the Electrical Trades Benevolent Institution, p. 579.

6.—Mr. J. C. W. Reith, managing director of the British Broadcasting Co., who broadcast a speech on the progress of broadcasting, p. 588.

7.—A guard-type pole at Hatfield on the line which is to connect the Hertford and St. Albans power stations, p. 589.

8.—The silver medal presented to Fulham electrical workers who came out on strike in support of the dustmen ("Daily Mail" photo), p. 584.

9.—Two Danish engineers, Messrs. Axel Petersen and Arnold Poulsen, claim to have produced a satisfactory speaking film. Their device differs from that of Dr. Lee de Forest in that the voice film is separate from the picture film. Our photo shows the inventors with their apparatus.

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LEGAL INTELLIGENCE.

Telephone Rental Charges.

In the Mayor's and City of London Court last week, the Postmaster-General claimed against William H. Taylor, trading as Rufus Webb, of Church Road, Epsom, formerly of Southampton Street, London, £32 2s. for telephone charges.—There was no dispute about the figures, but the defendant said he was not liable. —Mr. A. S. Wallis, a representative of the Postmaster-General, said that the defendant signed a contract for three telephone lines for one year. They were duly installed, and on an order signed by the defendant they were removed from Southampton Street to Old Bond Street. The defendant said he signed the order for the Turf Exchange, Ltd., of which he was the manager. It had failed to meet its liabilities, and the telephones were transferred to Rufus Webb, Ltd. Mr. Wallis said that Rufus Webb, Ltd., was not registered until after the defendant had signed the contract. The contract was for a year, but the telephone had been discontinued before that period had expired because of the non-payment of the account.—Giving judgment for the Postmaster-General with costs, Judge Shewell Cooper said that owing to a clause in the agreement of the Postmaster-General, the defendant was being sued for the rental of the telephone after it had been cut off, but the defendant had made himself responsible.

Wireless Apparatus Orders.

In the Bow County Court last Friday, before Judge Snagge, Mr. G. R. Judge, of 709, Romford Road, Manor Park, wireless apparatus manufacturer, sued Mr. H. Goater, of 41, Kempton Road, East Ham, wireless apparatus manufacturer, to recover £18 5s. 1d., for goods supplied.—Sir Alfred Callaghan, for plaintiff, said that a Mr. James used to call and order wireless goods from the plaintiff in the name of the Kempton Wireless and Radio Company, which company belonged to the defendant. Cash was paid for a long time, and then it was suggested that an account should be opened, to which the plaintiff agreed, and the account now sued for had run up. The defendant now suggested that James was never in his employ, and had no authority to order these goods; he, however, was not present in court.—Mr. Judge gave evidence bearing out this statement, and said that on most occasions Goater was present when the goods were ordered and taken away.—Mr. James was then called, and said he was employed by the defendant as "the electrician," the defendant knowing little about the technical side of the work. He suggested what should be purchased. Goater gave him money, and on most occasions came with him to buy. The suggestion to have a monthly account was made by Goater, and he arranged for it.—Judge Snagge said there was a *prima facie* case made out that James had been held out to be the agent, and there would be a verdict for the plaintiff for the amount claimed, and costs.

B.T-H. Patent Litigation.

When the case of the British Thomson-Houston Co. *v.* the British Insulated and Helsby Cables (reported in our previous issue) was resumed before Mr. Justice Russell in the Chancery Division last Thursday, Dr. Otto Oberlander, who had been consulting chemist to the General Electric Co. in respect of lamps and filaments, gave evidence for the plaintiffs. After describing the platinum and carbon filament lamps, Dr. Oberlander, dealing with the osmium lamp, said the maximum voltage that could be obtained with this type was from 50 to 70, and for voltages of 200 and 250 three or four lamps had to be run in series. He then went on to describe the tantalum lamp, which was the result of work done by von Welsbach in producing the osmium lamp. Tantalum was a brittle powder like osmium, and the firm of Siemens of Berlin discovered that pure tantalum could be melted into an ingot which was no longer brittle like the powder, and could be worked cold like any other ductile metal. The tantalum lamp was a great improvement on the osmium lamp, and was put on the market in 1905. The next step was the invention of the squirted tungsten filament of Just and Hannaman, the patent of which was dated 1904. This was the first practical tungsten lamp put on the market, although people had previously been looking for a method of obtaining a tungsten filament or a filament of some other metal. Hundreds of people were working on these lines. The process of making the squirted filament lamp was identical with that of the osmium lamp, subject to some slight alterations owing to tungsten possessing different properties from osmium. The filaments, however, were brittle like the osmium filaments, and they were held together by the fritting or sintering operation. The filaments could not be bent without breaking, but, notwithstanding their delicate condition, hundreds of millions were sold.

Replying to counsel, Dr. Oberlander said he did not know of any case in which drawn tungsten wire was ever made before 1909, nor did he know of any case in which drawn tungsten wire, which was ductile cold, was known before 1909. Until the specification was published neither of these bodies was known.

Asked by counsel to explain the B.T-H. patent 21 509 of 1906, witness said the specification suggested the production of bodies of tungsten which were suitable for being drilled or filed or otherwise worked into suitable shapes. Eventually these bodies were heated to 1 600 deg. C. in order to eliminate impurities. Witness saw nothing relating to the 1909 patent, and from his knowledge of the art at the time he was certain that what the inventor had produced was nothing but a tungsten carbide, which was more brittle than tungsten and correspondingly more unworkable. In his opinion it was impossible that a body could be obtained by heating to 1060 deg. C. as described which could be worked.

Dealing with the B.T.-H. patent 21 513 of 1906, in the specification of which it was stated that when tungsten was heated remarkable molecular changes took place and it became so ductile that it could be worked, witness did not agree that the molecular changes took place, because on cooling he found that the tungsten was unchanged. Tungsten could not be worked easily while hot.

After the visit of his Lordship, accompanied by one expert and two counsel from each side, to the works of the General Electric Co. at Hammersmith, the examination of Dr. Oberlander was resumed on Friday last.

Asked as to the 1906 specification 21 513, witness agreed that setting aside the information that tungsten could be worked hot and the information given for making a slug, he did not find anything in the document likely to help him, as a chemist, to work tungsten down to a filament.

Witness was asked as to the Siemens and Halske specification 3 174 of 1907, and said the process aimed at the production of ductile tungsten without mechanical working. It really amounted to a consolidation of a tungsten powder in a tube of ductile metal into which it was suggested that tungsten powder should be hammered. He had attempted to make a tungsten body by means of that specification, but found that, although when he removed the cover or shell which held the tungsten temporarily in position it looked coherent, immediately an attempt was made to handle it it fell back into powder. By the process they had seen that morning, he added, tungsten was made to cohere so that it could be handled and subsequently worked. Even with that process the body obtained was very delicate.

That part of the B.T.-H. specification 16 530 of 1907, which alleged that tungsten an inch thick could be rolled and drawn at a temperature which was below visible redness in the open air for the purpose of rendering tungsten ductile, was inoperative. It was generally believed at the time that it was unsafe to deal with tungsten above the oxidising temperature.

In reply to counsel Dr. Oberlander said that the process which was demonstrated that morning was one which followed throughout the description given in the 1909 specification. Witness was questioned in detail as to plaintiffs' process and agreed that by repeated mechanical working, the tungsten being heated during the earlier stages of the operation, a condition was reached where the metal acquired such physical or molecular characteristics that further working might, if desired, be continued at room temperature. The tungsten so treated was so ductile as to admit of bending, rolling, drawing, or the like either at ordinary temperatures, such as 20 deg. C or hot as might be preferred.

The hearing was adjourned.

B.T-H. Cases in Scottish Courts.

In the Outer House of the Scottish Court of Session last Friday intimation was made that settlements had been effected in six actions at the instance of the British Thomson-Houston Co. against John G. Mackintosh, 1, North St. David Street, Edinburgh; Archibald Low and Sons, 28a, Renfield Street, Glasgow; Malcolm and Allan, Ltd., 17, North St. Andrew Street, Edinburgh; Anderson and Munro, Ltd., 136, Bothwell Street, Glasgow; and W. C. Martin and Co., 10, West Campbell Street, Glasgow—all electrical engineers. The pursuers sought to have the defenders interdicted from selling lamps which had not been made by the pursuers, but which lamps were an infringement of the pursuers' 1909 patent. They further concluded for delivery of any infringing lamps which the defenders had in their possession and for payment of damages. Lord Blackburn interponed authority to a joint minute in similar terms lodged by the parties in each case, which set forth that the defenders consented to decree for interdict being pronounced, and had paid a sum in satisfaction of the conclusions for delivery and damages, and they accordingly craved the Court to grant interdict, *quoad ultra*, to dismiss the conclusions of the summons and to find no expenses due to or by either party.

B.E.A.M.A. Scholarships.

The Council of the British Electrical and Allied Manufacturers' Association has recently granted the following scholarships, tenable for one year, each of the value of £100 and the payment of college fees: In Electrical and Mechanical Engineering—John Douglas Cockcroft, tenable at Cambridge University; Arthur Bernard Everest, tenable at Birmingham University. In Electrical Engineering—George Knowling Franklin, tenable at Manchester College of Technology; George Sail Campbell Lucas, tenable at City and Guilds (Engg.) College, South Kensington; Richard Cyril Matthews, tenable at City and Guilds (Engg.) College, South Kensington; Henry Letham M'Broom, tenable at the Royal Technical College, Glasgow (Mr. M'Broom received his education at Airdrie Higher Grade School and the Royal Technical College, Glasgow); John Leonard Orme, tenable at Birmingham University; Cecil William Richards, tenable at City and Guilds (Engg.) College, South Kensington; Rowland Wright, tenable at the City and Guilds (Engg. College, South Kensington.

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PERSONAL GOSSIP.

Dover Town Council has appointed Mr. Plater as mains assistant at a salary of £235 per annum.

Ald. F. Smith has been reappointed as chairman of Birmingham Corporation Tramways Committee.

Mr. W. J. Thorrowgood, signal and telegraph superintendent under the chief engineer of the Southern Railway, has been elected

MR. W. J. THORROWGOOD.

chairman of the Railway Electrical and Telegraph Engineers' Conference for the ensuing year.

Mr. A. F. Harrison, secretary of the City of London Electric Lighting Co. has been elected President of the Chartered Institute of Secretaries.

Mr. Jack Moorhouse, son of Mr. C. F. Moorhouse, manager of the Reading telephone service, is shortly leaving for Fremantle, Western Australia.

Dublin Electricity Committee recommends that Mr. L. J. Kettle, the city electrical engineer, be appointed manager of the municipal electricity undertaking.

Ald. G. Billington, who is in business as an electric wiring contractor, has been reappointed chairman of Salford Electricity Committee, with Ald. Rothwell as vice-chairman.

Mr. T. McLeod has been elected chairman of the Hull Electricity Committee. Mr. A. D. Willoughby is again the chairman of the Tramways Committee, while Mr. E. Ombler has been chosen for that position on the Telephone Committee.

There is no truth in the announcement that Sir Ernest Benn is to stand in the Liberal interest for East Surrey. Sir Ernest has had five invitations to contest seats, but, in view of his many business responsibilities, is unable to see his way to take part in the present election.

Ald. Bowes enters on his 34th year of municipal service with his reappointment as chairman of the Manchester Tramways Committee for another year. Ald. Chapman, who has been re-elected deputy-chairman, has partnered Ald. Bowes on this Committee for nearly 17 years.

Mr. Lionel B. Whitaker, formerly electrical engineer, Ste. Madeleine Sugar Co., San Fernando, Trinidad, has left for Jamaica to take up the management of the Grays Inn Central Sugar Works at Anotta Bay. This, we understand, is the first British-built all-electric sugar factory in the world.

Hackney (London) Borough Council Establishment Committee recommends that as from November 1st the salary of Mr. J. R. J. Bowden, deputy borough electrical engineer, be £850 per annum (subject to quarterly adjustments in accordance with the cost of living figure), plus £15 per annum in respect of every million kWh sold in any financial year over 20 millions.

To celebrate the completion of his 25 years' continuous service as chief engineer and manager of the Aberdeen municipal electricity undertaking, the electricity staffs last Friday entertained Mr. John Alexander Bell at a smoking concert at the Imperial Hotel, Aberdeen. During the evening Mr. Bell was presented by Mr. James Murray, the oldest employee, with an illuminated address, and with a silver rose bowl for Mrs. Bell.

Ald. W. T. Dagnall has been re-elected chairman of the Manchester Corporation Electricity Committee, with Alderman W. Walker as deputy chairman. Ald. Walker, who is a director of Henry Simon, Ltd., of Manchester, was chairman of the North-Western Centre of the Institution of Electrical Engineers in 1921, and has recently entered upon his fifth successive year as chairman of the National Joint Industrial Council for the Electricity Supply Industry.

Mr. William Johnston, of the Chile Telephone Co., who has recently arrived in London from Valparaiso, informed a representative of THE ELECTRICIAN this week that telephone developments may be expected to take place in Chile if the Chilean Government agrees to proposals for increasing the length of the company's concessions. At present the period is only 10 years, but it is expected that this will be extended to at least 30 years. Mr. Johnston said that the Chileans have been so favourably impressed with the automatic telephone system already installed in Valparaiso that they are keenly anxious to see a development of the service, but until the position in regard to concessions is settled it will not be possible to proceed further. Mr. Johnston, who has been a Member of the Institution of Electrical Engineers since 1909, has spent some twenty years in Chile. He thinks that the country possesses wonderful possibilities for the employment of British capital and enterprise in almost every branch of electrical activity.

Among the late M.P.s who will again contest their seats at the forthcoming general election are: Lt.-Col. Sir F. Hall (Dulwich), a director of the County of London Electric Supply Co.; Sir William Bull (Hammersmith), a director of Siemens Bros. and Co. and of the British Broadcasting Co.; Mr. George Balfour (Hampstead), chairman of Balfour, Beatty and Co.; Sir Philip Dawson (West Lewisham), consulting electrical engineer, partner in Kincaid, Waller, Manville and Dawson, and author of "Electric Traction on Railways"; Sir Edward Manville (Coventry), consulting electrical engineer and partner in the firm of Kincaid, Waller, Manville and Dawson; Mr. F. A. Broad (Edmonton), electrical instrument maker; Sir J. S. Harmood-Banner (Everton), a director of the British Insulated and Helsby Cables, Ltd., and the Automatic Telephone Co.; Mr. R. G. Ellis (Wakefield), a director of the Yorkshire Electric Power Co.; Mr. R. R. Fairbairn (Worcester), formerly manager of the Worcester tramways; Sir G. C. Marks (Northern Cornwall), consulting engineer and patent expert; and Mr. J. Falconer (Forfar), a director of the Mersey Railway. Among the new candidates are Sir T. R. Bethell (Bury St. Edmunds), a former director of the Sterling Telephone and Electric Co., and Alderman J. B. Burman (Duddeston), chairman of the Birmingham Electricity Committee.

Mr. W. A. Gillott has been appointed Exhibition Manager of the electrical display which is being organised by the Electrical Development Association for the British Empire Exhibition. Mr. Gillott, whose electrical development work is well known in the industry, joined the Newcastle-on-Tyne Electric Supply Co. in 1906 as assistant engineer for the design, erection and maintenance of h.t. transmission lines, l.t. network, and sub-station equipment. Four years later he concentrated his attention on propaganda work for the extended use of electricity, with such success that within three

Elliott & Fry.

MR. W. A. GILLOTT.

months it was necessary to erect a new sub-station in what had been an unprofitable residential area, in order to handle the increased demand. Mr. Gillott was invited by the late Lord Rhondda to take control of the electrical work for the National Kitchens and Restaurants of the Ministry of Food, and held the position until the Department closed shortly after the Armistice. He joined the Jackson Electric Stove Co. as sales manager and engineer in 1920, a position which he relinquished in 1922. While with this company he gave close attention to the design of electrical and heating apparatus of all kinds, a particularly interesting piece of work for which he was responsible being the equipment which is installed in the dining cars of the Great Northern Railway. Mr. Gillott has been closely associated with the work of the E.D.A. ever since its formation.

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WIRELESS CHAT.

Mr. J. C. W. Reith on "A Year of Broadcasting."

In a speech broadcast from the London Broadcasting Station on November 14th, Mr. J. C. W. Reith, managing director of the B.B.C., recalled that a year ago the Broadcasting Co. was represented by a staff of three in temporary possession of one small room. Stations in Birmingham and Manchester began operating under the same auspices within a week, and at the end of December the first central organisation of the company began to take effect. Within a year about 15 000 hours of programmes had been transmitted from the various stations, and a large organisation had been created. The company felt that the broadcasting service was as yet only on the threshold of its possibilities.

With such a force, and at the institution of a service of such possibility, there must be policies and ideals on which to base the operations. Whereas the greater part of this influence was extended along the lines of entertainment, it would be a prostitution of it to regard it as that, and nothing else. Equally wrong would it be not to preserve a certain standard in the entertainment which was broadcast. They had avoided measures which would degrade or cheapen the service generally.

Marconi's and Empire Wireless.

The controversy on Empire wireless between the Postmaster-General and Marconi's Wireless Telegraph Co. appears to be no nearer settlement. In a letter to the Press, Senatore Marconi mentions that suggestions are being repeatedly made that his company is aiming at a monopoly of the wireless services. That this is not the case, he states, is amply borne out by the company's proposal to the Postmaster-General in its letter of October 19th, to which no reply has yet been received. In that letter the company stated that it was prepared to enter into pooling arrangements with the Post Office provided it could secure the commercial management of its services. If that were not agreeable to the Post Office, the company was prepared to accept a non-exclusive licence under which the Post Office station and that of the company would have equal facilities for communicating with the Dominion stations, thus affording free competition for the public support. "We further proposed," the letter continues, "that we should meet at the early convenience of the Post Office with a view to disposing of the remaining points in order that an agreement might be completed without delay. Having regard to the extreme desirability of losing no time in commencing work, which, apart from the importance which it has to the whole Empire, would give immediate employment to many thousands, we have written to the Postmaster-General expressing the hope that we may receive a reply to our letter of October 19th."

M. Belin on Wireless Possibilities.

Giving a demonstration at the Royal Society of Arts, on November 14th, on the process of transmitting and reproducing writing, drawing and photographs without wires, M. Edouard Belin said the Belin system of telephotography had to undergo many improvements in order to be not only of practical use, but also to respond to the actual conditions of the telephonic system. His system, which was now sufficiently well known, had led to apparatus which were equally adaptable to teleautography, for the use of which the French postal and telegraph authorities erected the first stations in Paris, Lyons, and Strasbourg. Messages thus transmitted were authentic, and even the transmission of shorthand would probably become general. An alternative application of the same system permitted absolute secrecy in telegraphic and radiotelegraphic transmissions. Autograph messages had been transmitted by wireless telegraphy in France and America, and quite recently he was able, with the aid of his assistants, to transmit by wireless real photographs in half-tones. For several months the researches in the laboratory at La Malmaison had shown in principle that television was no longer an impossibility. All the experiments were made with wireless, and M. Belin came to the conclusion that the expected solution of this problem was very near at hand.

A Wireless Transmission Experiment.

Information received from America records a very interesting wireless transmission experiment recently made by Dr. Alexanderson, chief engineer to the Radio Corporation of New York. From the Corporation's Broad Street office (states the "Engineer") a signal was sent through the Long Island station direct to Poland, where it was made to actuate the Warsaw transmitter and return to New York. On its return it was again reflected to Warsaw, and so on, back and forth, each time with diminishing intensity, until after forty double journeys it became inaudible. Each double journey represented a distance of nearly 9 000 miles, so that, all told, the signal—if it be permissible to regard it as one and not a series of signals—traversed a total distance of something not far short of 360 000 miles, or approximately fourteen times round the earth at the equator. The total time occupied in the forty traverses was, approximately, two seconds.

(*Continued at foot of next column.*)

IN PARLIAMENT.

Statutory Expenses of the Electricity Commissioners.

Sir James Remnant (House of Commons, November 13th) asked the Parliamentary Secretary to the Ministry of Transport if his attention had been called to the case of the King *v.* the Electricity Commissioners, in the Court of Appeal on July 27th, 1923, in which judgment with costs was given against the Commissioners and in favour of the London electric companies; and, if so, would he see that these costs were not included amongst the ordinary expenses which the Electricity Commissioners were allowed under Act of Parliament to levy upon the companies?

Lieut.-Colonel Moore-Brabazon: Section 29 of the Electricity (Supply) Act, 1919, as qualified by Section 7 of the Electricity (Supply) Act, 1922, is mandatory, and precludes any differentiation of expenses. Costs against the Commissioners in an action are properly to be included as expenses of the Commissioners. Replying to a supplementary question he thought there was no limit to the expenses allowable to the Electricity Commissioners.

Recording Telephone Calls.

Replying to Capt. Wedgwood Benn (House of Commons November 15th), Sir L. Worthington-Evans said that where a subscriber challenged the accuracy of the number of calls charged against him, the Post Office figures and the recording machinery were carefully examined and tested, and any evidence which a subscriber could produce received full and careful consideration. Should the result indicate that the Post Office account was inaccurate, adjustments were made.

Cleethorpes Electricity Supply.

Mr. F. Hall was informed by Lt.-Col. Moore-Brabazon (House of Commons, November 15th) that it was not proved to the satisfaction of the Electricity Commissioners that the establishment of a small generating station by the Cleethorpes district council would, from the point of view of consumers in Cleethorpes, be more economical than taking a supply in bulk from Grimsby, and the Commissioners refused their consent to the council's application to establish a new power station. A full explanation was given to the district council, and in the course of subsequent correspondence the Commissioners intimated to the council that it would serve no useful purpose and would be a waste of money for a deputation from the district council to journey to London to discuss the matter in further detail.

The Tata Power Co.

In answer to Mr. G. White (House of Commons, November 15th), Lt.-Col. Guinness said there would be a Government representative on the board of the Tata Power Co., but he was not yet in a position to give his name.

(*Continued from preceding column.*)

American Wireless Developments.

The opening up of direct wireless communication between Warsaw and New York on October 3rd last marks another step in the plans of the Radio Corporation to make New York the centre of a world-wide radio communication system. The circuit is now open for public business, and is (the "Financial Times" understands) being well patronised by the business community in both cities. The high-power station at Warsaw was built by the Radio Corporation of America for the Polish Government on a contract for a period of thirty years. To accomplish this a new receiving circuit has been installed at Riverhead, Long Island (15 miles from New York), which is connected with the chief operating office in Broad Street, New York, by underground wires, and one of the high-power transmitting units at Rocky Point, Long Island, similarly connected with the New York City Office, will transmit to Warsaw, where the received signals will be relayed automatically over land lines to the centre of the business section.

Wireless News in Brief.

Sheffield's Relay Station was formally opened by the Lord Mayor on November 10th.

Burndept, Ltd., have presented a wireless receiving set to the wireless section of the South African Institution of Electrical Engineers.

According to the "Daily Express," experiments are being made with apparatus which, it is claimed, will record wireless messages transmitted months ago.

Organised by the Nottingham and District Radio Experimental Association, a wireless exhibition was held at the Albert Hall Institute, Nottingham, on November 15th, 16th, and 17th.

According to "Izvestia," the Electric Trust Co. has signed an agreement with the Persian Government for the installation of a powerful wireless station in Teheran and 11 auxiliary stations in other centres. The total cost of the order is estimated at £50 000.

The use of wireless for university extension work has progressed rapidly in America. Of fifty-seven universities and colleges possessing broadcasting stations at least two have organised regular radio extension courses, and the National Radio Chamber of Commerce is developing a plan for establishing other similar courses.

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ELECTRICITY SUPPLY.

Extensions and Developments.

Dover Town Council has received sanction to a loan of £21 336 for new plant at the electricity works.

Shrewsbury Town Council has received sanction to a loan of £9 250, for mains, extensions, services, etc.

Walsall Town Council has approved the expenditure of £26 401 on additional plant for the Birchills power station.

Tunbridge Wells Town Council has received sanction to a loan of £53 200 for extensions to the electricity works.

Watford Town Council has applied for a loan of £20 000 for converting the electricity supply from single phase to three phase.

Menai Bridge Urban Council has applied for a loan of £3 171 for the completion of arrangements for a supply of electricity from Bangor.

Wimbledon Town Council has received sanction from the Electricity Commissioners to borrow £8 572 for mains, transformers and kiosks.

Lanark Town Council is considering a proposal to utilise Bonnington, Stonebyres, and Corra Linn Falls for the generation of electrical energy.

Elland Electricity Committee has approved a scheme prepared by Mr. W. C. Knowles, the electrical engineer, for lighting the streets electrically at an estimated cost of £7 500.

John C. Bannister and Co. have applied to the Electricity Commissioners for consent to establish an electricity generating station on their premises in Back Lane, Easingwold.

It was stated at the annual dinner of the Swansea electricity Department that, roughly 75 per cent. of the energy produced at Swansea was utilised for power purposes, only 25 per cent. of the output being used for lighting.

Sanction has been received by Sunderland Town Council for the borrowing of £19 000 for electricity extensions. The Council has approved a proposal of the Electricity Committee to rent a shop in Fawcett Street for use as electricity showrooms.

Free Wiring Advocated.

At a meeting of the York City Council, Alderman Wragge suggested that it would be a good business proposition if the system of free electric wiring could be adopted in the city. If this were done, more people would take advantage of the municipal supply.

It is reported in the local press that operations will probably commence at an early date on the construction of the North Wales Power Co.'s large dam at Trawsfynydd, Merioneth. The dam will be five miles long by four wide, and a power station will be erected at Maentwrog.

Grange Urban Council has passed a resolution giving S. Wilkinson (Arnside) Ltd., twelve months' notice to terminate the existing agreement for a supply of electricity in the Council's area on the alleged ground of failure on the part of the suppliers to carry out their principal covenants.

Ilkley Urban Council has decided to take a bulk supply of electricity from the Yorkshire Electric Power Co. Application is to be made to the Commissioners for sanction to borrow £6 800 for converting the present plant and switchboard, and for other necessary alterations at the power station.

The Essex Power Co. has informed the Southend-on-Sea Town Council that it proposes to construct a power station at Mersea Island, and has inquired whether the Council will be prepared to enter into negotiations for a bulk supply of electricity. Consideration of the matter has been adjourned.

A meeting was held at the Town Hall, Thame, on November 15th, to discuss proposals in connection with the provision of a supply of electricity for the town. The meeting was preceded by a lecture by Mr. Victor W. Dale (business manager of the E.D.A.) on "The Uses of Electricity in Home and Business." A resolution was unanimously passed recommending the Council to investigate the best means of obtaining a supply as early as possible, one lady in the audience stating that she was willing to put in 100 points at once.

On our picture page this week is an illustration of one of the poles on an overhead line between the Hertford and St. Albans power stations from which some idea can be gathered of the guarding of the power wires, the manner in which the pilot cable is carried from the earth wire, and the stitching at the pole itself. The line is arranged for working at 20 000 V, the section of the conductors being 0·075 sq. in. bare copper, the telephone cable being a 4-pair, 1/19 air space. It is the second section of a line which now extends from Hertford power station to the sub-station in Hatfield Park. Work on the last section of five miles to St. Albans will probably be put in hand next year.

Tenterden Town Council has decided to support the application of the Cranbrook Electricity Co. to supply electricity in the borough, while the Cranbrook Rural District Council has taken similar action in regard to the rural area.

It was reported at a recent meeting of the Bethesda Council that a recent plebiscite showed that over 500 residents and several churches were willing to use electric light if it could be installed in the town. The North Wales Power Co. wrote stating that they were arranging for a distributing company to take over the supply of places like Bethesda.

Stokesley Rural Council has decided to offer no objection to Middlesbrough Corporation supplying electricity in the rural district with the exception of the township of Yarm. Middlesbrough Town Council has taken over the powers of the Cleveland and South Durham Electric Power Co., which had power to supply electricity in the district of the Middlesbrough and Stokesley Rural Councils.

Inquiries and Orders.

The Oxford Electric Co., Ltd., has applied to the Electricity Commissioners for an order to extend the area of supply so as to include the parishes of Sandford-on-Thames, Cowley, Elsfield, Forest Hill, Shotover, Headington, Horsepath, Iffley, Littlemore, Marston, Cutteslowe, Water Heaton, Wolvercote and Pixey Mead.

Neston and Parkgate Urban Council has decided to lodge a formal objection to the application of the Gayton Park Electricity Co. for an order to supply electricity at Wirral. The Council has also decided to confer with the Wirral Rural Council and the Bebington and Bromborough Urban Council with a view to the provision of a joint electricity scheme.

An application will be made in December to the Secretary for Scotland for a Provisional Order to incorporate a company to construct, equip and work hydro-electric power works on the River Clyde, in the County of Lanark, to acquire lands to supply electricity to the London, Midland and Scottish Railway Co., the Clyde Valley Electrical Power Co., Lanarkshire County Council, Lanark Town Council and others.

The Grampian Electricity Supply Co. will apply to the Secretary for Scotland on or before December 17th for a Provisional Order giving powers for the raising of capital, to acquire electricity undertakings within or without the area of supply as defined by the Act of 1922, to make arrangements with other undertakers for mutual assistance in regard to the supply of electricity, etc. Copies of the order can be obtained, at 2s. per copy, on or after December 21st, from Shepherd and Wedderburn, 16, Charlotte Street, Edinburgh, or John Kennedy and Co., 25, Abingdon Street, Westminster.

POLITICS AND BUSINESS.

E.D.A. Campaign to Maintain Electrical Interest During Elections.

In order to maintain public interest in matters electrical during the elections, the Electrical Development Association is again issuing in large quantities the small 8vo leaflet which did such valuable work and was circulated very widely at the last General Election.

As the Association points out, unless very energetic action is taken by supply undertakings and contracting firms, the valuable position which these branches of the electrical industry secure at this time of the year is likely to be hampered seriously. In order to "make politics serve business," the E.D.A. asks all concerned to circulate these leaflets—one of which is reprinted below—as freely as possible during the next two or three weeks. They can be obtained from the Association at 15, Savoy Street, Strand, London, at a cost of 6s. per 1,000 :—

Since the days of Magna Charta, all over the world the Englishman has taken a delight in depreciations upon himself from friends and foes alike. When he is told that his beautiful country peoples a NATION OF SHOPKEEPERS he smiles complacently with an eye upon the home and creature comforts which such avocations have provided. When he is reminded that he is of a NATION OF MUDDLERS he pleasantly acquiesces and remarks . . . . "We muddle through, you know, and get there." . . . But these pious self-satisfying observations are not quite so acceptable as they used to be. In these troublesome times it is a reflection upon ourselves to say that we are the most

CONSERVATIVE

people in the world. England, which has led the way on land and sea in all the arts and sciences, was not long ago the workshop of the world utilising, often only too wastefully, her

LIBERAL

stores of fuel and mineral wealth. To-day she is deliberately wasting, not only those valuable possessions, but, what is of far greater importance, she is wasting in the workshop, and equally in the home, that

LABOUR

which could be used more economically and extensively, and so go towards bringing England's industries in the van again and make her people the healthiest, happiest, and most prosperous under the sun. There is only one way to achieve it. Never mind your colour or your politics. Make up your mind either BEFORE, ON or AFTER December 6th to

VOTE

FOR

ELECTRICITY

You can get a Ballot Card from your Local Electric Supply Undertaking.

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ELECTRIC TRACTION.

The Edinburgh tramway to the Comely Bank district has been electrified, and was opened for traffic last week.

The Glasgow tramways extension from Baillieston to Bargeddie, which forms part of the route linking up the Baillieston tramways with Coatbridge, was opened for traffic on Sunday.

It is stated that negotiations are proceeding with the object of purchasing the Scarborough tramways, which were closed down on November 10th, and that the stoppage may only be temporary.

The Danish correspondent of the "European Commercial" states that the possibility of establishing a trackless tramway service between the principal towns is being considered by the Government of Iceland.

The Elswick Road tramway extension along Benwell Lane, Newcastle-on-Tyne, and the new Melbourne Street line were inspected by Major Hall, of the Ministry of Transport, and opened for traffic on the 9th inst.

It is reported that Santiago de Chile Municipality has authorised the British Tramways and Electric Light Co. to double its tramway fares in order to recoup it for the expenditure of £1 000 000 on the improvement of the service.

The Eltham Branch of the National Citizens' Union has presented a petition to London County Council protesting against the Council's proposal to construct an electric tramway from Southend (Catford) to Eltham, on the grounds that there is no present demand for the line, and that, when improved access to the places on the route is necessary, it will doubtless be provided by the omnibus companies

Proposed Edinburgh Extensions.

Edinburgh Corporation is applying to the Secretary of State for Scotland for a Provisional order authorising the construction and working certain electric tramways in the city and the city parish of Edinburgh, the acquisition of lands and other property, the laying or the erection of electric wires in common stairs for the purpose of supplying electricity to occupiers, etc. A copy of the draft order will be deposited in the Private Bill Office, the House of Commons, by December 17th.

We understand that the Union Internationale de Tramways de Chemins de Fer d'Intérêt Local et de Transports Publics Automobiles will hold its 19th International Congress in Paris in 1924 at a date to be arranged later. Among the subjects for discussion are: "Recruiting of Car Crews: Supervision and Periodical Physical Examination"; "Improvements effected in Track and Apparatus: Construction, Electrical and Mechanical Control of Points"; "Use of Auto-motors upon Rails," and "Arrangements to Adapt Light Railway Locomotives in such a way as to secure Fuel Economy."

London County Council has asked the Highways Committee to consider and report as to whether the tramway receipts would be increased if the distances for all fares were increased, and if half-penny, transfer, return and season tickets were introduced.

Statistics compiled by Col. Bressey for the Ministry of Transport show that there is a surplus on the working of the London County Council tramways for the year 1922–23 of £230 251, compared with a deficit of £88 757 for the preceding year, and that 733 811 376 passengers were carried, compared with 688 151 316.

Electric Railway Items.

The Polish Electric Railway Co. has just been formed, with a capital of 3 000 000 gold marks, to construct and operate an electric railway between Dombrowa Basin, Upper Silesia and Cracow. The "Iron and Coal Trades Review" states that the Polish Coal Mining Association, the Coal Industry Company, and the Electric Industries Bank, of Warsaw, are associated in this venture.

On and after December 1st a system will be put into operation on the London Electric, City and South London, and Central London Railways, of charging for carriage of merchandise under 56 lb. in weight and accompanied by a passenger. Where the ordinary single passenger fare is 5d. or under, the single fare will be charged, above that fare the charge will be 6d. This will not apply to passengers conveying their own shopping parcels up to 14 lb. in weight.

The extension of the Hampstead (London) tube railway from Golders Green to Hendon was opened on Monday by the President of the Board of Trade (Sir Philip Lloyd-Greame), who drove the first train. The line is to be further extended to Edgware, 4·68 miles beyond Golders Green. The extension to Edgware will probably be completed next year. These works form part of a big programme of Underground extension and reconstruction, involving an expenditure of about £6 000 000. Passengers will be able to travel the whole 16½ miles from Edgware to Clapham Common in 49 minutes, without changing trains.

A list of comparative wholesale prices of British and German goods sold in this country has been compiled by the National Union of Manufacturers. Some of the items of electrical interest are given below, with the German price in parentheses:—Porcelain insulators, 6½d. each (3½d.); wood bell pushes, imitation walnut, 74s. per gross (45s. to 50s.); and paxolin (bakelised paper insulation) sheets over 0·020 in. thick, 4s. per lb. (2s. 10d.).

TELEGRAPH & TELEPHONE.

It has been calculated that the American people make twelve billion calls a year on the telephones of the Bell system alone.

It is anticipated that the automatic telephone system which is being installed at Torquay will be put into operation next May.

At the end of October there were 395 000 telephones in use in the London area, compared with 392 300 at the end of September and 387 700 in August.

The Headington (Oxon) Board of Guardians have decided to re-instal the telephone at their institution. This follows a fire at the institution, when much might have been saved had the telephone been available.

A new telephone exchange has been opened at Kennford, near Exeter. The exchange is one of a series of 14 new installations which are to be opened in the Exeter telephone district, which comprises the whole of Devon, except Plymouth, and Somerset.

Demands for telephone service in Pennsylvania have increased so rapidly that one company is installing 1 500 new instruments every week, according to the Pennsylvania Public Service Information Committee. More than 76 000 new telephones will have been installed by the company by the end of the year.

Some 80 trunk lines, or 20 per cent. of the trunk telephone service, were out of order last Friday owing to the recent storms. The places most affected were Bristol, Cardiff, Glasgow, Hull, Manchester, Margate, Newcastle, Eastbourne, Folkestone and Ramsgate, all of which had three or more lines not working. Six lines to Paris and two to Antwerp were also not working.

Special apparatus has been fitted in London on several of the Manchester-London trunk telephone lines to improve the transmission on long-distance calls connected over that route. During the past few weeks calls have been made from Manchester to Leeuwarden, Rotterdam, Haarlem, Amsterdam, Brussels, Paris and Boulogne, and, according to the official report, the quality of the transmission was a very distinct advance on anything that has been achieved in the past.

Forty Years Ago.

"The Electrician," November 24th, 1883.

PATENTS AND THE POST OFFICE SERVANTS.—The Postmaster-General has issued an order prohibiting officers of the department taking out any patent for an invention without his consent being previously obtained.

* * *

HEAD LIGHTS FOR LOCOMOTIVES.—American papers say that the Smith-Woolley electric head light for locomotives has been tried at Indianapolis with satisfactory results, the jolting of the engine having no effect on the steadiness of the light.

* * *

THE SOCIETY OF TELEGRAPH ENGINEERS AND OF ELECTRICIANS.—A considerable body of the members and council of this society assembled at their usual place of meeting on Thursday evening last in order to mark their respect for their past President, Sir William Siemens, by postponing the reading of the papers fixed for that meeting, and passing a vote of condolence to the members of his family. Next Thursday evening is fixed for the reading of the postponed papers.

* * *

OVERHEAD WIRES IN THE COUNTRY.—Whilst the London local authorities are making up their minds to ascertain, and that quickly, what authority they have over overhead wires in London, the question has been summarily decided in the country. At the Peterborough County Court on Thursday week Thomas Johnson, surveyor of highways in the parish of Walton, Northamptonshire, objected to the Post Office stretching overhead wires in his parish. The County Court judge held there was no ground for his objection. He did not think overhead wires dangerous, and to object to their presence in a small village was unreasonable. Mr. Casserley, on behalf of the Postmaster-General, said the case was a test one, which would rule many other similar objections.

Institution Notes.

The Board of the Institute of Physics has elected the following corporate members: Fellows.—G. R. Bolsover, J. A. Jones, C. H. Lander, T. Takamine, A. Warren. Associates.—K. R. Brain, A. L. Gregson, J. S. Grew, J. A. Hughes, E. O. Hercus, T. J. Lonsdale, R. D. Thompson, J. F. Wood.

It has been decided to form a Norwich Engineering Society with the following officers:—President, Mr. A. E. Collins; vice-presidents, Mr. F. M. Long (City Electrical Engineer) and Mr. W. H. Scott (Laurence, Scott and Co.); hon. treasurer, Mr. C. J. Jewell (Norwich Tramways Co.); hon. secretary, Mr. R. A. Lower (Corporation Electricity Works).

The Junior Institution of Engineers has for many years been enabled, through the generosity of the late Mrs. E. O. Durham, to offer annually a bursary of £25 for competition amongst members between the ages of 20 and 23 years. It was Mrs. Durham's desire that this bursary should be continued after her death, and to effect this bequeathed, by her will, to the Institution a sum sufficient to endow the bursary in perpetuity.

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BUSINESS OPPORTUNITIES AT HOME AND ABROAD.

Contracts Open.

BELFAST CORPORATION, November 26th.—Electric light wiring, etc., at the medical superintendent's residence, Whiteabbey Municipal Sanatorium. Specifications from the City Surveyor, Belfast.

DUNDEE CORPORATION, November 26th.—Wiring 332 houses at Fairbrothers' Fields. Specification from City Treasurer's Office, Lord Edward Street, Dublin, on £1 1s. deposit.

ECCLES CORPORATION, November 26th.—Supply and laying of 3 060 yards 0·20 sq. in. e.h.t. three core cable and 2 300 yards 0·125 sq. in. l.t. concentric armoured cable.

HAVANT URBAN DISTRICT COUNCIL, November 26th.—Electric light installation in Town Hall, Council Chamber, etc. Particulars from the Surveyor, Council Offices, Havant.

PRESTON CORPORATION, November 26th.—Two 1 500 kW rotary converter equipments (specification R.P.S.6); h.t. and l.t. switchgear (R.P.S.7); and h.t. cables (R.P.S.8). Specifications, etc. (£2 2s. deposit each), from the Town Clerk. Additional copies of specifications, 10s. per copy (not returnable), from Mr. J. A. Robertson, 20, Brazennose Street, Manchester.

LAMBETH (LONDON) GUARDIANS, November 27th.—Electric light wiring and fitting at the Hospital, Brook Street, Kennington, S.E. Specification from the Clerk, Brook Street, Kennington Road, S.E.11.

RHYL URBAN DISTRICT COUNCIL, November 27th.—Removal of existing and laying of new electric light mains, supply and erection of lamp columns, lamp heads, time switches, etc. Particulars from the engineer, Electricity Offices, Rhyl.

SHEFFIELD CORPORATION, November 27th.—Electrical equipment for new garage, Bernard Road, for the Health Department, including cable, d.c. switchboard, and battery charging switchboards. Specification from the Cleansing Superintendent, Town Hall, Sheffield.

WASHINGTON (CO. DURHAM) URBAN DISTRICT COUNCIL, November 27th.—Material for and erection of six electric lamps in Lean Square, Springwell, and one at the Fold, Great Unsworth. Specification can be seen at the Council Chambers.

DUBLIN CORPORATION, November 30th.—Maintenance and testing of electricity meters. Specifications from City Electrical Engineer, Fleet Street, Dublin, for 10s. 6d. deposit.

TYNE IMPROVEMENT COMMISSION, November 30th.—20-ton hydraulic crane, with accumulator and electrically-driven force pump. Specification from the General Manager, Bewick Street, Newcastle-on-Tyne; deposit £1.

BELFAST CORPORATION, December 1st.—Construction of 3 200 yards of single track tramway. Specification from the General Manager, Corporation Tramways, Belfast.

REIGATE CORPORATION, December 1st.—Electric wiring in the Old Town Hall, Market Place, Reigate. Particulars from Borough Surveyor.

LONDON COUNTY COUNCIL, December 3rd.—About 3 400 tons (or, alternatively, about 5 100 tons) steel girder tram-rails, lipless track rails and renewable guard rails, with fastenings. Specification from Chief Engineer, Old County Hall, Spring Gardens, S.W.1; deposit £2.

SOUTHAMPTON CORPORATION, December 3rd.—Two e.h.p. switch cubicles, with control panels, indicating diagrams, etc. Specification from Borough Electrical Engineer. Deposit £1 1s. for each specification, to be paid to the Borough Treasurer.

EDINBURGH CORPORATION, December 4th.—Twenty top-covered tramcar bodies, 32 tramway trucks, and electrical equipment for cars. Specifications from the Tramway Manager, 2, St. James' Square, Edinburgh.

HEREFORD RURAL DISTRICT COUNCIL, December 4th.—Water mains, electric motor and pumps, poles for overhead wires, etc., in connection with Little Birch water supply. Specifications from Mr. J. Parker, 141, St. Owen Street, Hereford, on £2 2s. deposit.

METROPOLITAN ASYLUMS BOARD, December 5th.—Electric light and power installation in new kitchen at Tooting Bec Mental Hospital. Specification from the office of the Board, Victoria Embankment, E.C.4, on £1 deposit.

ST. PANCRAS (LONDON) BOROUGH COUNCIL, December 6th.—Vertical electric motor-driven condensing water pump, capable of dealing with 750 000 gallons per hour. Specification from the Electricity Office, 57, Pratt Street, Camden Town, N.W.1, on £1 deposit.

GREENOCK CORPORATION, December 8th.—Three 3 000 kVA transformers, 22 000 V three-phase switchgear, transformers with boosters, etc. Specifications from the Burgh Electrical Engineer; deposit £2 2s.

PORTHCAWL (GLAMORGAN) URBAN COUNCIL, December 15th.—Provision of electricity supply undertaking. Particulars from the Clerk to the Council.

BELFAST GUARDIANS, December 18th.—Schemes for centralised heating and lighting plant in Institution buildings. Further information from the Clerk, Workhouse, Belfast, on £5 5s. deposit.

Overseas.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS, November 28th.*—Motor generator. December 5th.*—Transformers for White Bay power house. December 19th.*—Transformers for Meek's Road sub-station. February 6th.*—Equipment of two sub-stations. February 27th.*—Motor generator sets. February 27th.*—Motor-driven air compressors, and batteries for switch operating.

INDIA STORE DEPARTMENT, November 29th.—Switchboard cable (schedule No. 7) and v.i.r. insulated wire (No. 8). Forms from India Store Department, Branch No. 11, Belvedere Road, Lambeth, London, S.E.1.

CAPE TOWN MUNICIPALITY, November 29th.*—Transformers.

COMMONWEALTH OF AUSTRALIA, December 1st (Australia).—Telephone and telegraph apparatus (V.673). December 12th (in London), or December 15th (in Australia).—Cable terminal boxes (S.A. 676). December 17th (London).—Cable terminal boxes (S.A. 674). January 3rd (London).—Telephone and telegraph apparatus (T. 415). Tender forms, etc., from the Supply Officer, Australia House, Strand, London, W.C.2.

VICTORIAN ELECTRICITY COMMISSION, December 15th.—Four 1 000 kVA single phase transformers and spares. January 19th.—Transformers, switchgear and accessories for sub-station B. Specification (Nos. 23/145 and 24/2) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

VICTORIAN ELECTRICITY COMMISSION, December 19th.*—Fibre for insulators. January 3rd.*—Aluminium steel cored cable and accessories.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO, December 27th.* Electrical supplies, including cable, wrenches, insulating compound, lamp shades, also rubber belting, ironmongery, etc.

SYDNEY CITY COUNCIL, January 7th (in Australia).*—Electrically driven coal unloading and conveying plant at Darling Island power houses. January 14th (extended from November 19th.)—Stepdown transformers (Contract 758).

VICTORIAN RAILWAYS COMMISSION, January 9th (in Australia).*—Spring coiling machine with electric motor and taper rolling machine with electric motor. (Contract 36 659.)

POST AND TELEGRAPH DEPARTMENT, WELLINGTON, N.Z., January 30th*.—30 000 galvanised iron earthrods.

ARGENTINE STATE OILFIELDS ADMINISTRATION, February 14th.*—Erection and equipment of 11 250 kW electric power station.

SYDNEY CITY COUNCIL, February 18th.*—Armour-clad switchgear.

Tenders Accepted.

WHITBY.—T. C. Beecroft, electric wiring at new Cottage Hospital.

MALVERN URBAN COUNCIL.—Ferguson, Pailin Ltd., switchgear, £1 027 14s..

SOUTHERN RAILWAY.—General Electric Co., Osram incandescent lamps for four months.

ADMIRALTY.—Siemens and English Electric Lamp Co., spiralised metal filament traction type lamps.

DOVER GUARDIANS.—A. Lent, electric wiring at the Children's ward of the Institution, £39 13s. 6d.

LICHFIELD CITY COUNCIL.—T. Barratt and Co., maintaining electric fire alarms for a year, £27 10s.

TEWKESBURY CORPORATION.—Hayward and Sons, alterations in connection with electric lighting, £14 10s.

LONDON MIDLAND AND SCOTTISH RAILWAY.—General Electric Co., Osram gasfilled lamps for three months.

FULHAM (LONDON) BOROUGH COUNCIL.—British Electric Transformer Co., six months' supply of transformers.

H.M. OFFICE OF WORKS.—General Electric Co., Osram metal filament, vacuum and gasfilled lamps for nine months.

BRISTOL CORPORATION.—E. W. Poole and Son, erection and electric wiring of 12 houses, £391 6s. 5d. per house. A. W. Norris, erection and electric wiring of eight houses, £386 6s. 5d. per house.

MANCHESTER CORPORATION.—B. Morton and Sons, erection of substation at Hulme. J. Armstrong and Co., electric wiring at Great Bridgewater Street Yard. Macintosh Cable Co., cables in connection with the diversion of Mill Gill.

KEIGHLEY CORPORATION.—F. Watson, electrically-driven hydro extractor at the baths, £203 15s. (recommended). Craven and District Private Telephone and Electric Co., transmission line from Oakworth to Haworth, £415 (recommended).

SHOREDITCH LIGHTING COMMITTEE.—Pirelli General Cable Works, 200 yards, 75 sq. in. l.t. single core cable for connections between converters and switchgear, £103; Vaughan Crane Co., 10 cwt. electric ash hoist, £193. Laurence, Scott and Co., four spare armatures for motors driving forced and induced draught fans, £180.

RUSSIAN GOVERNMENT.—Metropolitan-Vickers Electrical Co., electrical plant; and Babcock and Wilcox, steam plant for electric power stations at Moscow and Donetz Basin. The value of the Metropolitan-Vickers Co.'s contract is about £400 000.

SHOREDITCH (LONDON) BOROUGH COUNCIL.—W. T. Glover and Co., ½ mile 19/·052 three core lead covered armoured cable. Hackbridge Cable Co., ½ mile 7/·064 ditto, and ¼ mile 7/·036 twin rubber insulated lead covered armoured cable. Siemens Bros. and Co., 1 mile 7/·064 single paper insulated lead covered cable. A. Morgon, maintenance of electric travelling crane at the canal wharf, Whiston Street, for one year, £35.

NELSON CORPORATION.—Brush Electrical Engineering Co., 6 000 kW turbo-generator with condensing plant, air rejector, water-extraction pump, motor and control gear for pumps, air filter, etc. Metropolitan-Vickers Electrical Co., one 250 kW rotary-converter, with e.h.p. and l.p. control, panels, etc., and extension of high pressure switchgear; Babcock and Wilcox, one water-tube boiler, 200 lb. super-heat, with economiser, chain-grate stoker, etc.

* Particulars from the Department of Overseas Trade.

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COMPANY NEWS.

Meetings, Reports and Dividends.

MONTREAL TRAMWAYS CO.—A quarterly dividend of 2½ per cent. is announced.

CHLORIDE ELECTRICAL STORAGE CO.—An interim dividend of 5 per cent. actual, less tax, has been declared on the ordinary shares.

ADELAIDE ELECTRIC SUPPLY CO.—The directors have declared a final dividend of 6 per cent, free of British tax, on the ordinary shares, making 12 per cent. for the year.

ARGENTINE LIGHT AND POWER CO.—For the half year ended September 30th an interim dividend on the preference shares at the rate of 7 per cent. per annum, less tax, is announced.

BRITISH ELECTRIC TRACTION CO.—Interim dividends of 3 per cent. on the 6 per cent. cumulative participating preference stock and 2 per cent. on the ordinary stock are announced.

OFFICIAL QUOTATIONS.—The Stock Exchange Committee has ordered 55 500 £3 fully paid ordinary shares of the London Electric Supply Corporation and 100 000 6 per cent. £1 fully paid cumulative preference shares of the Urban Electric Supply Co. to be quoted in the Official List.

CANADIAN WESTERN NATURAL GAS, LIGHT, HEAT AND POWER CO.—The net loss for the year ended September last was £64 822. The report states that the company has maintained improved relations with the public and that the attitude of municipalities and other governing bodies appears to have changed in the company's favour.

AMERICAN TELEPHONE AND TELEGRAPH CO.—The revenue of this company for the nine months ended September 30th was $102 955 751, and after providing for expenses, $31 952 270, the net earnings were $71 003 481. Deducting $9 747 338 for interest and $46 770 739 for dividends, there is a balance of $14 485 404 to carry forward.

PARA ELECTRIC RAILWAYS AND LIGHTING CO.—The holders of the 5 per cent. first debenture stock agreed on Monday to a scheme under which interest and sinking fund payments will only be made during the next three years as earnings permit after provision for certain other charges. Compensating advantages were offered to the debenture holders.

NORWICH ELECTRIC TRAMWAYS CO.—The report, approved at the recent annual meeting, showed that the revenue for the year ended June 30th was £81 487, decrease £4 659, and the total expenses were £61 127, decrease £11 625, the net profit being £20 360, increase £6 965. The reserve was increased from £26 415 to £32 571, and investments were increased by £8 073. Passengers were 11 687 362, compared with 11857 956, and car miles run, 1 002 663, against 1 000 402. The chairman (Mr. F. Fitzgerald) expressed the opinion that the introduction of penny fares had checked the decrease in receipts. The report and accounts were adopted, and a dividend of 3 per cent., less tax, approved.

INDIA RUBBER, GUTTA PERCHA AND TELEGRAPH WORKS CO.—The report for the year ended August 31st states that there was a net profit of £96 343, or £99 936 after adding the amount brought forward from previous year. Dividends on preference shares paid in January and July absorbed £12 500, and £39 278 was added to the reserve fund, leaving a disposable balance of £48 157. The directors recommend a dividend of 5 per cent., tax free, on the ordinary shares, leaving £10 657 to be carried forward. Apart from the Excess Profits Duty refund, the accounts of the company show that the gradual improvement of the position has been maintained. The directors have considered the position of the assets in France arising out of the wide variation from the normal rate of exchange between France and London, and have raised the reserve fund to £180 000.

WESTERN UNION TELEGRAPH CO.—For the past nine months the directors report an increase in net income of $526 600. Revenue, including dividends and interest, was $84 878 754; maintenance, repairs, depreciation, and other operating expenses amounted to $73 148 113, and interest on bonded debt, $1 730 137, leaving net income, $10 000 504. The company's cable ship "Lord Kelvin" has arrived at Bermuda with a section of the new Permalloy conductor cable, which is to be laid in the form of a loop for 150 miles, so that experiments can be made previous to laying the main transatlantic section. This new type of conductor was developed in the laboratories of the Western Electric Company, New York. It is claimed that it will increase the speed of transmission at least four times, to 400-600 words per minute. It is understood that an agreement with the Portuguese Government in regard to landing the new Western Union cable between Italy and U.S.A., at the Azores, has been reached.

New Companies.

DOUGLAS AND ROWLAND, LTD.—Cap., £200. Electric light and water engineers, etc. Reg. office: 2, East Street, Herne Bay.

RATCLIFFE'S (LEIGH) LTD.—Cap., £2 000. Dealers in motor cars, electrical goods, etc. Reg. office: 113A, Bradshawgate, Leigh.

CRAIGROSSIE ENGINEERING CO., LTD.—Cap., £7,000. Mechanical, electrical and motor engineers, etc. Reg. office: Feus, Auchterarder.

F. T. RASHBROOK, LTD.—Cap., £1 000. Electrical engineers, etc. Reg. office: Elm Works, 68, St. Ann's Hill, Wandsworth, London, S.W.18.

NEWMAN, HENDER AND CO., LTD.—Cap., £50 000. Makers of lamps, chandeliers, bells, electric fittings, etc. Reg. office: Woodchester, Gloucestershire.

H. C. PHILLIPS AND SONS, LTD.—Cap., £1 000. Manufacturers of wireless accessories, etc. A director: H. C. Phillips, 31, Dowsett Avenue, Southend-on-Sea.

CLARKE BROS., LTD.—Cap., £300. Display and advertising contractors, electricians, etc. Reg. office: 28, Portugal Street, Kingsway, London, W.C.2.

LONDON AND PROVINCIAL RADIO CO., LTD.—Cap., £1 000. Wireless, electrical, mechanical and general engineers, etc. Reg. office: 22A, Colne Lane, Colne, Lancs.

H. J. AND N. G. BREEZE (PHOTOGRAPHIC). LTD.—Cap., £2 000. Photographers, dealers in electrical goods, wireless telegraph apparatus, etc. Reg. office: 178, Broad Street, Birmingham.

WILFRED CROSS AND CO., LTD.—Cap., £1 000. To acquire and carry on the business of W. Cross, electrical engineer, etc., 11, Quarry Road, Tunbridge Wells. Reg. office: 4, Dudley Road, Tunbridge Wells.

CLARMAR LTD.—Cap. £5 000. Manufacturers, importers and exporters of apparatus connected with illuminating or heating by gas, spirit, oil, electricity, etc. Reg. office: 2, Gresham Buildings, Guildhall, London, E.C.2.

SALTER BROS (ELLESMERE PORT), LTD.—Cap., £600. To acquire the business carried on at Ellesmere Port by C. Salter and S. Salter, electrical and general engineers, etc. Reg. office: Heath Farm, Whitby Heath, near Birkenhead.

BUSINESS MEMS.

Selbourne, Ltd., King's House, King Street, London, E.C.2, have removed to Bank Chambers, 329, High Holborn, London, W.C.1. The new telephone number is "Holborn 2077."

H. W. Sullivan, Ltd., inform us that they have appointed S. Glover and Co., 13, Akenside Hill, Quayside, Newcastle-on-Tyne, as their sole agents for electric fires, cooking appliances and wireless apparatus in the Northern Counties.

Mr. H. A. Pearson, who represents Allen West and Co., and The Reason Manufacturing Co. in London and the South of England, has moved into new offices at College Hill House, 176-8, Upper Thames Street, London, E.C.4. His telephone number remains the same as before, i.e., City 7493.

Vickers, Ltd., are making headquarters for their hydro-electric department at the works at Barrow-in-Furness. Correspondence with reference to water power equipment and hydro-electric projects of all kinds should in future be addressed to Vickers, Ltd., Hydro-Electric Department, Barrow-in-Furness.

United Water Softeners, Ltd., who four years ago became sole licensees for the Sharples super-centrifuge, have now formed a separate company under the style of Super-Centrifugal Engineers, Ltd., to deal exclusively with the Sharples business. No change in the directorate or management has been made, the directors of United Water Softeners, Ltd., remaining directors of the new company, but the board has been strengthened by the inclusion of Mr. P. T. Sharples, the president of the Sharples Co. of America, and of Messrs. A. H. Keable and Z. A. Toula, technical directors.

METAL & CHEMICAL PRICES.

TUESDAY, November 20th

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£64 15 0	—	£1 5s.
Electro Wirebars ..	„	£68 10 0	—	10s.
H.C. Wire, basis ..	per lb.	9 13/16 d.	—	1/16 d.
Sheet	„	10 1/8 d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 1 13/16 d.	—	1/16 d.
Brass 60/40—				
Rod, basis	„	7½d.	—	—
Sheet, basis ..	„	10½d.	¼d.	—
Wire, basis	„	10½d.	¼d.	—
Pig Iron—				
Cleveland Warrants	per ton	£5 5 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
Lead Pig—				
English	„	£32 0 0	—	15s.
Foreign or Colonial	„	£30 5 0	—	17s. 6d.
Tin—				
Ingot	„	£220 5 0	£3	—
Wire, basis	per lb.	2s. 10½d.	½d.	—
Aluminium Ingots ..	per ton	£120 0 0	—	—
Spelter	„	£32 7 6	—	£1
Mercury	per bottle	£9 17 6	2s. 6d	—

Sulphur (Flowers)—Ton £8 0s. *Sodium Chlorate*—Per lb. 2½d.
„ (Roll-Brimstone)—„ £8 0s. *Sulphuric Acid* (Pyrites, 168°) per ton, £7 10s.
Copper Sulphate.. „ £25
Boric Acid (Crystals). „ £48 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2⅜d.; plantation 1st 1 tex, 1s. 2½d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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COMMERCIAL INFORMATION

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ALEXANDRA (A. C.) AND CO., LTD., 10, Iddesleigh House, Caxton Street, Westminster, electrical manufacturers. £12 16s. 6d. October 15th.

BUCKLEYS (LONDON), LTD., 1, Liverpool Street, King's Cross, electrical engineers. £18 13s. 7d. September 12th.

CHARD, G. H., AND CO., 24A, Great Portland Street, W., electrical engineers. £10 4s. 8d. October 5th.

LORD AND JAMISON, 280A, High Road, Ilford, electrical engineers. £39 4s. 8d. October 8th.

PHOENIX ELECTRIC CO., 48, Church Street, High Road, Lee, electrical engineers. £10 16s. 2d. October 17th.

SOUTHPORT ELECTRICAL SUPPLIES CO., LTD., 99A, Eastbank Street, Southport, electrical contractors. £13 3s. 4d. October 13th.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

ANDCOLE AND TURNER, LTD., London, S.W., electricians. Registered October 30th. £3 000 debentures. Present issue £1 000; general charge. *Nil. January 10th, 1923.

GENERAL RADIO CO., LTD., London, W. Registered October 30th. £2 000 debentures, part of £6 000; general charge.

Satisfactions.

BERKELEY AND YOUNG, LTD. (late BERGTHEIL AND YOUNG, LTD.), London, E.C., dealers in electrical appliances—Satisfaction registered October 26th, all moneys, etc., registered February 14th, 1923.

INTERNATIONAL ELECTRIC CO., LTD., London, N.—Satisfaction registered October 25th, all moneys, etc., registered May 14th, 1920.

NEW BRITISH ELECTRIC SUPPLY CO., LTD., London, E.C.—Satisfaction registered October 26th, £26 000 (not ex.), registered February 14th, 1923.

Private Meeting.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

LINDSAY (WILLIAM) AND CO., Holm Street, Glasgow, electrical engineers and wireless dealers. Creditors were called together recently at the offices of Mr. Wishart, 138, Bath Street, Glasgow, when a statement of affairs was presented which showed liabilities £1 566 and assets £407, a deficiency of £1 159. It appeared that the firm started trading in March, 1922, the partners being Mr. J. Rule and Mr. W. Lindsay. During the first year's trading a profit of £192 was made, but since then there had been a loss of £150. An offer was made and accepted of 5s. in the £ payable in cash on acceptance by all the creditors and 1s. per month for the next three months, these three payments being fully secured to the satisfaction of a committee of inspection consisting of the three principal creditors.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-up.

WIRELESS INSTALLATIONS, LTD., 81, Turnmill Street, London. Meetings of creditors (11.30 a.m.), and contributories (12 noon), November 22nd, 33, Carey Street, Lincoln's Inn, London, W.C.2.

Companies Winding-up Voluntarily.

ELECTRIC TRACTION DEVELOPMENTS, LTD. H. W. J. Vertigan, 82, Collingwood Buildings, Newcastle-upon-Tyne, accountant, appointed liquidator. Meeting of creditors at the office of L. H. Booth, solicitor, Milburn House, Newcastle-upon-Tyne, on Monday, November 26th, at 2.30 p.m.

HATCHAM MANUFACTURING CO., LTD.—A. Leonard, of 8, Layer Garden, Acton, W., appointed receiver and manager by the debenture holders.

Bankruptcy Information.

EMMETT AND CO., 249, Goldhawk Road, Shepherd's Bush, London, electrical engineers. Receiving order, November 12th. Creditor's petition. First meeting, November 23rd, 11 a.m.; and public examination, March 12th, 1924, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

HILLIER, John Adrian, 58, Trafalgar Terrace, Swansea, electrical engineer. Receiving order, November 12th. Debtor's petition. First meeting November 29th, 11 a.m., Official Receiver's Office, Government Buildings, St. Mary's Street, Swansea. Public examination, December 21st, 11 a.m., Town Hall, Swansea.

WESTON, Selwyn Byers, trading as WESTFORREST RADIO CO., Utworth Manor, Cranleigh, Surrey, wireless apparatus manufacturer. Receiving order, November 9th. Debtor's petition. First meeting, November 23rd, 11.30 a.m., 29, Russell Square, W.C.1. Public examination, December 4th, 11.30 a.m., Guildhall, Guildford.

Notices of Dividends.

GRIFFIN, Douglas Henry, 5, The Mart, St. David's Road South St. Annes-on-the-Sea, trading as MIDLAND ELECTRIC CO. First and final dividend of 1s. 9½d. per £, payable November 23rd, Official Receiver's Offices, 11, Winckley Square, Preston.

ROGERS, Philip Marsden, carrying on business at Great Darkgate Street, Aberystwyth, as the LONGBRIDGE ENGINEERING CO. First and final dividend of 1s. 10d. per £, payable November 21st, 4, Queen Street, Carmarthen.

Notices of Intended Dividends.

EMBURY, Henry John William, and EMBURY, Kenneth Stuart (trading as H. AND K. EMBURY), 29 and 110, Queen Street, Newton Abbot, Devonshire, electrical and mechanical engineers. Last day for receiving proofs, November 28th. Trustee, A. L. Honey, 23, Catherine Street, Exeter.

GARNETT, William Terrell, trading as W. T. GARNETT'S CABLE CO., Barkerend Mills, Bradford, electric cable and wire manufacturer. Last day for receiving proofs, November 24th. Trustee, W. Durrance, Official Receiver, 12, Duke Street, Bradford.

Partnerships Dissolved.

W. T. BOWER AND CO. (William Thomas BOWER and John Hamilton DWYER), electric engineers and manufacturer's agents, 36, Cannon Street, Birmingham, as from November 10th, 1923, by mutual consent. Debts received and paid by J. H. Dwyer, who will continue the business under his own name.

DEES AND MATSON (Albert Edward DEES and George MATSON), electrical engieeers and suppliers, 33, Groat Market, and 5, Wilsons Court, Newcastle-upon-Tyne, by mutual consent as from October 15th 1923. Debts received and paid by A. E. Dees.

RIPPON, JOHNSON AND CO. (Ebenezer JOHNSON and James William RIPPON), electrical contractors, 57, Surrey Street, Sheffield, by mutual consent as from October 27th, 1923. Debts received and paid by J. Hancock, 57, Surrey Street, Sheffield, chartered accountant.

T. AND H. JOYCE (Gerard Gwyn CRUTCHLEY and Thomas Howell JOYCE and William Ernest WILLIAMS), dealers in electrical supplies, 210B, Shaftesbury Avenue, W.C.1, by mutual consent as from October 30th, 1923. Debts received and paid by T. H. Joyce and W. E. Williams.

VICTORIA ELECTRICAL CO. (John Cecil RIDSDALE and Earl Stanley JODRELL), electrical engineers, 30, Great George Street, Leeds, by mutual consent as from November 3rd, 1923. Debts received and paid by E. S. Jodrell, who will continue the business.

WAGERS (Albert James WAGER and Ernest George FAITHORN), electrical engineers, 552B, Coventry Road, Small Heath, Birmingham, as from September 7th, 1923, by mutual consent; A. J. Wager will continue the "Electrical Engineer Department" and E. G. Faithorn will continue the "Wireless Department" of the business.

Bankruptcy Proceedings.

THORPE, Francis Bertram, 1, West Laithe Gate, Doncaster, electrical engineer. The public examination of this debtor was held last week, his statement of affairs showing liabilities £842 and assets £792. Debtor attributed his failure to shortness of capital, small profits and losses on contracts. It appeared that he traded successfully from 1911 to 1922, but trade latterly declined. He had made an offer to the creditors of a composition of 12s. in the £, and this had been accepted. The examination was formally adjourned that an application might be made to the Court for approval of the composition scheme. The following are creditors: Electrical Specialities Co., Ltd., £22; Electric and General Stores Co., Ltd., £194; Electric Lamp Factors, Ltd., £24; Mining and General Stores, Ltd., £76.

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PATENT RECORD.

Specifications Accepted.

203 724 H. Baron (F. Aldendorff). Electric switching apparatus and automatic and semi-automatic telephone switching systems. (13/3/22.) (Cognate Application, 15 750/22.)
203 727 C. J. Gordon. Electrically-propelled motor vehicles. (17/3/22.)
204 068 W. A. Powell and J. E. Price. Electric insulation. (31/3/22.)
181 691 Philips. Gloeilampenfabrieken. Electric discharge tubes. (14/6/21.)
179 962 J. C. Lincoln. Dynamo-electric machines. (13/5/21.)
203 748 Automatic Telephone Manufacturing Co., S. R. Smith and P. N. Roseby. Receivers as used for telephone or like purposes. (17/5/22.)
203 759 Siemens Bros. and Co. and D. A. Christian. Telephone systems employing selecting devices. (9/6/22.)
203 765 English Electric Co. and L. Rothera. Controlling-gear for electric motors. (10/6/22.)
203 771 British Thomson-Houston Co. and R. D. Given. Control mechanism for electric motors and other apparatus. (12/6/22.)
203 772 British Thomson-Houston Co., R. D. Given and H. W. C. Liddiard. Control of dynamo-electric machines. (12/6/22.)
203 781 A. E. White (Elyria Iron and Steel Co.). Electric butt-welding machines. (13/6/22.) (Patent of Addition not granted.)
203 782 A. E. White (Elyria Iron and Steel Co.). Electrical connections between relatively moving conductors. (13/6/22.) (Patent of Addition not granted.)
183 115 W. Stubbs and L. Frost. Electric heaters. (13/7/21.)
203 788 L. G. Preston, G. Shearing and E. J. Grainger. Methods of and means for signalling in wireless telegraphy. (14/6/22.)
203 799 C. Davis. Wireless direction-finding apparatus. (16/6/22.)
203 804 Sir C. A. Parsons and J. Rosen. Dynamo-electric machines. (17/6/22.)
203 814 Crompton and Co. and H. O. Burge. Couplings for electric ceiling-fans. (23/6/22.)
203 815 C. M. Brown and H. G. Cocks. Electrically-operated apparatus for advertising or display devices. (24/6/22.) (Cognate Applications, 19 403/22 and 25 485/22.)
203 818 M. I. Pupin and M. C. Spencer. Means for obtaining steady continuous currents. (26/6/22.)
203 829 L. Miller, W. Richardson and Metropolitan-Vickers Electrical Co., Ltd. Electric motor control system. (3/7/22.)
203 830 Leonard Ward Electric Co. and L. Kebler. Electric resistance switches. (5/7/22.)
203 836 E. Seymour. Portable electric lamps for use in eye testing. (10/7/22.)
183 816 Philips' Gloeilampenfabrieken. Manufacture of tungsten powder. (29/7/21.)
203 846 H. Standsfield-Dodd. Electric hand irons. (22/7/22.)
203 861 A. B. Field and Metropolitan-Vickers Electrical Co. Electrical marine propulsion. (1/8/22.)
203 865 H. A. H. Nijland. Electric switch mechanism. (8/8/22.)
203 870 Western Electric Co. and D. Nunn. Systems for measuring the capacity of electrical circuits. (12/8/22.)
203 872 J. A. Hirst and Brook, Hirst and Co. Electric control switches and current-regulating means, such as resistances or auto-transformers for use therewith, specially applicable to motor starters. (15/8/22.)

Applications for Patents.

November 5 h.

27 698 S. G. Pickering. Commutator for ignition systems.
27 702 Brolt, Ltd. and W. Holt. Electric generating systems for motor vehicles.
27 730 A. E. Katz, H. G. B. Corby and F. C. R. Holland. High frequency amplifiers for wireless apparatus.
27 733 E. Bolton. Electric switches.
27 735 W. C. Davey and G. Wallace. Filament rheostats for valves for wireless telephony, etc.
27 736 H. Cooch. Measuring electricity.
27 744 P. R. Ord. Electric lighting for motor vehicles.
27 760 K. F. Henneman and P. Kerkhoven. Electric water-heating apparatus. (7/11/22 Holland).
27 779 G. H. and H. F. Collins. Stands for electric heaters, etc.
27 786 Lissen, Ltd., and R. P. Richardson. Electric switches.
27 787 Lissen, Ltd., and R. P. Richardson. Electric condenser.
27 788 Sterling Telephone Co., and M. R. Lawrence. Telephones, etc.
27 789 D. Muller and H. Thirring. Electric alarm apparatus. (11/11/22 Austria.)
27 796 Creed and Co., and F. G. Creed. Telegraphic transmitting receiving and printing apparatus.
27 797 W. Hancock and T. P. Middleton. Electric interrupters, etc.
27 799 British Thomson-Houston Co., and A. A. Pollock. Cooling dynamo-electric machines.
27 800 H. Baron (Aldendorff). Shaft-setting arrangement for electric switches, etc.
27 818 Automatic Telephone Manufacturing Co. Telephone systems. (19/3/23 U.S.)
27 819 Automatic Telephone Manufacturing Co. Telephone systems. (9/4/23 U.S.)

November 6th.

27 845 H. J. Everill. Crystal detectors.
27 849 H. E. Angold and W. T. Hughes. Indicating device for electric heating apparatus.
27 853 Western Electric Co. Telephone systems.
27 866 J. A. MacDonald. Electric water-heaters.
27 876 Lodge-Cottrell, Ltd. (Metallbank u Metallurgische Ges). Apparatus for electrical precipitation of suspended particles from gases.
27 877 Lodge-Cottrell, Ltd. (Metallbank u Metallurgische Ges.) High voltage insulator for electric gas purifiers, etc.
27 890 E. L. Conrade. Electric resistances.
27 904 W. Ure, R. L. Randall and C. Seymour. Electric condensers.
27 913 R. Mercer. Telephone systems.
27 922 A. G. Bloxam (Akt. Ges. fur Anilin-Fabrikation). X-ray photography.
27 900 B. and E. Thomas. Electric heaters.
27 928 Chamberlain, Hookham and S. James. Electricity meters.
27 933 Akt. Ges. Brown, Boveri et Cie. Electric switches. (6/11/22 Germany.)
27 934 Akt. Ges. Brown, Boveri et Cie. Process for operating steam power plant. (6/11/22 Germany.)
27 935 Akt. Ges. Brown, Boveri et Cie. Steam turbines. (6/11/22 Germany.)
27 936 P. T. King. Brush mounting for motors.
27 938 Metropolitan-Vickers Electrical Co. and J. A. Kuyser. Dynamo-electric machines.
27 939 Metropolitan-Vickers Electrical Co. and G. H. Fletcher. Dynamo-electric machines.
27 940 R. R. Muras. Crystal detectors.
27 949 British Thomson-Houston Co. Thermostatic devices. (6/11/22 U.S.)
27 950 British Thomson-Houston Co. Circuit arrangement employing thermionic valves. (9/1/22 U.S.)
27 953 L. A. Hammarlund. Variable condensers. (28/11/22 U.S.)
27 962 E. T. Williams. Electric lamps.

November 7th.

27 997 P. E. Cheeseman. Apparatus for teaching telegraphy.
27 999 P. J. Browne. Automatic morse transmitter.
28 001 L. G. Toplis. Telephone receivers, etc.
28 013 G. Green, and A. J. Younger. Telegraph receivers, etc.
28 023 W. H. Matthews. Connection of electrical apparatus in circuits.
28 028 L. E. and L. W. C. Fillmore. Vernier control device for variable condensers, etc.
28 030 W. J. Polyblanc. Electric generators.
28 036 J. Henderson. Coils for wireless telegraphy, etc.
28 044 A. G. Goddard. Induction motors.
28 045 Igranic Electric Co., and W. S. Flight, and A. H. Mackley. Wireless receiving apparatus.
28 048 Igranic Electric Co., A. H. Curtis, A. H. Mackley, and S. R. Wright. Coil-holders for wireless signalling systems.
28 049 Metropolitan-Vickers Electrical Co., and H. G. Bell. Frames, etc., for electrical apparatus.
28 053 Ges. fur Drahtlose Telegraphie. Means for eliminating disturbing electric oscillations. (8/11/22 Germany.)
28 058 R. C. Arter. Remote control systems.
28 063 J. and R. S. Athirstone, and F. H. and L. Brewerton. Wireless reception apparatus.
28 067 M. B. Richter. Devices for counting electrical or mechanical impulses.
28 079 Akt. Ges. Brown, Boveri et Cie. Tapping switches for high voltage transformers. (13/11/22 Germany.)
28 080 Automatic Telephone Manufacturing Co. Telephone systems. (6/7/22 U.S.)

November 8th.

28 093 H. G. Cameron. Electrical machinery for immersion in liquids, etc.
28 101 W. A. G. Burton. Batteries for wireless installations.
28 013 F. Milborne. Wireless receiving apparatus.
28 105 B. Groom. Variometer for wireless telegraphy.
28 115 F. W. Baker. Distributors for electric ignition systems for automobiles, etc.
28 120 Unity Engineering, Etc. Co., and A. Muir. Trolley leads.
28 122 S. Timings. Wireless telephone receivers.
28 129 J. E. Dawson. Coil-holder stands for wireless apparatus.
28 130 and 28 131 Radio Communication Co., and R. E. Beswick. Panel boards for wireless apparatus.
28 132 Radio Communication Co., and R. E. Beswick. Casings for sectional panel boards, etc.
28 141 A. S. Marks. Rheostat for wireless sets.
28 148 L. Murphy. Motor control.
28 159 Siemens und Halske Akt. Ges. Protection of electrical machines. (8/11/22 Germany.)
28 168 Ferranti, Ltd., and E. D. T. Norris. High frequency electric protection device.
28 173 R. Lomax. Electric lamps.
28 189 C. Grimshawe. Adjustment of magneto contact-breaker.
28 195 A. H. Hunt. Crystal detectors.

November 9th.

28 201 W. Brewer. Connection of wires to terminals.
28 203 A. M. Taylor. Electric power transmission.
28 212 T. Hough, and W. J. Joughin. Electric condensers.
28 214 F. R. Johnston. Wireless receiving apparatus.
28 215 B. Hesketh. High frequency transformers for wireless telegraphy, etc.
28 216 B. Hesketh. Induction coil-holders.
28 217 B. Hesketh. Crystal detectors.
28 227 S. W. Richards. Telegraph insulators.
28 247 G. Turner. Coil-holder for wireless telegraphy.
28 263 Fabrik Elektrischer Apparate F. Sanier Akt. Ges. Electric switches. (10/11/22 Germany.)
28 265 E. G. Robinson. Vacuum electric tubes.
28 275 F. W. and A. J. Bull. Electrical connections.
28 277 Eclairage des Vehicles sur Rail. Control of battery charging. (9/11/22 France.)
28 280 A. A. Alcock. Electric thawing of frozen meat.
28 282 Automatic Telephone Manufacturing Co. Telephone systems. (23/12/22 U.S.)
28 284 Measurement, Ltd., and F. Holden. Electricity metors.
28 287 D. Bellegrandi, and F. Lussia. Utilisation of electrical energy.
28 288 and 28 289 English Electric Co., and H. Barnes and G. Schroder. Dynamo-electric machines.
28 298 British Thomson-Houston Co. Electric discharge devices. (29/11/22 U.S.)
28 299 British Thomson-Houston Co. Electric discharge devices. (11/11/22 U.S.)
28 300 British Thomson-Houston Co. Electric discharge devices. (21/12/22 U.S.)
28 301 British Thomson-Houston Co. Regulating systems. (10/2/23 U.S.)
28 302 British Thomson-Houston Co. (General Electric Co., N.Y.). Electric engravers.

November 10th.

28 326 R. A. R. Dalton. Reception of wireless telegraphy, etc.
28 331 G. Hopkinson. Wireless receiving apparatus.
28 352 C. V. Owen. Adjustment instruments for wireless telegraphy.
28 358 and 28 359 English Electric Co., G. Schroeder, W. E. Highfield and J. E. Calverley. Dynamo-electric machines.
28 346 Western Electric Co. (Deakin). Automatic selecting switches.
28 347 Western Electric Co. Electric transmitting systems.
28 371 British Electrical and Allied Industries' Research Association, and E. B. Wedmore. Surface condensers.
28 373 British Thomson-Houston Co. (General Electric Co., N.Y.). Control of dynamo-electric machines.
28 374 British Thomson-Houston Co., and H. C. Hastings, and E. B. Tuppen. Electric motor control.
28 380 J. J. Bell. Electrical apparatus.
28 382 Measurement, Ltd. Electro-magnetic relays, etc. (12/1/23 France.)
28 383 Measurement, Ltd. Protecting arrangement for winding of transformers, etc. (27/1/23 France.)
28 384 Measurement, Ltd. Relays for polyphase circuits. (22/2/23 France.)
28 385 Measurement, Ltd. Relays for alternating circuits. (4/4/23 France.)
28 389 D. E. Barnett. Electric lamp holders.
28 394 R. W. Tarrant. Electric power transmission.
28 401 O. Kiærbje. Resistances.
28 402 O. Kiærbje. Starting resistances for motors.

Arrangements for the Week.

Friday, November 23rd (To-day).

Birmingham and District Electric Club.
7 *p.m.* At the Grand Hotel, Colmore Row, Birmingham. *Paper by Mr. E. C.* McKinnon on "Storage Batteries."

The Junior Institution of Engineers.
7.30 *p.m.* At the Institution, 39, Victoria Street, Westminster, S.W.1. Lecturette on "Technical Arbitrations," by Mr. W. A. Tookey.

Monday, November 26th.

The Institution of Electrical Engineers.
(North-Eastern Centre.)
7.30 *p.m.* At Armstrong College, Newcastle-on-Tyne. Paper on "The Electrification of the Midi Railway," by Mons. Bachellery, to be read by Lieut.-Colonel O'Brien.

Thursday, November 29th.

The Institution of Electrical Engineers.
5.30 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.2. Joint Meeting with the Physical Society of London. Discussion on "Loud Speakers for Wireless and other Purposes."

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THE ELECTRICIAN," November 30, 1923.

SIXTH ANNUAL IRON AND STEEL NUMBER.

THE ELECTRICIAN

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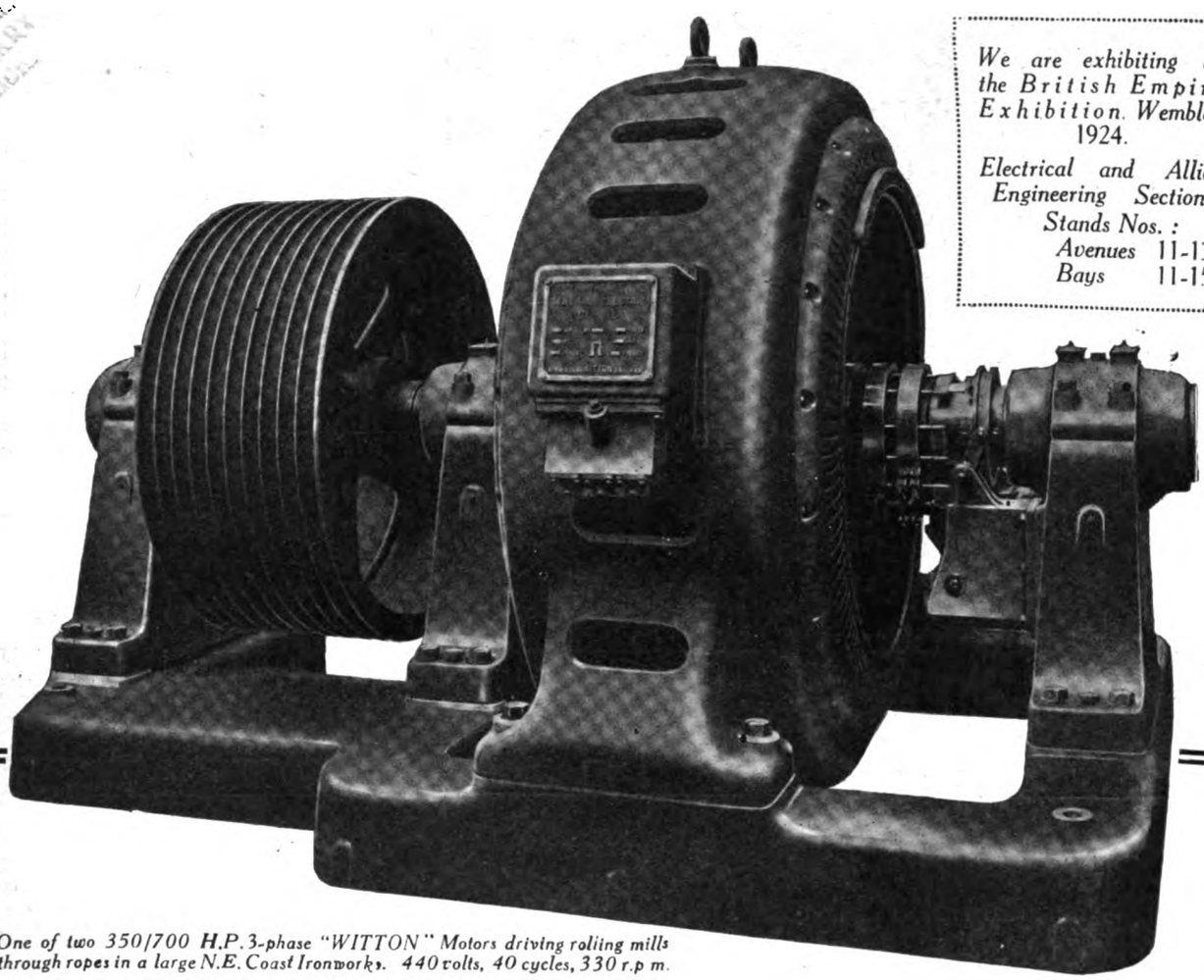

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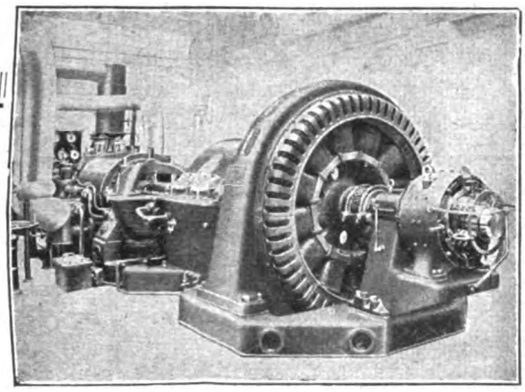

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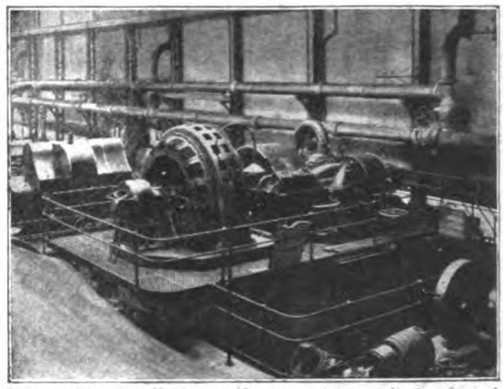

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IRON AND STEEL.

The three principal industries of this country in point of both size and importance are agriculture, coal, and iron and steel in alphabetical order. In the development of the first, electricity has as yet begun to play no great part, and though we do not despair that eventually a secure and useful footing will be obtained for the electrical idea in it, it will be by slow permeation and education; and it will probably never, on a horse power basis, compare with what can be done in the other two fields. In the coal industry much has been done and much remains still to be done. Electric winders, electric coal cutters, electric locomotives, not to speak of electric lighting in the ordinary sense, and in its particular application to miners' safety lamps, are being increasingly used, and it cannot be denied that their further employment will help to increase production, improve working conditions and lead to a reduction in the price of coal. It need hardly be added that the last factor is one of the highest importance to the electrical industry. It would assist the cheaper production both of the apparatus and the electricity used in it, and so cause real electrical development. This point may be emphasised by the simple statement that while in 1914 the Manchester Electricity undertaking paid 13s. 9d. per ton for its coal, in 1923 the price was 37s. 7d. per ton. So that in helping to reduce the cost of getting coal electrical engineers will not only benefit the coal industry, but will benefit themselves and so the general public.

The prosperity of the third industry we have mentioned—iron and steel—is intimately bound up with the prosperity of the coal industry; the prosperity, that is, which means high production and low selling cost. Without cheap coal we cannot have cheap iron and steel, and without cheap iron and steel development in the engineering and many other industries is obviously sadly hampered. And here again electrical engineers can play a part. By the provision of suitable equipment they can assist mine owners to produce coal at a low cost, and by the same means they can help iron and steel masters to produce cheap iron and steel. This means general prosperity, trade development and the solution of many of the problems which hamper us to-day. As this week we publish our sixth special iron and steel issue, it will be well to deal more particularly with the relation of the electrical and the iron and steel industries on those lines.

In 1913 the average monthly production of pig iron in this country was 855 000 tons. This fell in 1921 to the low figure of 217 600 tons and rose to 408 300 tons in 1922, the second half of the year being decidedly better than the first. In 1923 matters still further improved, an output of 714 200 tons being obtained in May, though this had fallen to 599 800 tons in August. The monthly average for the first eight months of the year was 632 400 tons. In steel ingot production the monthly average in 1913 was 639 000 tons. This fell in 1921 to 302 100 tons, and rose in 1922 to 485 900 tons, the second half of the year again being better than the first. May, 1923, showed a production of 821 000 tons, slightly exceeding the figure for March, the average for the first eight months of the year being 711 100 tons. The monthly average of iron and steel imports in 1913 was 185 900 tons and of exports 414 100 tons. In the first half of 1922 of imports the monthly average was only 65 100 tons and of exports 256 500 tons. These figures rose to 81 800 tons and 310 200 tons respectively in the second half of the year. The average monthly imports for the first eight months of 1923 was 111 800 tons and of exports 343 300 tons. In the United States, on the other hand, the figures for pig iron and steel ingot production in 1923 exceed largely those for 1913, and, while the imports are about double those in 1923 the exports are less, though in France both the imports and exports are much larger. Compared with 1913 the German imports in 1922 were about four times as great, while the exports had fallen to one half.

On the score of production, then, there is great leeway to make up, and the difficulty of the task is emphasised by comparing the relative prices in July, 1914, and September, 1923. The figures refer to the raw materials used in the iron and steel trade in Scotland. Taking the figures in July, 1914, as 100, ore stood at 122, limestone at 160, coal at 195, coke at 213, hæmatite pig at 161, and scrap at 158. These figures, though far below those for the peak, when coal reached 323 and coke 359, are sufficient to indicate the need for examining ways and means for still further reducing costs and selling prices. These figures should be below those of 1913 and not above.

In bringing about this desirable end it will not be denied that electricity can play a great part. It has been stated by Mr. E. A. HURME, manager of the steel mill section of the Westinghouse Electric and Manufacturing Co., that "more electric power is being used in the production of steel than in the production of any other commodity." This, of course, applies to the United States. We fear it is not true of this country, but there is no reason why it should not be. For its employment in every section of the industry is both possible and beneficial. Whether

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it be for driving compressors or fans, hauling or hoisting ore, and other raw materials, handling molten metals, operating mixers, driving pumps, heating electric furnaces, driving rolling and other mills and their subsidiary machinery, manipulating ingots, rods and plates, furnishing power for saws and shears, preventing dust by precipitation methods, and rendering possible various electrolytic processes, it can play a great part. In these days machinery must be called in to replace the shortage of skilled labour and the high price of unskilled labour, and the advantages which electrically driven machinery offers deserve the fullest consideration.

Current Topics.

Broadcasting to America.

In the early part of this year we recorded the successful transmission of speech across the Atlantic by radio-telephony, and we have recently published an account of the work undertaken to bring this about. Another step in international intercommunication has now been made by the British Broadcasting Co., who early Monday morning last transmitted music at normal broadcasting wave lengths and power and succeeded in getting the programme picked up in various parts of America. To be more precise, the piano solo transmitted was heard but no one could distinguish the tune. Successful attempts were also made to receive American broadcasting programmes in this country on Tuesday morning, with the result that several American broadcasting stations were heard. The first of the successful experiments consisted of simultaneous transmission from London and the other British broadcasting stations, after which each station continued the transmission on its own wave length. This partial success is the more striking for, as is well known, the short wave lengths such as are used in broadcasting are more liable to absorption than the long wave lengths used in the telephone experiments. At the same time, the experiment was conducted in favourable weather and at the best time of year. Even so, they were not wholly successful. The experiments were however nearly spoilt by the prevalence of atmospherics, which could not be helped, and by the number of oscillating sets, which could. This question of interference will have to be seriously taken up if the development of broadcasting is not to be retarded It is not likely therefore, nor is it probably intended, that broadcasting to America will be a regular thing.

Electric Furnace Progress.

War conditions in the iron and steel industry gave the electric furnace a fillip which, unfortunately, has not been maintained. As pointed out by Mr. W. S. Gifford in the article which we publish on another page of this issue, the total capacity of electric furnaces in Sheffield alone was at least 150 000 tons per annum, and these were mainly installed during the period 1914 to 1918. It is satisfactory, therefore, to learn that several new installations have recently been made, among them a 15-ton Heroult furnace with an electrical capacity of 2 400 kVA, and that we are not only using furnaces but making them for export. In point of size America, as usual, leads with a 80-ton Greaves-Etchells furnace of an electrical capacity of 12 000 kVA. This, it is interesting to note, is installed at the Ford works. A more important question is how developments in the iron and steel industry itself can be aided by the use of the electric furnace. On this point Mr. Gifford is optimistic. Stainless iron, like stainless steel, should be a useful electric furnace application, especially as electric heating is economically the best method to employ. The other great use for electric furnaces is for such processes as hardening, tempering and annealing, while the employment of the induction furnace in brass manufacture is extending. Supply engineers do not regard electric furnaces as an ideal load owing to the power factor conditions to which they give rise. But taking the works as a whole it should be possible by the use of suitable machinery to overcome this difficulty and to take advantage of the good load factor and heavy consumption to which it gives rise.

Steel Works Drive and Equipment.

In the course of an interesting discussion on the electrical equipment of rolling mills, Messrs. W. E. Taylor and C. E. Raeburn make the important point that the drive chosen should neither be underpowered or overpowered. The former means a curtailment of production and the latter necessitates unprofitable capital expenditure and maintenance costs, and on the electrical side gives rise to difficulties with the power factor. There are a number of possible forms of drive in use, and greater experience will probably show that each have their disadvantages and advantages though the variable speed direct current motor system is at present in the ascendant. Experience will also show, what is more important, the exact power requirements of each particular type of mill, and allow that mill to be provided with the most efficient and economic type of equipment. To bring this about, however, means the consideration of details of design of the plant used. As Mr. Orsettich shows, a great deal of the machinery in iron and steel works can be satisfactorily driven by standard motors, special steel works motors only being necessary where dust, grit and steel scale is prevalent. The original steel works motor was developed from the traction motor, and had certain inherent disadvantages which Mr. Orsettich fully discusses. The points he raises are of importance both to the designer and manufacturer and should be closely studied. As we have shown in our leading article, the movement towards cheaper iron and steel can be accelerated by the greater use of electrical plant. But that plant must be capable of doing the work which it is called upon to perform with the minimum risk of breakdown. In achieving that end past experience will be a great help.

Operating Electric Furnaces.

Some interesting details on the operation problems of electric furnaces were given in a Paper read recently before the American Institute of Electrical Engineers by Mr. F. V. Andreae. As a result of a large number of observations he was led to believe that the transformation of electrical energy into heat energy in the furnace takes place in an arc passing through an atmosphere of vapours under pressure. The properties of the arc vary with different materials. In a three-phase furnace the electrical energy is transformed into heat in three different zones situated under the three electrodes and the load resistance is probably furnished by an arc in an atmosphere of the vapours under pressure. He reached the conclusion that the general performance of the three-phase furnace can be determined in advance with a large degree of accuracy by using the simple equations of the balanced three-phase system where the only thing that is necessary is the previously determined reactance per phase. It has also been discovered that there is room for assuming that the electromagnetic effect of the current has a decided bearing on the metallurgical processes which occur during refining. How much the reactance of the field on the atomic constituents of the furnace charge can be utilised is a subject for further investigation. But if there is a possibility of obtaining new or better alloys by subjecting the change to the influence of a strong field during cooling, a remarkable opportunity exists for further furnace applications.

Inspection and Progress.

The Presidential Address of Mr. F. R. Wade to the Institution of Engineering Inspection, though exceedingly general in its conception and almost poetical in its realisation, contains a fundamental thought worth the consideration of every engineer, and especially of those whose business is outlined in the title of the particular body to

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whom he was speaking. Not only are the wonders o everyday life, which have been mainly brought about by the work of the scientist and engineer, been accepted with a complacency which indicates profound ignorance of the circumstances, but the enormous addition to our knowledge has tended to a sectionalising and sub-sectionalising of engineering in a vertical direction. The object of the Institution of Engineering Inspection is to bring about a horizontal intersection across all branches of engineering, in other words, to standardise the methods adopted by those whose duty it is to see that only good work is allowed to go forth to those who depend on the quality of product for their existence. This, indeed, is a most important aim. All scientific discovery and all engineering research are in their application to human existence of little avail unless the products which they have made possible are of good quality. The slightest error in manufacture, the slightest weakness in material, will spoil the best design. The inspector, in acting as a filter which will prevent poor quality stuff reaching the consumer, is playing a most important part, and the more his knowledge can be increased and standardised the better for engineering progress.

Electric Traction in France.

THE most interesting point, among many interesting points, in Mr. A. BACHELLERY'S descriptive Paper on the "Electrification of the French Midi Railway," which was read before the Institution of Electrical Engineers last week, is that dealing with the standardisation of the system. Like the corresponding body in this country, the French Ministry of Transport have adopted direct current at 1 500 V as their standard system, but, unlike us, they have made this system rigid, and the Midi Railway, which was already operating certain sections on the single phase system, had to set about the work of conversion. In addition, however, they began to carry out a new programme of electrification, and in 10 years' time it is hoped 2 000 miles of road will be worked by this method. Much of the company's system is peculiarly adapted to electric traction ; it is mountainous and there are many tunnels. A great deal of hydro-electric power is available, and as coal is expensive an actual saving in fuel cost is possible. The company are wisely making this saving certain by combining with their electric traction schemes an extensive programme of industrial development. As Mr. BACHELLERY rightly points out, in many of the agricultural areas served by the railway the demand for electrical energy would scarcely justify the expense involved in the erection of long transmission lines. On the other hand, many sections of the railway would only require a small proportion of the power the transmission lines can carry. A combination of these two unprofitable operations is, however, profitable, and has the advantage of bringing cheap electric power into a number of small localities. This is a hint which might well be taken and acted upon in this country.

British Enterprise Rewarded.

MR. BACHELLERY gives a great deal of interesting technical information in connection with this scheme, which we summarise elsewhere in this issue. For conversion, both rotary convertors and mercury vapour rectifiers are being used, and a direct comparison of their operation will therefore be possible. Some of the rotaries have an output of 750 kW at 1 500 V, and were described by Mr. F. P. WHITTAKER in a Paper read before the Institution of Electrical Engineers in 1922. The rectifiers have the large output of 1 500 kW, and details of their construction were given by Mr. R. L. MORRISON before this year's meeting of the British Association. A gratifying feature is that so much of the equipment has been supplied by British firms, and this is an enterprise which we hope every endeavour will be made to foster. We note that Mr. BACHELLERY is not very enthusiastic about regenerative braking and that it has been abandoned. This is the more surprising since the sections operated are very mountainous, and it would be interesting to have some further information about this. The Paper is full of useful hints for British engineers engaged on similar work, and it is therefore a pity that the discussion tended to be discursive rather than critical.

Preventable Accidents.

THE "Safety First" movement, particularly in its application to workers amongst machinery, has proved its value beyond a doubt. Hitherto there has been separate industrial and public organisations, but under a new scheme these are to be welded together under the title of the "National Safety First Association." The waste of human life, and of valuable time which legitimately belongs to the industry of the country, from preventable causes is appalling, and just as efforts are being exerted to save steel manufactures from the wastage of corrosion, so the "Safety First" movement aims at reducing to a minimum the wastage due to preventable accidents. To quote an instance, a prominent electrical engineering and manufacturing company in the Midlands states that the cost of compensation per £100 of wages has fallen from 9s. 11¼d. in 1913 (when "Safety First" work was organised) to 2s. 10d. in 1921.

Trade and the Election.

ONE of the most satisfactory features of the General Election is the comparatively little adverse effect it is having on the steady upward trend of trade—much less, in any case, than had been feared. This, of course, proves pretty conclusively the earnestness of the "push" which industrial and commercial interests are endeavouring to give to the business of the country, and also suggests that the day when politicians could hold up the nation's commerce in order that the fullest possible attention might be focussed on doings at the hustings has definitely passed. The formation of a new Parliament is a matter of great importance, but the successful development of the new trade push is absolutely vital. How the electors view the politicians' various specifics for the recovery of the country's prosperity will be known to the candidates, and to everybody else concerned, in the course of a week. In the meantime we note with interest that the National Chamber of Trade, while holding aloof from party influence, has drawn up a list of measures which, it is suggested, candidates might be asked if they are willing to support in the event of their election, the place of honour being rightly given to "retrenchment in expenditure and reduction of taxation"—points we have urged again and again.

The European Position.

ONE may sometimes, perhaps, be tempted to despair of the recovery of Europe as a whole, with its markets which were formerly, and should be still, of such great importance and value to this country. If so, a little consideration of what is taking place before our eyes in Austria, the country which, since the carving up of Francis Joseph's Empire by the Allies, has been described as a head without a body, should restore one's faith in the ability of any other country on the Continent to do at least as well; for, with one great exception, none has made a nearer approach to the brink of ruin. According to figures just issued by the League of Nations Commissioner-General in Vienna, the October gross customs and tobacco receipts, amounting to 276 milliards paper crowns, are the highest since the beginning of the reconstruction period. Compared with the monthly average of 189 milliards paper crowns for the first six months of the financial year, October shows a net increase of 87 milliards. Should this high level be maintained until the end of the financial year, the annual service of the reconstruction loans, to which the yield from these securities is assigned as a guarantee, will be thrice covered. A point which business men do not forget is that all the Continental countries are not in the parlous condition that characterises certain of them. The state of some is quite satisfactory, and it is reasonable to believe that the coming year may witness not only a sound trade recovery in Britain, but an appreciable movement toward prosperity throughout Europe.

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ELECTRIC PLANT FOR IRON AND STEEL WORKS.

Some Important Points that Must be Considered in its Manufacture.

By R. ORSETTICH.

In considering the manufacture of motors for driving auxiliaries in steel works, the very wide variety of machines used is at once evident, and it is therefore essential to divide them into two classes: one the standard industrial motor, more or less successfully adapted to suit special conditions, and the other the steel works type proper.

In this article the remarks are confined to plant of the second class. Before going into details, however, I should like to say that it must not be inferred that the industrial motor is not suitable for steel works conditions; the fact that many more standard motors are found in a steel works than the other kind would prove this beyond doubt. Amongst the applications where the standard motor, if protected, can do excellent service, the operation of cranes may be mentioned. Steel mill motors, although sometimes employed on cranes, are, generally speaking, too heavy and cumbersome, and it is seldom therefore that sufficient space can be found for them, while there is no point in carrying an excessive load to no good purpose. Other examples of the same argument can be found on the hoists for loading blast furnaces, cantilever cranes for handling ore or coal, truck and tilting cranes; in addition there are a large number of minor applications, such as jib cranes, pumps, compressors, and, above all, in the machine and the repair shops, where again in practically every instance only standard industrial motors are found Even on furnace-charging machines and on tilting gear for mixers, the standard industrial motor answers quite well.

Field of the Steel Works Motor.

The field of the special steel works type of motor, therefore, is particularly where the motor is exposed to dust and grit and to steel scale; further, where a motor is installed and has to work under high surrounding air temperatures, where it is exposed to severe mechanical vibration, and to very sudden reversing with high torque. Most of these conditions are exemplified by the driving of live rolls. For such conditions a special type of ironclad motor is almost exclusively used. It is massively built, in most cases is fitted with a steel frame, with a double shaft extension, and is seldom ventilated. This motor was originally developed in the United States, and it was introduced into this country when installations similar in design to American ones were tried. The use of this motor in America is extensive, and it is there that it is found performing a large number of duties mentioned above, which in this country can be performed quite satisfactorily by standard machines. It is difficult to state definitely whether the wide application of this type of machine in America represents an extravagant expenditure or a sound policy, without enquiring into the treatment which motors receive over there from the unskilled operators employed.

This sturdy type of motor has been developed from the designs of a traction motor, and like the original d.c. traction motors was made with the bearing shields in one piece with the frame, and with the frame parted across the horizontal axis. When lifting the top half of the frame the armature and the two bearings are exposed at the same time. The bearing bushes have the two halves bolted together so that the armature can be lifted with its own bearing bushes. The top half of the bush is for this purpose fitted with an eyebolt.

Some Disadvantages.

From a manufacturing point of view this motor had come severe disadvantages; it required a difficult steel sasting, which extended down to the lips of the bearings. When boring the frame a boring bar smaller in diameter than the bearing bush had to be used, and the frame had to be bored without it being possible to watch the work except through a small window in the frame above the commutator. The gauging of the bore was accordingly a difficult procedure, and necessitated the removal of the top half of the frame. Furthermore, in operation this motor had the weakness that if an accident to a gearing occurred, the probabilities were that the frame itself would be cracked or smashed entirely. The lubrication was not satisfactory, and no one could watch the behaviour of the bearings except after the top half had been removed.

The motor being totally enclosed it was soon found that for certain duties the machine was entirely unsuitable, and an alternative line of machines was proposed by American designers, in which the greatest portion of the upper frame was removed, leaving only a band for the magnetic section, and two straps to keep the bearing bushes in position. This motor, however, although widely used in the States, has never found any application in this country, and to my mind rightly so, because it only looks like a special steel works motor, and in practice is less protected and less suitable for general steel works use than the average industrial machine.

Referring now to the ironclad type of steel works motor, the defects of these early American designs were soon noticeable, and most of the British designs have been evolved so that they are free from the objections mentioned.

The shield bearings have been cast independently of the main frame, a feature now common to traction motors as well, and are fitted in strong recesses of the frame, reinforced all round so as to stand any sudden thrust due to accidents, e.g., to the gearing. The manufacture of the motor is much easier if the bore of the two openings is larger than the bore of the armature, as it enables an ordinary boring mill to be used for this operation and the accuracy of the work whilst machining can be checked.

The bearing brackets, which are split horizontally, are made with particular regard to the circulation of the lubricant without leakage into the motor. In some cases where there is a danger of suction from the armature or from the commutator, baffle plates are employed between the armature and the bearings, reaching down to the shaft, and the shield bearing itself is fitted with windows to admit air between the baffle plate and the lip of the bearing. The bearing bushes are of steel and are fitted with white metal cast round a mandril and hammered in before boring clean. The same arrangement of lifting the armature by means of the two bearing bushes is preserved, as this has distinct advantages when parts have to be replaced at short notice.

The brush gear in the case of direct current machines is usually fixed to two spindles only, and these come away with the top half of the frame. The lugs for bolting the frame to the foundation plate are usually very strong, and care is taken that the centres of the bolt holes are symmetrical with the centre line of the motor and with the shoulders of the two extensions of the shaft, so that in case of necessity a motor can be turned round should damage occur to the shaft or to the keyway. The shaft itself is made of good quality carbon steel of not less than 35 tons tensile strength, with an elongation of 18 to 20 per cent. on a 2 in. test piece. The shaft extensions are usually tapered.

A few words should now be added regarding the steel works type of motor for three-phase supply. This motor, in its main characteristics, resembles the direct current machine, with the exception that the magnetic section of the stator cannot be split. The frame itself is split as before, and when removed exposes the outside of the

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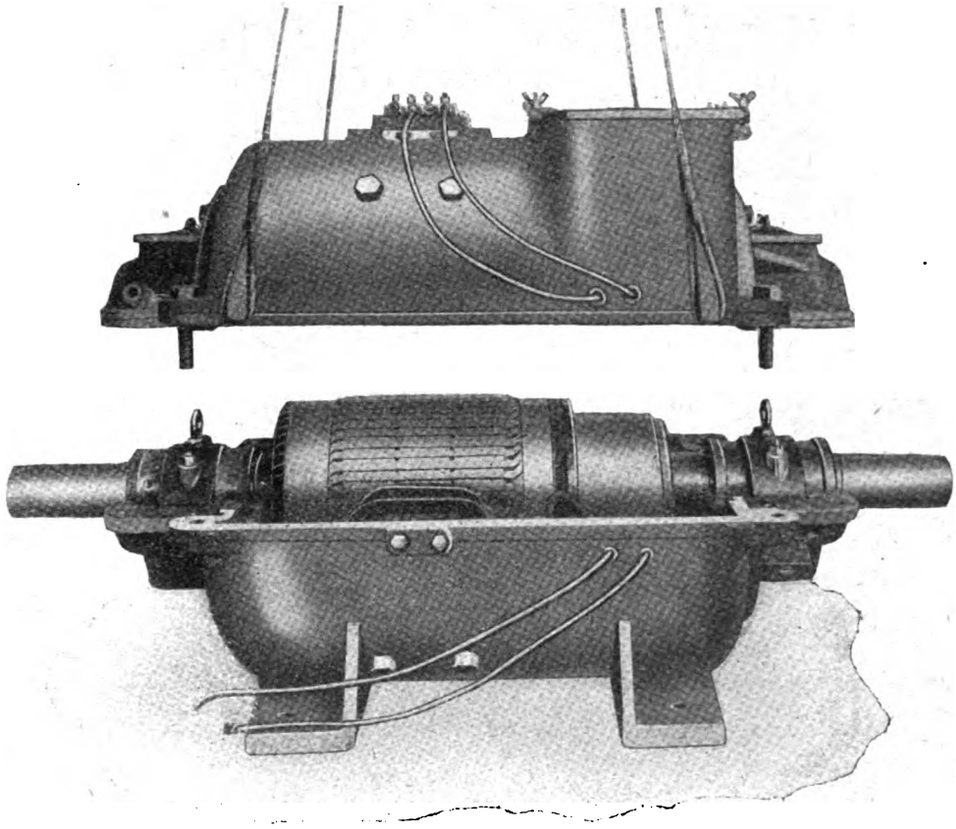
stator stampings threaded on to the rotor. The stator stampings are usually assembled under a hydraulic press and clamped between two steel cheeks. These cheeks are themselves gripped tightly together by means of drop forged key strips, which are placed in hot condition in grooves provided in the stampings. The two ends of these keys are swelled out fungus shape, and engage corresponding recesses in the two cheeks. When these keys cool down they contract and make the cheeks exert very powerful pressure upon the stampings, so that the whole of the stator becomes a solid ring, which is wound in the ordinary way like an induction motor fitted with an external frame. When this ring is dropped into its own frame, it is prevented from rotating by either one or two keys placed in a vertical line and engaging in a groove in the stampings.

The most debatable question in connection with this type of motor has been the material for the frame and bearings. A number of makers have adopted cast steel frames, but the writer has always been of the opinion that this was unnecessary, as it made the manufacture more expensive and required longer deliveries than cast iron frames. There is not the slightest difficulty in making a cast iron frame equally strong as a steel frame. The same argument applies to the bearings, and there is no doubt that in case of accident it is infinitely quicker to replace a broken bearing shield if made of cast iron.

Another characteristic in which the steel works motor differs materially from the industrial motor is in the nature of the windings. Owing to the fact that the ambient temperature is often even higher than the total final temperature of an industrial motor, and also owing to the presence of dust and grit and scale, it is necessary to provide materials which will successfully stand the high temperature, and therefore only Class B materials can be used. Mica wrapping is adopted very successfully for the armature coils, in some cases the mica being backed by silk tape, and in others by thin paper strips. Asbestos is also used a great deal. With relatively small wires a covering is placed on the wire itself. For larger sections asbestos is usually applied as a finishing covering over mica materials. Asbestos being highly hygroscopic, it is necessary to bake the coils well before the asbestos is applied; the asbestos tape itself, which must be of the woven type, is then applied with a good tension, and after being thoroughly dried is varnished and baked, the final finish being by means of a layer of shellac. This gives an excellent sealing to the winding, which is particularly important in view of the metallic dust always present in the air.

Another point which deserves great attention is the necessity of providing very large leakage surfaces, not only on the exposed parts, such as commutators and brush gear, but also on the ends of the windings where the ferrules are applied. These are usually left bare, but if this is done it is important that the taping should be carried right up to the ferrule, and that the ferrule itself should be coated with several layers of heat-resisting varnish.

Brushes, particularly of the metallic type as used on slip rings, are harmful on steel works motors, especially if any trace of oil is present.



DIRECT CURRENT STEEL WORKS MOTOR WITH TOP COVER RAISED (GENERAL ELECTRIC CO.).

In providing leakage surfaces on the commutator it is advisable to varnish these perfectly smooth so that they can be wiped regularly without forcing any metallic dust into the crevices. The commutator risers in these motors should be made as in traction motors, in one piece with the bar, in order to make certain that there is no relative movement between the two, and also to prevent the entry of dust between the risers into the armature.

In concluding I should like to give a warning against the too extensive use of the so-called bakelite varnishes. These have been so widely advertised that some people are inclined to think they are good for every purpose, and some engineers have actually specified that they should be used for a varnishing coating on field coils and armatures. This, however, is a mistake. These varnishes consist of a synthetic gum, dissolved in methylated spirit or a similar solvent; when heated they give off a considerable amount of vapour, in fact the surface is full of bubbles all over, and when dried it is more like a sponge than anything else. The value of the coating is therefore *nil*. There is, however, another danger; that is, that if the motor is totally enclosed and tested as such, an explosive mixture is developed inside which can be ignited quite easily.

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ROLLING MILL EQUIPMENT.

Some Present Day Problems in Design and Construction Discussed and Elucidated.

By W. E. TAYLOR and C. E. RAEBURN.

This article discusses certain of the more important aspects which govern the design of electrical equipments for rolling mills of large output.

The paramount problem in any steel works installation is the delivery of a specified tonnage of finished steel product of specified grade at a minimum total cost. Each case must therefore be analysed carefully and the most suitable equipment chosen.

Selection of Mill.

The type of mill is determined by the tonnage and sections rolled; the quality of the steel rolled (usually the percentage carbon content and alloy content are the determining factors); the temperature at which rolling takes place; the general layout of the steel works and the labour conditions existing. It is essential, therefore, that the following information be supplied to enable the selection of proper drive to be made :—

1. Type of mill, including layout.
2. Weight, shape, material and temperature of ingot or billet.
3. Section of finished product.
4. Diameter and profile of the rolls.
5. Time required to handle material between passes and ingots.
6. Average tonnage per shift of 8 hours.
7. Average tonnage per hour.
8. Total time of rolling one ingot or billet.
9. Number of bars in the mill at any one time.

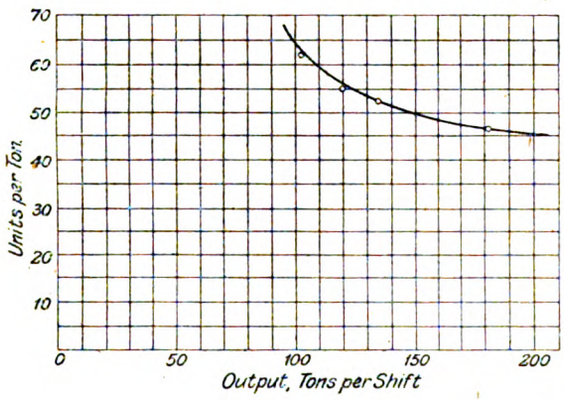

FIG. 1.

These particulars are generally fixed by the steel works manager and are supplied to the rolling mill engineer to enable him to calculate and fix the ratings, peaks and other characteristics of the electrical plant to be supplied.

In general, the drives may be classified as follows :— (1) Reversing mills. (2) Continuous running mills. Reversing mills are applied to the work of cogging, plate and large section mills. The speed of rolling is changed from pass to pass as the billet lengthens, while the reversing feature does away with the lifting tables, generally necessary in 3-high mills.

Reversing Mills.

In designing the flywheel set and motor to be used on a reversing mill, the R.M.S. value may be arrived at by first determining the total energy required to be given out by the mill motor, due allowance being made for the dynamic energy required for accelerating the mill motor, in order to make the specified reduction in section of the ingots or blooms in the specified times with the specified initial temperature and other conditions; or each pass may be worked out separately, as is more generally the practice. From the results the R.M.S. rating of the motor is obtained, due consideration being given to the influence of peaks, following on which the ratings of the generators, flywheel and driver are fixed. There are, however, many other considerations to be taken into account by the designer of the equipment which affect

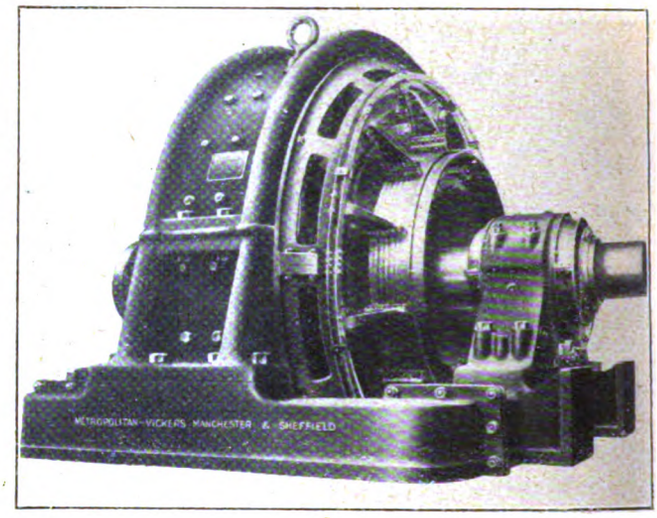

FIG. 2.—METROPOLITAN VICKERS 800/2 100 H.P. VARIABLE SPEED MOTOR DRIVING 10 IN. PIERCING MILL.

to a great extent the ultimate fixing of the ratings of the machines.

Motors which are to meet reversing rolling mill service must be capable of withstanding large overloads, since no flywheel is interposed between the mill and motor. They should be capable of rapid acceleration and retardation. When the ingot has entered the mill an acceleration of abour 30 revs. per min. per second and a retardation of 40 revs. per min. per second are desirable for certain sizes of mills. Another desirable feature is that the motor should work up to its maximum capacity during the whole rolling time, in order to ensure maximum tonnage from the mill. In order to meet these ideal conditions, the motor should be rated with a maximum operating torque and

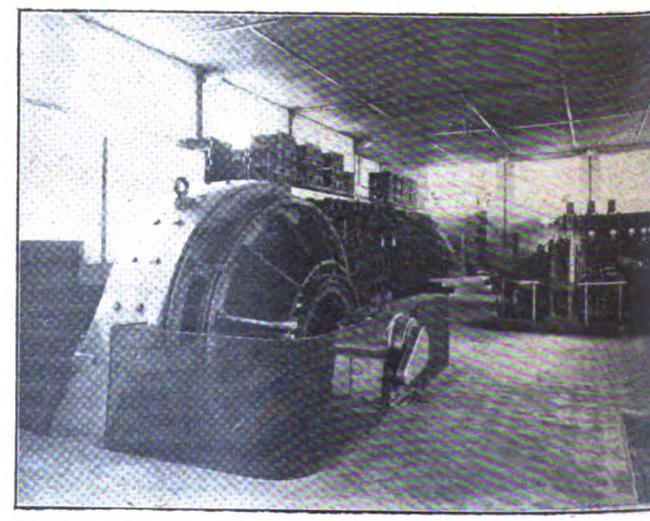

FIG. 3.—2 500 H.P. VARIABLE SPEED MOTOR DRIVING FINISHING ROLLS OF HOOP MILL.

also a maximum emergency torque, this latter figure being something like 10 to 25 per cent. above the maximum operating torque. It has been found in practice that the

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operator throws his control lever to the furthest point which corresponds to maximum speed position, say, 120 revs. per min., even though he is working on the earlier passes, when not over 50 revs. per min. would ordinarily be attained. This condition (*a*) is met by fitting a device which limits the current to a safe figure, so that under these circumstances the current will reach a value corresponding to the maximum operating torque, and remain there until the metal leaves the rolls. Again, the maximum emergency torque is fixed by the setting of the circuit breaker placed in the circuit between the generator and reversing motor, and under the circumstances above described, provided the current required

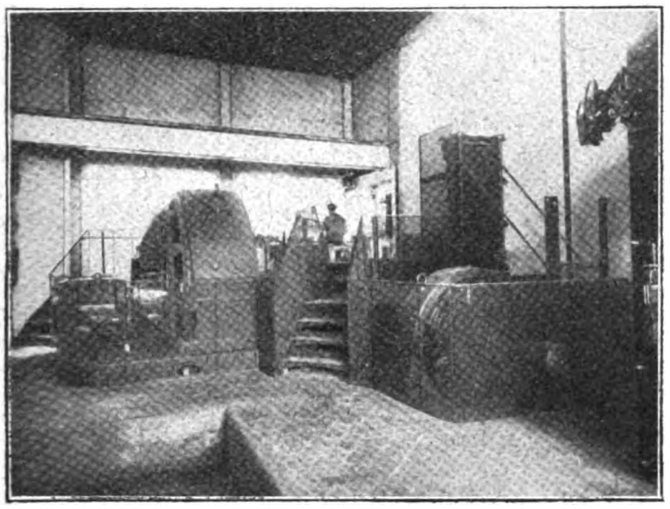

FIG. 4.—1 500 H.P. VARIABLE SPEED MOTOR DRIVING ROUGHING ROLLS OF HOOP MILL.

is not in excess of this circuit breaker setting, but exceeds the maximum operating torque, then the mill will continue to roll but only at a slow speed (*b*) or at the speed at which the maximum operating torque was exceeded.

This feature, together with rapid acceleration of the mill, forms a valuable addition to the control for ensuring maximum tonnage from the mill. It is now adopted on all American reversing mill installations and is being embodied on one of the mills now being manufactured for use in this country.

The features indicated above are obtained by the fitting of forcing and control devices in the fields of the generators or their exciters and also in the field of the mill motor; or, in other cases, by the combination of exciting machines or booster control of current (load) and voltage conditions. For instance, features (*a*) and (*b*) are obtained by forcing devices fitted to the generator and motor fields and comprise the temporary application, automatically controlled, of a much higher than normal voltage, in conjunction with a temporary and automatically controlled insertion of a much greater resistance than normal.

"Control," therefore, forms a not inconsiderable part of the design in the case of reversing mills. Briefly, the whole must be designed to save time whilst keeping peaks off the input to the equipment.

Ilgner sets are now being run at as high a synchronous speed as 750 revs. per min. on the largest mills, and are found to be quite as free from trouble as the older sets are at the slower speeds. This increase of speed enables smaller machines and also smaller weight flywheels for the same stored energy to be used; cast steel wheels are being employed with a peripheral speed of 28 000 ft. per min. Another advantage is that not only the capital cost of the electrical equipment but the floor spaee required are reduced and also the amount of foundation, thereby effecting a further saving in capital cost of buildings and foundations.

In selecting the size of drive for a reversing mill, due regard must be paid to the tonnage requirements, even allowing for future developments. The drive should neither be underpowered or overpowered. If it is underpowered, then the production of the mill will be curtailed, a very serious consideration; but overpowering a mill is also very bad, as it means that the initial capital expenditure is increased, and therefore the capital charges, also the running expenses, etc., will be increased due to loss in efficiency; likewise, maintenance charges, etc., will be increased per ton of steel rolled. As an example of the reduced efficiency caused by rolling less tonnage than the electrical driving equipment is capable of dealing with, will be seen by the curve in Fig. 1, showing the energy consumption per ton of steel rolled against output per shift. It will be seen that at 100 tons per shift, 65 kWh per ton are required, whereas, at 200 tons per shift, only 46 kWh per ton are required; which at 1d. per kWh would mean that the cost of the finished product would be 1s. 7d. per ton cheaper.

Another point against the overpowering of mills, especially those that draw their supply from a power company, and pay for current on maximum kVA, is that at normal output the power factor is low; therefore the power company will penalise the user either by charging more per unit or, what is equivalent, reduce the allowable discount. In order to overcome this defect, some power factor correcting device, for example, static condensers or phase advancers, are installed, necessitating increased capital expenditure and therefore again increasing the capital charges per ton of steel rolled.

In the selection of equipments for continuous running variable speed mills of large output, in those cases where flywheels are used to minimise the input peaks, there are two clearly defined types to be chosen from—the rotary and d.c. motor with flywheel, and the Scherbius or Kramer types, both of which latter have various off-shoots. The same choice is given in the case of continuous running mills where outstanding peaks are absent and therefore flywheels are also absent.

With regard to the consideration of the Kramer or

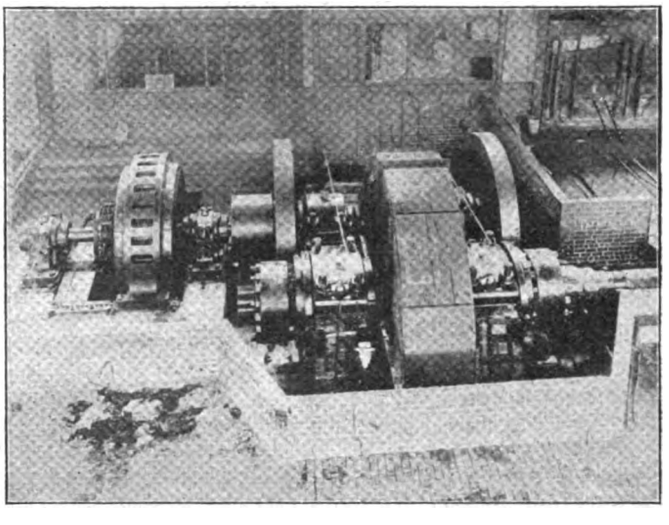

FIG. 5.—A.C. MOTOR DRIVE FOR AMERICAN SHEET MILL WITH TWO HIGH SPEED FLYWHEELS.

Scherbius or d.c. type of drive, it may be shown that for variable speed drives the d.c. drive as far as the motor is concerned is the more suitable. Speed ratios of 4–1 are easily on field regulation obtainable with practically any intermediate gradations. Experience has shown that rotary or motor generator conversion from a.c. to d.c. combined with d.c. drive for continuous running mills not only compares very favourably with the a.c. variable speed drive obtained by the combination of converting machines, as in the Kramer and Scherbius system, but is

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in most cases a better engineering solution, as it tends towards greater overall efficiency on the aggregate over the range of speeds.

According to the report of the Electrical Developments' Committee of the A.I.S.E.E. for 1922, there were no less than six new d.c. variable speed equipments installed in U.S.A. that year.

"The list also shows that there is a tendency to utilise d.c. motors supplied with power from a motor generator set or rotary converter, in preference to one of the several successful schemes of obtaining adjustable speed by means of auxiliary equipment used in connection with a wound rotor motor. The use of d.c. motors, particularly where several are desired, simplifies the equipment considerably, which naturally reduces the amount of atenuion and inspection required."*

D.C. Installations Justified.

The foresight of those engineers who installed rotary and d.c. variable speed mill installations in this country during the past 11 or 12 years appears, therefore, to be justified.

In large continuous running mills, such as plate and sheet mills, where flywheels are necessary in order to reduce the peak load on the power station, but where speed variation is unnecessary, other than the speed drop required to enable the flywheel to give up its energy, a.c. motors are generally fitted. Practically all new installations are geared (double helical). The principal objection to rope drive is its high maintenance cost, and also the fact that it necessitates the use of a comparatively slow speed motor owing to the limited size of the rope wheel and also the large pulley diameter necessary for the 2 in. rope most commonly used, a ratio of approximately 4 to 1 being obtained.

With double helical gear, 8 or even 10 to 1 is possible. This not only means a cheaper motor, but better performance, particularly as regards power factor.

The question of flywheel effect is very important, both as to the proper amount and also the proper utilization of same. With engine driven mills, and also motor and rope driven mills, sufficient flywheel effect is impossible to equalize the peaks on the mill and prevent excessive slowing down of the mill under peak load. The result is that the motor and line have to carry very high peak loads.

In order to obviate this defect, the present tendency is to adopt flywheels on the high speed pinion shaft, one on either side of the pinion overhung, and the task of the designer is to arrive at the best combination of the motor and flywheel and the best speed for the motor and the design of the flywheel.

Flywheels of cast steel are at present in operation, as previously mentioned, having a peripheral speed of 28 000 ft. per min. These wheels are cased in, in order to reduce the windage losses on the wheel. When small wheels are employed, as in such drives referred to above, speeds may be economically limited to 10 000 ft. per min., and, as the windage losses are small, covers may be omitted.

Automatic regulators of the liquid type are the most commonly used in this class of work. In this case the motor operates with only the inherent slip of the motor and cables until a predetermined load is reached, when the automatic feature is introduced, causing the set to drop in speed and the flywheel to give out its energy, thus maintaining a practically constant demand from the power station. It will thus be seen that the slip losses only occur to any great extent after the motor has reached the maximum setting, thus reducing the losses to a minimum; so that it is considered inadvisable to adopt any means whereby the slip losses are regenerated. The saving gained by recuperation does not balance the increase in the capital cost of the equipment and the increased running and maintenance charges.

The tendency in the design of continuous mills with large outputs of strip, etc., is to fit accurate speed ratio control to each stand comprising the mill, and this feature has justified its inclusion. As these mills produce their stock at a greatly increased rate as compared with older mills, the size of the machines has grown. The satisfactory fitting of individual motor drive to these large mills with accurate control of speed during rolling forms a problem to-day. As is found in the case of paper making mills, so it is with continuous mills, the production must be made automatic and speed the main object.

When designing the layout of a motor generator sub-station, which contains practically all the auxiliaries used in connection with an Ilgner set, it is important that the arrangement be as far as possible such as to minimise the amount of attention required, and thus keep down the number of attendants. The number of operations performed on various switch and control apparatus, when starting up and closing down, should be cut down.

The design of the brake for stopping the flywheel set which is generally of the dynamic type in preference to a mechanical friction brake, should be of a simple nature. This is ensured by the use of the slip regulator apparatus for the dual purpose; reverse power with rotor current limited is, however, the simplest form.

The oiling apparatus should be of such a design as will ensure freedom from stoppage while running year in and year out. This may be obtained by duplicating the motors, pumps and coolers, also the strainers. An important point is that the overhead and sump tanks should be of sufficient size to hold all the oil in the system, in order to facilitate the renewal of joints in the piping and repair of leaky couplings, and for the cleaning out of the overhead and sump tanks. The forced ventilation fans and motors should be in duplicate.

The design of the air filter when of the dry type requires careful consideration, as the facilities for cleaning the dry type filter are not, as yet, perfect. The process is cumbersome, and because of this it may be that cleaning is sometimes postponed, especially in busy times. Duplication of the filter, therefore, presents advantages which call for a large amount of additional space, which in some cases is not easily obtainable and is costly.

Main cables for large reversing mills are best of the bare strap conductor type, supported on edge and built up in multiple, with spaces between the straps, in order to obtain maximum cooling. This type of main connection is found to be superior to insulated cables, effecting considerable economy in copper and at the same time less I^2R losses. All a.c. primary connections for main rolling mill motors are best made with paper insulated and lead covered cables.

*R. B. Gerhardt, chairman, speaking before annual conference of the A.I.S.E.E., Sept., 1922.

The Future of Turbo Alternators.

In an article in a recent issue of the "Elektrotechnische Zeitschrift" Dr. R. Pohl makes some valuable suggestions as to the future possibilities of obtaining more economic and reliable turbo-alternators. He foresees a great future for the totally enclosed generator by a circulating gas, which is used over and over again without external replenishment. At a suitable point in the wake of the cooling gas, preferably under the generator, a system of water-cooling coils is interposed which absorbs the heat. By utilising the heated water for boiler-feed purposes the effective efficiency of the generator may be raised from 95 per cent. to 96 per cent., which would mean a great saving in fuel on a large machine. It is further pointed out that air, commonly used as gaseous cooling medium, is by no means the most suitable gas for that purpose. Carbon dioxide is too heavy, hydrogen is hard on the packing system, but nitrogen, and particularly helium, would give excellent results. It is claimed that the cooling action of the latter gas would be 25 per cent. better than that of air. As neither of these two gases maintain combustion, the generator would be fireproof.

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ELECTRIC FURNACE PROGRESS.

Recent Progress in the British Iron and Steel Industry.

By W. S. GIFFORD.

The depression in the iron and steel trades has had, as is to be expected, a serious effect on the production of electric steel in Great Britain. In Sheffield especially there are a number of furnaces idle. The production of electric steel in Sheffield increased in a remarkable manner during the war, the total capacity of furnaces in that town alone being at least 150 000 tons per annum. This steel was of course required for armament purposes, a very large tonnage being used for aircraft, tanks, armour-piercing shell, armour plating, helmets, etc. At the end of the war it was necessary to find a new outlet for this tonnage, and while progress has been made, the present capacity of electric furnaces in Sheffield is still very much larger than the requirements. At present the principal use of electric melting is for manufacturing alloy steels of various kinds including high speed steel, drill steel and steel castings.

For some time after the Armistice, foundries which had electric steel furnaces were able to keep them busily employed, but the depression in the motor car and ship-building industries, combined with the moulders' and coal strikes and severe Continental competition have proved disastrous to several foundries which were not connected with engineering shops, but depended on outside firms for the whole of their orders.

In spite of the general depression, several new installations have been made recently. Of these perhaps the most interesting is the erection of a 15-ton Heroult furnace in Sheffield. This furnace was partly constructed during the war, but on the cessation of hostilities, its completion was delayed. It is equipped with transformers of a total capacity of 2 400 kVA, and is the largest furnace erected in this country. It is not of the usual Heroult design, the electrode mechanism being at the side instead of the back, and it is charged from behind. Fig. 1 gives a general view of this furnace.

While in England the number of furnaces in operation has decreased recently, there have been numerous new installations in other parts of the Empire, and several furnaces originally erected in English works have been sent to South Africa, India and elsewhere, while new plant has also been recently constructed in England and sent to various countries. Fig. 2 shows a small furnace which is being sent to Thibet. It was necessary to make this as light as possible, as it will have to travel for great distances over the mountains on mule back. The furnace is of 3 to 5 cwt. capacity, and, as can be seen from the photograph, simplicity has been one of the principal objects in the design.

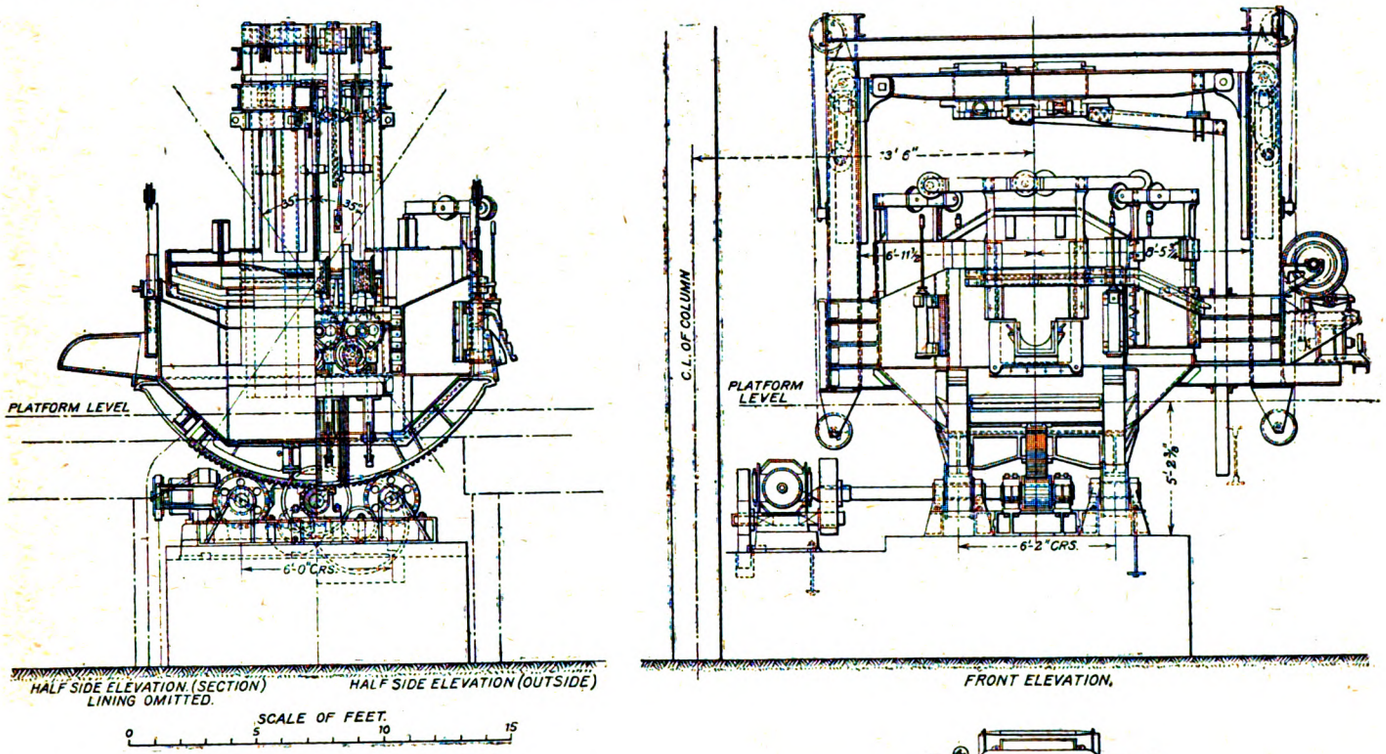

FIG. 1.—15 TON HEROULT FURNACE.

In America an interesting experiment is being made by the Ford Motor Co., who are reported to be installing a furnace of the Greaves-Etchells type of 60 to 80 ton capacity. This furnace is to be fitted with eight electrodes and transformers of a capacity of 12 000 kVA.

The Soderberg continuous electrode process makes possible the use of furnaces of larger capacity than could be previously used. The limit of capacity of a furnace is the amount of current which can be carried by the electrodes. The multiplication of electrodes in a furnace presents many disadvantages, and 24 in. diameter is about

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the limit in size for an ordinary electrode, but by the Soderberg process, electrodes of any size can be used. So far this method has been principally used in carbide and ferro-alloy furnaces, but it has also been successfully applied to steel furnaces.

Stainless Iron.

The development of a cheap process for the manufacture of stainless iron gives at the present time the most hopeful prospect for an outlet for electric furnace products. Stainless steel has for a number of years been made in electric furnaces, but the total output has been small in comparison with the potential production of electric furnaces already installed. The new process, which is based on the direct reduction of chrome ore and manufacture of a low carbon chrome iron alloy in the same furnace, greatly reduces the cost of the metal, and makes the cost lower than brass.

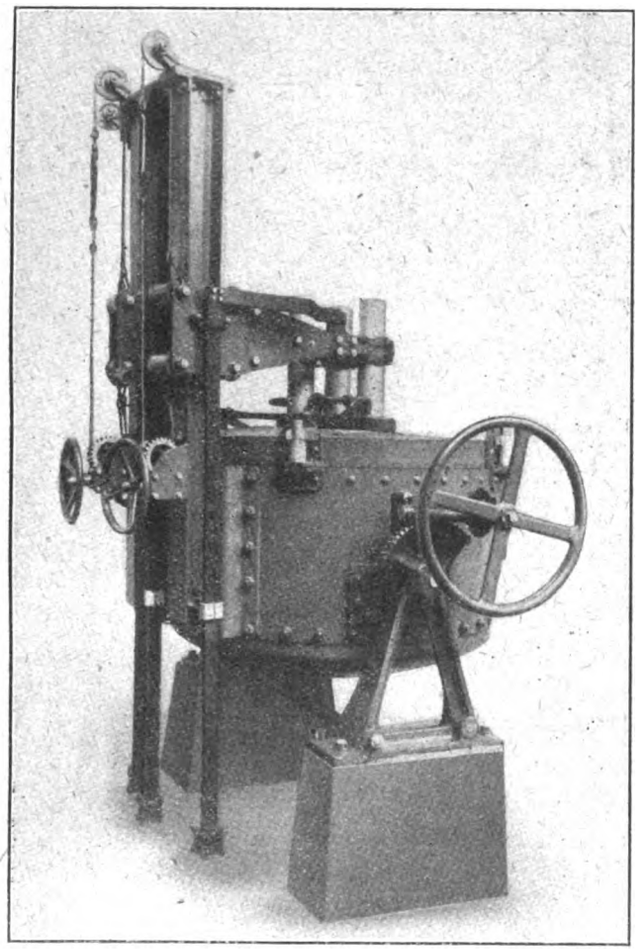

FIG. 2.—3 TO 5 CWT. HEROULT FURNACE FOR THIBET.

The result is that a very large number of products can now be made at a reasonable price, and there is no doubt that within the next few years an important new industry will be established, which will employ many of the electric furnaces which are now idle. The process is already being worked by five or six of the principal steel firms, and it is expected that progress will be repaid.

Electric furnaces are making some progress in the steel industry for purposes other than that of actual steel melting. Messrs. Wild and Barfield have invented a number of different types of electric furnaces for hardening high speed steel, and annealing and tempering steel, and other metals. The furnaces are of the resistance type and a very interesting feature is the magnetic detector used in the hardening furnace. This is based on the facts that steel surrounded by a coil of wire through which an electric current is flowing becomes magnetised, but that when the AC_2 point is reached, the steel becomes non-magnetic. This point is also the correct temperature for hardening, so that by means of an outer winding super-imposed on the heating coil, and connected to an indicating device, the operator can see immediately when the steel has reached the correct temperature.

The Leeds Electrical Construction Co. also manufacture furnaces for hardening and tempering steel, annealing wire and rivet heating. The hardening furnaces are also of the resistance type, but in the furnace used for the annealing process, the resistance of the wire or strip is the source of heat.

In America, considerable progress has been made with large electric furnaces for heat treatment, enamelling, etc., and a number of furnaces of 200 or 300 kVA capacity each have been installed. The large automobile manufacturers especially are using furnaces of this kind for annealing castings. These furnaces are of the resistance type, and as a rule nichrome wire or ribbon is used as a resister. There are undoubtedly many advantages to be gained by this use of electric power, as the temperature can be maintained at any desired point with great regularity by the use of temperature control devices. So far little progress has been made in this direction in Great Britain, owing largely to the comparatively high cost of power and the low cost of coal in this country, but several different types are now being introduced here, and it is probable that before long electricity will be used for these purposes. The load is especially attractive to power companies, as it is exceptionally steady, and either direct current or single, two or three-phase power at any periodicity can be used.

Another ingenious application of electric heating which is finding use in the United States is in connection with the annealing of steel bars and tubes, and also copper locomotive tubes.

The machine utilised for this purpose consists of a pair of clamp heads, into which the tube is instantaneously fixed by means of two solenoids, and one of these clamp heads is on a sliding head. The operator, by pressing a pedal closes the solenoids, and the main current is immediately turned on, whereby the bar or tube is immediately heated and expanded. The expanding metal pushes one of the clamping heads against a trigger, which releases the main switch at the predetermined point and cuts off the current, when the solenoids immediately release the tube.

The temperature of annealing can be determined with great accuracy by adjustment of the position of the trigger, which releases the main switch.

In the case of copper locomotive tubes, the operation is completed in about eight seconds. In the case of steel tubes about 10 ft. in length, the indicator showing the expansion of the tube indicates most clearly the increase in length of the tube up to the critical point, after which it is again reduced in length, and as the heat continues, expands again. In this way the critical temperature can be most accurately determined, and the main switch tripped at any desired temperature or at any point in the cycle of operations. The great advantage of these instantaneous methods of annealing lies in the lack of scaling due to the short time which the metal is submitted to the high temperature, and this is especially valuable in the case of metals such as duralumin, copper, brass, etc. The accuracy with which steel tubes can be annealed and the fact that any unevenness in the thickness of the walls is immediately detected, makes this method of annealing extremely valuable where difficult specifications have to be met.

Another very interesting recent development in electro-metallurgy is the induction furnace. Two induction furnaces were erected in steelworks in England fifteen years ago, but on account of the impossibility of making successive heats of different analyses and troubles with the lining, these were both shut down. Recently the induction furnace has been most successfully used for melting brass, especially in the United States, where nearly all of the brass rolling mills use metal melted in this way. In England there are about five induction furnaces, one rotating arc and one resistance furnace used for this

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purpose, and probably these numbers will be greatly increased before long. It is not, however, likely that the induction principle will again be applied to steel making as the difficulties which prevented its development in 1909–1910 have not yet been overcome.

The use of high frequency current has been developed by Dr. Northrup, of Princeton University, and this process is likely to have most interesting results on account of its adaptability to research work. The principle of the furnace is that of an ironless transformer whose primary is the furnace coil and whose secondary is the metal to be melted, or, where a non-conducting material has to be melted, a conducting crucible. In order to obtain effective heating by this means, a frequency of several thousand cycles per second is used at a voltage of 6 600. As a rule a single phase supply is used, but three phase furnaces have also been installed. The high frequency converter sets consist of a transformer with a high reactance, a set of static condensers and a metal discharge gap with the necessary switchgear and instruments. A typical wiring diagram is shown in Fig. 4.

The furnace can also be used for melting in vacuo. Several furnaces have been installed in Great Britain for melting platinum and for research work, and as 2 lb. of steel can be melted in 10 minutes, or 14 lb. charges in about 40 minutes, it is possible to make and examine a series of new alloy steels very much more rapidly than before.

The use of electric currents of medium frequency is opening up new fields for electric heating in industry, as it is possible to heat conductive bodies without any direct connection between the external inductive coil and the object which is heated. In the case of magnetic material, such as iron, this heating can be effected with electricity of comparatively low frequency, provided the range of temperatures required is within the temperatures at which

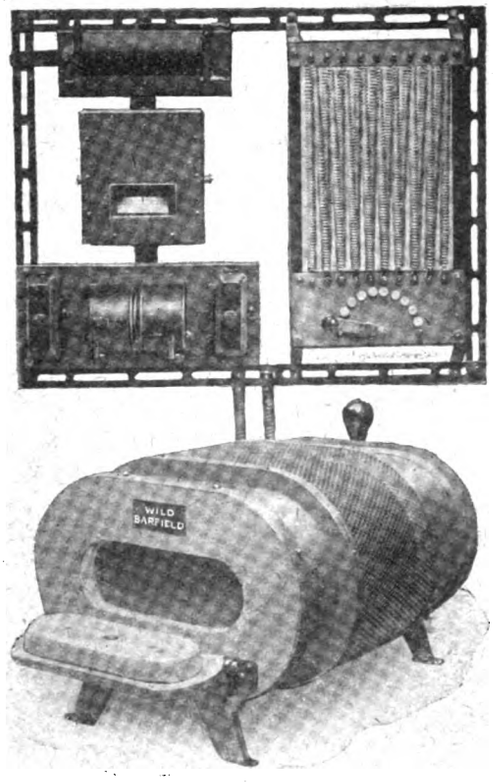

FIG. 3.—A WILD-BARFIELD RESISTANCE FURNACE.

iron is magnetic. Similar heating can be carried out with non-magnetic substances with higher frequencies.

As has been pointed out in detail in this article, we are of the opinion that while the present depression in the electric steel furnace industry is undoubtedly serious, there is every probability that it will greatly improve, partly when conditions throughout the steel trade become more normal, and partly owing to the great possibilities of stainless iron and steel, and that the use of electricity for

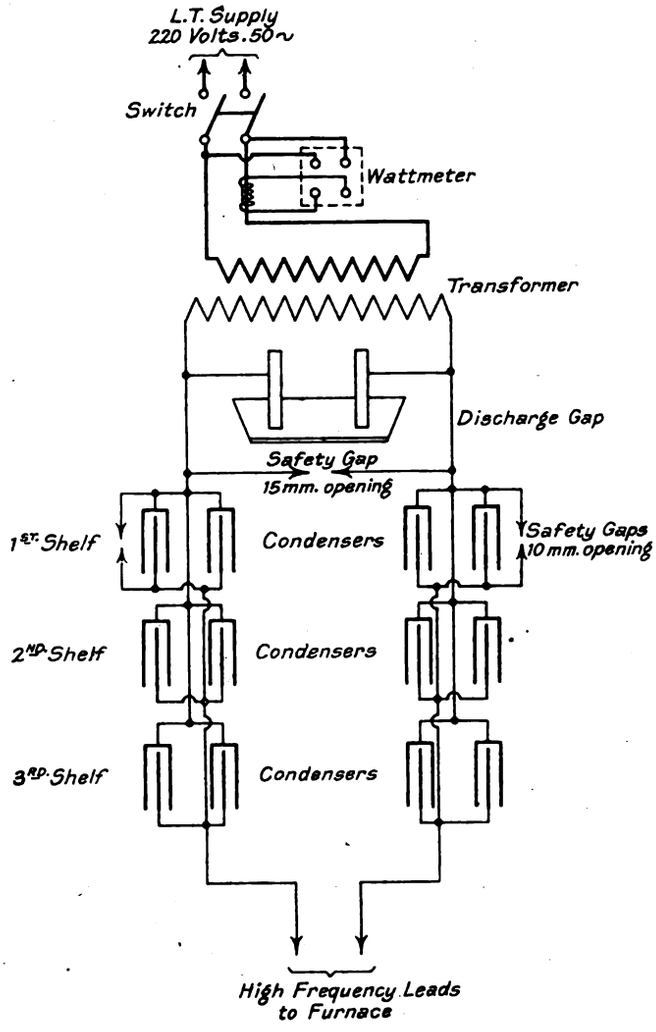

FIG. 4.—DIAGRAM OF CONNECTIONS OF HIGH FREQUENCY FURNACE.

heat treatment and research is progressing rapidly abroad and will undoubtedly increase in Great Britain.

SELLING ELECTRICITY.

Obtaining an Industrial Heating Load.

Some hints for obtaining an industrial heating load were recently given by Mr. J. D. Noyes, of the Detroit Edison Co., to a conference of salesmen. These hints may be summarised as follows :—

1. See that one person is responsible for the oven design and installation.

2. Insist on a guaranteed performance in pounds of metal per kilowatt hour and see that this figure is in accordance with the best modern practice. This will require that the electric oven be properly heat-insulated after erection and not merely assembled out of standard parts.

3. Do not discuss industrial heat applications merely on comparative B.T.U. costs of heat supplied. In electric heating a large part of the heat supplied goes into the work ; in the combustion process 80 to 90 per cent. of the heat in the fuel goes up the stack.

4. The oven should be properly laid out for the work required so that it will not have to operate at partial loads a large part of the time. If an oven is designed for 4 000 lb. of metal per hour, but operated at 2 000 lb. under normal conditions, its efficiency is greatly reduced, since radiation and ventilation losses are more or less constant. It is better that the oven be a little small. Put on a night run when necessary in rush times.

5. In any comparison of costs see that all expenses are covered. This will include fixed charges in the excess investment of the fuel-fired installation, incidental electric power for auxiliary motors, carrying costs of fuel in storage, etc.

6. The combustion process requires careful attention to keep it up to its highest efficiency. Temperature control is automatic, provided that the furnace and all of its auxiliary apparatus are in first-class condition. It appears doubtful that such an oven can be run without higher maintenance expense and more expert supervision than is required by the electric outfit.

7. The depreciation of high-temperature fuel-fired furnaces is high—20 to 25 per cent. annually is about the rate of well-established installations and should apply here.

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SPEED REGULATION OF STRIP AND BAR MILLS.

Practically all merchant and bar mills are required to roll a large variety of products; even those designed for a large tonnage being called upon to handle weights which vary in the ratio of 10 to 1, while ordinary mills are required greatly to exceed this weight ratio. Combined with this factor, the fairly definite speed which exists for each particular product, at which the mill will roll the maximum tonnage, necessitates that the speed of the mill motor should be adjustable. In addition to the usual characteristics required for mill motors generally, it is essential also with motors for these mills that when adjusted for any definite speed, throughout the range of control, this speed should be only slightly affected by wide variations in load. The motor should be capable of carrying high overloads throughout the full-speed range and the efficiency of the motor should be highest for the particular range of speed required for the maximum period of production. Added to these features it is also essential that the power factor should be high, and that the cost should be low.

Under these conditions it was only natural to find mill men making every effort a few years ago to adapt the mills to induction motor characteristics. Where the range of sections to be handled was such as to require different speeds, two or three compromise speeds were chosen and multi-speed motors were purchased, but, even at their best, these motors are inflexible and their use always entails a sacrifice, especially with 25-cycle power.

Essentials of A.C. Motor Design.

Appreciation of these facts has led many of the leading engineers of Europe, as well as those of America, to devote considerable time and expense to the study of the problem of making an alternating current motor which would embody the mechanical characteristics of the induction motor with the speed characteristics of the direct current adjustable speed motors and, at the same time, have an efficiency which would approach that of a multi-speed induction motor. Many systems were suggested, and a few actually found their way way into steel plants, although by far the greater number have passed into history with only a patent office record.

The system most widely used for such speed control to-day is a modification of the Scherbius system, which has been adopted by the General Electric Co. of America, and which has been found to meet most requirements of rolling mill drives. With this system the speed of the driving induction motor may be varied over a large range and when set to any desired value it will remain practically constant, independent of the load. Under this system equipments may be designed to meet any variation of speed with load—i.e., constant torque, constant horse-power, or any variation between these values, and the speed may be easily and quickly adjusted without affecting the overload capacity.

As an installation of this type, the first of its kind in Europe, the electrical equipments of the new 12-in. merchant and 10-in. strip mills at the Templeborough works of Steel, Peech and Tozer are of interest.

The system employed in this case is what is known as the double range modified Scherbius system, which permits speed control of the main motor below, at or above synchronism and up to such limits as are determined by the capacity of a regulating machine. This system also includes provision for improvement of the power factor under the various conditions of load and speed regulation.

Rating of Motors.

The electrical equipment of these mills, which was supplied by the British Thomson-Houston Co., consists of a main mill motor and regulating set for the 12-in. merchant mill and three motors and two regulating sets for the 10-in. strip mill, the roughing and finishing mills being equipped with induction motors and the intermediate edging rolls being driven by a direct current variable speed motor.

The ratings of the various motors and regulating sets are as follows:—

12-IN. MERCHANT MILL.

Induction Motor 3 000/3 000/3 000 H.P. at 470/375/280 revs. per. min.

Regulating set 375 revs. per min., comprising a 950 kW a.c. commutating machine and a 775 H.P. induction motor.

10-IN. STRIP MILL (Roughing Mill).

Induction motor 1 500/1 150/805 H.P. at 325/250/175 revs. per min.

Regulating set 750 revs. per min., comprising a 310 kW a.c. commutating machine and a 420 H.P. induction motor.

INTERMEDIATE EDGING ROLLS.

D.c. variable speed motor 50/100 H.P. 240/600 revs. per min., 230 V.

10-IN. STRIP MILL (Finishing Mill).

Induction motor 2 500/2 080/1 670 H.P. at 240/200/160 revs. per min.

Regulating set 750 revs. per min., comprising a 375 kW a.c. commutating machine and a 510 H.P. induction motor.

The main mill motors are of the usual three-phase induction type with polyphase wound rotors, the stator winding being primary and the rotor windings secondary. When voltage is applied to the primary windings, as is well known, the alternating currents in the various coils produce a magnetic field which revolves at a speed depending on the frequency and, inversely, on the number of poles. In the secondary windings, which are cut by this rotating field a voltage is generated which is of maximum value when the rotor is stationary, whilst the frequency is exactly the same as that of the primary. The currents which flow in the secondary windings will exert a torque which causes the rotor to turn in the direction of the rotating field at a speed which will increase only with a corresponding decrease in the voltage and frequency of the secondary circuit. The rotor speed will increase until a definite speed is reached, when the voltage is only just sufficient to send the current through the impedance of the windings to develop the required torque.

If the load remains constant (normal conditions being assumed) and the speed is reduced by the usual method of inserting resistance in the secondary circuit, then, at any definite speed, the voltage and frequency are practically proportional to the slip (stated as a percentage of synchronous speed). If, instead of employing an external resistance, a constant voltage, at rotor frequency, is used to oppose the secondary voltage, the speed of the rotor will adjust itself to such a value that the secondary voltage will exceed the opposing voltage only by an amount equal to that necessary to send sufficient current through the impedance of the circuits, to develop the required torque. If the opposing voltage is adjustable, the speed of the main motor may be changed by varying the opposing voltage.

Function of Regulating Set.

It is the function of the regulating set to provide a source of adjustable voltage which may be imposed on the secondary windings of the main motor, and, in this manner to economically adjust the speed of the latter, either above or below synchronous (free-running) speed, independent of the load. The field excitation is obtained from a field control transformer provided with a number of taps adjusted by means of a master switch. With this source of excitation but with power-leads open, and when running at constant speed, the induced voltage of this regulating machine will remain constant, but, in the case of the mill motor, the induced voltage and frequency will vary proportionally with the departure (regulation) from synchronous speed.

If, under the circumstances described above, the terminals of the regulating motor are connected to the slip-rings of the main motor, any difference between the induced voltages of the two machines would circulate a current through the rotor windings of the main motor and produce in conjunction with the field of the main motor a torque therein which, in turn, would tend to adjust the speed of the latter to a value corresponding to that at which the induced voltages of the two machines are equal.

The speed of the main motor will vary slightly with the torque—i.e., the greater the torque demanded by the mill the greater is the departure from synchronous speed (the speed at which the induced voltages of the two machines are equal).

The regulating machine consists of a completely compensated shunt-wound three-phase, a.c. commutating machine, equipped with interpoles and directly coupled to a squirrel-cage induction machine. The function of the squirrel-cage motor is to maintain a practically constant speed for the regulating machine; acting as a motor and drawing the necessary current from the line when the mill motor is running

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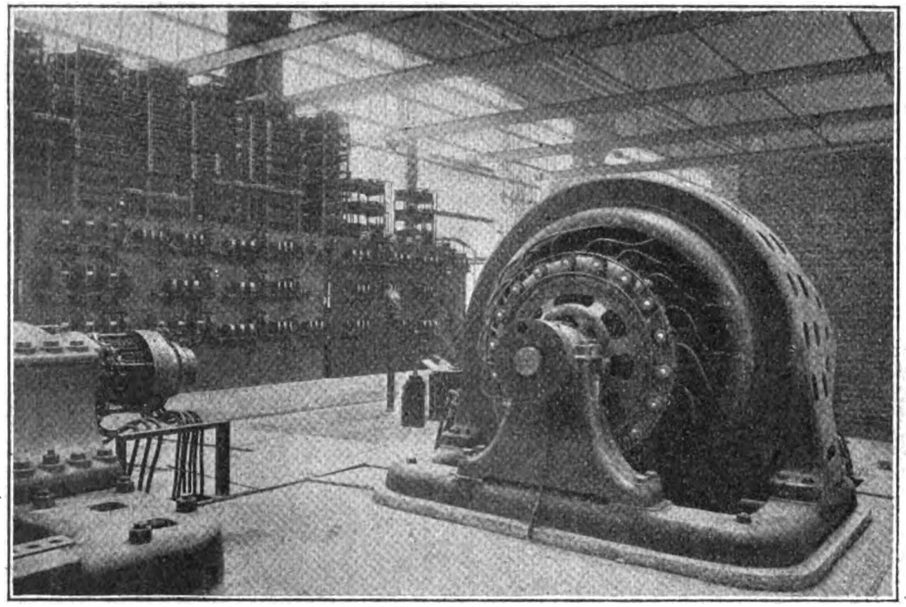
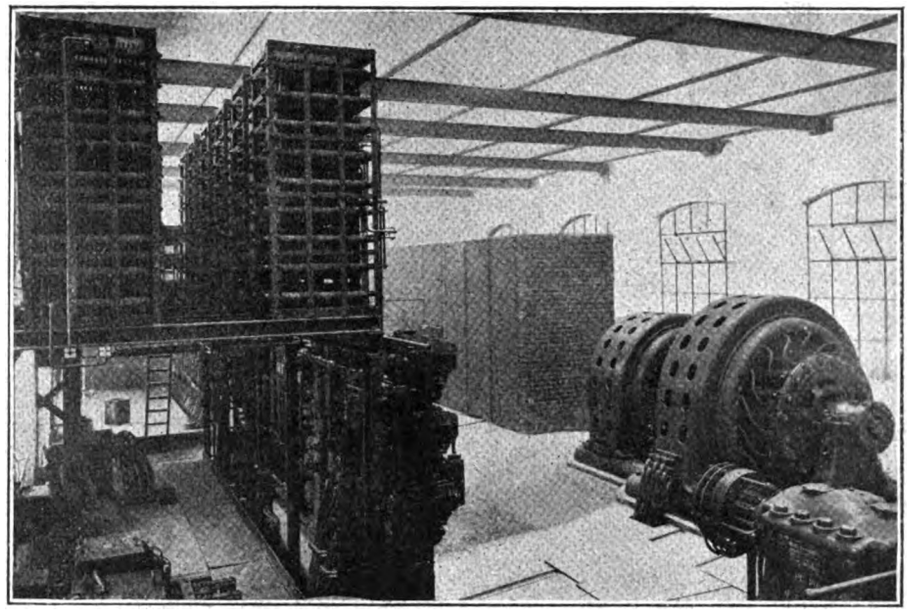
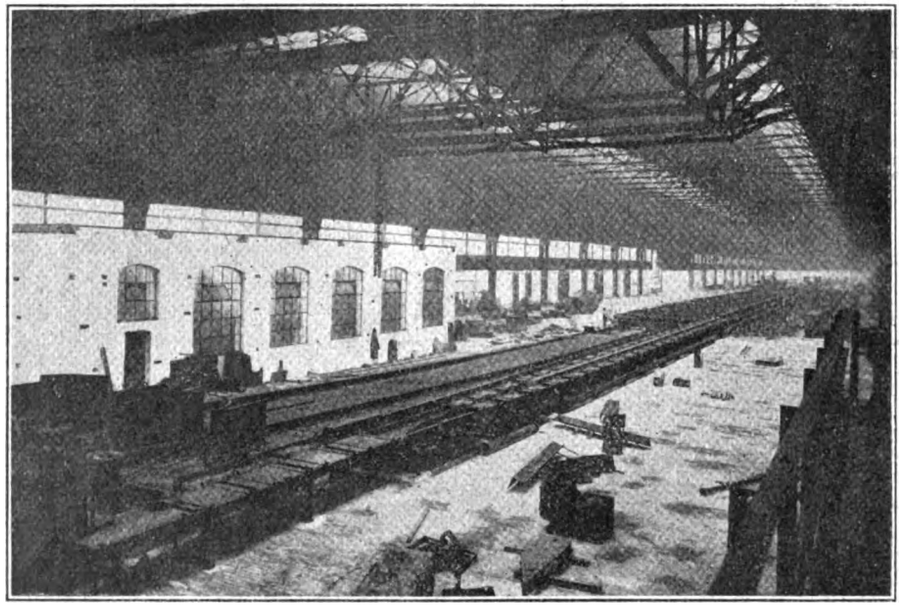
VIEWS IN STEEL, PEECH AND TOZER'S ELECTRICALLY DRIVEN MILL.







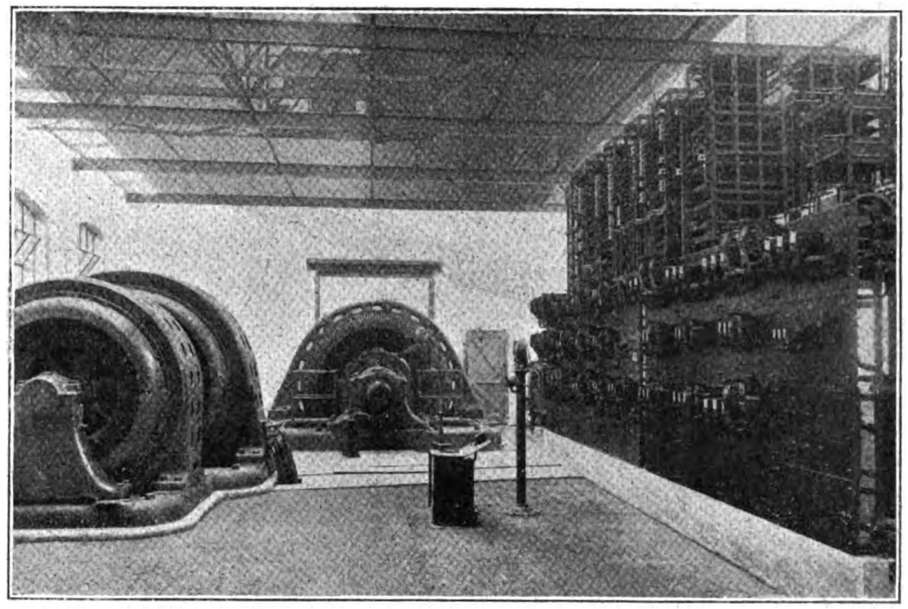


FIG. 1.—VIEW OF 12-IN. CONTINUOUS MERCHANT MILL MOTOR HOUSE SHOWING CONTACTOR, CONTROL AND REGULATING SET.

FIG. 3.—GENERAL VIEW OF MILL SHOWING COOLING BEDS.

FIG. 2.—VIEW OF THE CONTACTOR CONTROL BOARD.

FIG. 4.—VIEW IN THE MOTOR HOUSE SHOWING MAIN MOTOR.

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above synchronous speed and, being driven as a generator and returning energy to the power system when the mill motor is operating below synchronism. When the squirrel-cage machine is acting as a motor, under the conditions described above, the regulating machine is driven as a generator, supplying energy to the slip-rings of the mill motor and, when the squirrel-cage machine is acting as a generator, the regulating machine operates as a motor by power transmitted from the mill motor slip-rings. The regulating machine will operate with either phase rotation at all frequencies up to the maximum and also with direct current. A second source excitation at exact slip-ring frequency and phase rotation at all times is provided by a commutator frequency changer (called the ohmic drop exciter).

Ohmic Drop Exciter.

The ohmic drop exciter has the property of giving a constant voltage with a varying frequency, the frequency always being exactly the same as that of the secondary circuit of the mill motor. The armature of this exciter is mounted on the mill motor shaft, and resembles the armature of a rotary converter, having both commutator and slip-rings. The field punchings, which surround the armature, are without slots or windings, and the commutator, being usually designed to handle three-phase current, is supplied with a multiple of three sets of brushes. The slip-rings of the exciter are connected to the power main lines through a transformer which is so designed that it gives a suitable voltage necessary for exciting the regulating machine.

At any speed the voltage generated is constant, and alternating current is delivered from the brushes at a frequency equal to the slip frequency of the mill motor. It should be observed in this connection that alternating current at zero frequency is direct current.

If the armature is driven above synchronism the magnetic field will rotate in an opposite direction, and the machine will deliver alternating current, the phase rotation of which will be reversed in comparison with that obtained when operating below synchronism.

When operating at any speed other than synchronism, alternating current will be supplied to the field windings of the regulating machine, and except at speeds near synchronism the inductance of the field windings will then preponderate over the resistance. As synchronous speed is approached the excitation supply from the main motor slip-rings gradually decreases until, at synchronism, it becomes zero. It is when near to and at synchronism that the ohmic-drop exciter is brought into service for excitation purposes, and it should be noticed that at synchronism direct current will be supplied by this machine. The regulating machine field at such periods will have resistance preponderating over inductance, and the value of the exciting current can be adjusted by altering the amount of resistance in series with the ohmic-drop exciter.

Necessary Plant.

In addition to the machines described above, the following plant is necessary to complete the electrical equipments for this system :—

Field control exciting transformer.

Interpole transformer for use with regulating set. The function of this transformer is to correct the excitation for the interpole windings on the regulating motor in such a manner as to keep the magnitude and phase relation correct at all values of load for the regulating range.

H.t. transformer for use with the ohmic drop exciter.

"Bulging" transformer for use with regulating set. The purpose of this transformer is to improve the power factor of the main machine when running on load. It provides, above synchronism, a compensating voltage of the correct phase relation and magnitude to overcome the inherent inductive voltage drop in the regulating machine which would otherwise lower the power factor.

Main contactor equipment with resistance for starting the main motor and including the necessary contactors for connecting the regulating machine and ohmic drop exciter in circuit when required.

Field control contactor equipment, for use with the field control exciting transformer, for obtaining the various speed points. This equipment includes the field reversing contactors, necessary master controllers, interlocking contactors, selector switches, push buttons, etc.

H.t. switchgear with auxiliary transformers.

From this list it will be seen that the main circuits are entirely controlled by contactor gear, operated by master controllers, and this equipment, which is reversible, in addition to giving the necessary starting-points, also provides both a plugging point for use in emergency and speed-regulating points for use in emergency and speed-regulating points above, at and below synchronism. The high-tension switchgear and transformers are housed in brick cell work and are controlled from a switchboard mounted in front.

The main motors, which are illustrated in Fig. 4, are of exceptionally heavy and rigid construction, and incorporate means of adjustment of the stator, both vertically and horizontally, at right angles to the shaft, for adjustment of the air gap and for moving the stator in a direction at right angles to the shaft for repairs.

Contactor panels and master controllers, as previously mentioned, are used for starting up and regulating the speed of the main induction motors both above and below synchronism, the master controllers being so arranged that the operator can control the three mills, roughing, intermediate and finishing, from a single pulpit. This pulpit is situated in full view of the loop between the roughing and finishing stands, and the operator can thus control the length of the loop as required, and is also in a position to shut down the mill, in emergency, in the shortest possible time if such occasion should arise.

The contactor panels provided for starting the main induction motors of both the roughing and finishing mills are of the usual type, and consist of a number of starting contactor switches controlling grid resistances which are inserted in the rotor circuits of each machine during starting, the closing of these contactor switches being under the control of current limit relays. The operator, if he desires, can start up the mill slowly by advancing the master controller one point at a time, but if the controller be thrown hard over the contactor switches will only close at a predetermined rate, the amount of current drawn from the line being regulated within definite limits by the current relays.

Speed Control Arrangements.

The speed-control panels provided for the two main motors differ somewhat in arrangement, that for the finishing mill being provided with a manual operated master-controller for giving the required speed changes, whereas the speed control of the roughing mill motor is governed by a remote control master-controller, the operator only moving a small pilot switch in the required direction to actuate the motor-driven controller. This motor-driven controller is so arranged that it must travel a complete step, even though the operator may release the pilot switch before the controller has had time to complete full movement to the next notch. Indicating lamps are provided to show the direction of movement of the motor-driven controller, whether raising or lowering the speed, and for indicating also whether the controller has completed its movement to a running notch.

A transfer switch, situated on each of the starting panels, enables the operator to set the control for "regulating" or "non-regulating" running of the main motors; if the switch is set in the non-regulating position, the last of the series of rotor contactors is arranged to short circuit the rotor, when the machine is up to speed, leaving it operating as an ordinary induction motor. If, however, the switch is set in the "regulating" position, the main induction motor, when up to speed, is automatically connected to the armature of the regulating machine, but provision is made that this connection cannot be made unless there is no excitation whatever on the regulating machine.

If the operator desires to run the main motor above synchronism, all that is necessary is to move the regulating controller one point at a time in the desired direction and, on the other hand, if he wishes to run the motor below synchronism, the same master-controller handle is moved in the opposite direction. The contactors on the regulating panel, which are controlled by the master-controller, merely change the excitation on the regulating machine, to give the required voltage variation which will produce the desired speed.

The strip and merchant mills are each entirely controlled by one operator and, although the system of control is somewhat difficult to describe briefly, the actual operation of the mills is extremely simple. The apparatus, also, is so interlocked electrically that it is quite fool-proof, there being no possibility of damage even if the wrong sequence of operation is attempted. Emergency push-buttons, both on the operators' table and in the mills themselves, enable the main motors to be shut down instantly whenever required.

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RAILWAY ELECTRIFICATION.*

Notes on the Equipment and Traffic Conditions on the French Midi Railway.

By A. BACHELLERY, Ingenieur-en-Chef, Chemins de Fer du Midi, France.

The Midi Railway of France extends in the southernmost part of that country from the Atlantic Ocean to the Mediterranean—amongst the snow-covered Pyrenees, and across the Cévennes district, a very wild, picturesque and mountainous country. Several of its lines have very steep gradients grades over 3 per cent. being not infrequent. Difficulties in working with steam locomotives and the close proximity of water power naturally led to consideration of electric traction in 1902. The company then constructed a narrow-gauge line, 35 miles long, from Villefranche-de-Conflent to Bourg-Madame, in the eastern Pyrenees, a single track line climbing to an altitude of 5 000 ft., with long 6 per cent. grades and curves of 200 ft. radius. The chosen system was direct current, third rail, at 850 V, the highest direct current voltage then used in Europe for traction.

The motor-cars and trailers were fitted with Sprague multiple-unit control. The line was opened in 1910, and has since worked well. An annual return of 5 000 francs per mile was considered optimistic. It is actually 40 000 francs, although the fares have been increased only from 100 to 150 per cent.

Trials of the Single Phase System.

Electrification of lines of normal gauge on two lines crossing directly through the mountain chain into Spain was next considered. In order to test the single phase system the company equipped 15 miles of line between Ille and Villefranche-de-Conflent with 16 cycles, 12 000 V on the contact wire. Six different systems of overhead construction and six locomotives, built by different constructors according to the company's requirements, were tested, and three of the latter were accepted.

It was decided to apply the single phase system to 70 miles of double track between Pau and Montrejeau, and the single track branch lines of Pierrefitte, Bagnères-de-Bigorre, Arreau and Luchon, measuring 63 miles. A power house was built at Soulom and contained six 2 500 kW generators. Orders were also placed for 30 motor-cars, each of 500 H.P., and for 24 new locomotives. Tests revealed trouble in the telegraph and telephone lines along the track, due to inductive interference. This was removed by two extra wires run beside the trolley wire, namely: (1) A negative feeder along which the return current is forced by means of booster transformers, instead of going back through the track rails; (2) a counter-voltage wire in which there is an alternating voltage directly opposed to that in the trolley wire.

The outbreak of war brought these experiments to a standstill, and it was only after the armistice that the company could resume work. Meantime the French Government had decided to standardise for electric railways, both the primary current and the traction current, so that different power plants could work in parallel, and locomotives could be used indiscriminately on all electrified lines. A Commission was appointed by the Ministry of Transport and reached the conclusion that 1 500 V d.c. system should be standardised.

The company set to work immediately on the alterations and on a new programme of electrification, exemplified in 1922 by the first French 1 500 V direct current locomotives in the western part of the Midi system. The Toulouse-Dax line is to be entirely equipped this year, and is already partly run by electricity. Other developments are in prospect, the whole length of road to be electrified in the next 10 years being nearly 2 000 miles. Current is produced in two hydro-electric stations at Soulom and Eget, the first equipped with 21 000 H.P. and the second with 35 000 H.P., this last from a fall 2 300 ft. high. In addition, the Midi Co. is building on the Gave d'Ossau three new power stations equipped for 130 000 H.P., with falls ranging from 600 to 2 500 ft. Other power plants in the central and eastern Pyrenees are under consideration.

The current produced by all these plants is three-phase, 50 cycles, at 60 000 V. Part is transformed to 150 000 V for long-distance transmission. Thus total length of lines to Bordeaux and Toulouse is actually 420 miles. The longest distance between step-up and step-down transformers is 175 miles. Lines are also designed to furnish energy for numerous power plants all working in parallel.

Each line, designed to carry from 30 000 to 50 000 kW. It consists of three copper cables each of 283 000 circular mils section. A steel earth wire is provided for protection. Cables are suspended by insulator chains of 9 plate-type elements from steel towers 66 ft. high and normally 660 ft. apart. Transformation from 60 000 to 150 000 V, and *vice versa*, is carried out in two-step-up stations, equipped for 60 000 kW, and in three step-down stations equipped for 80 000 kW. The latter are provided with sychronous condensers of 60 000 kVA total capacity. All these stations are of the outdoor type. Sub-stations for converting three-phase current to direct current are built at distances varying from 8 to 20 miles, the drop in the line voltage not exceeding 20 per cent. under normal service. Different types of converting apparatus have been used. Besides the classical groups of two 750 V rotary converters connected in series, some sub-stations have 1 500 V 750 kW rotary converters as single units. These are believed to be the first machines of this type wound for 50 cycles. They have been entirely successful, and can withstand 200 per cent. overload during five minutes, without flashing over.

The newest feature, however, is the use, in some sub-stations, of mercury rectifiers producing 1 500 V direct current. Five sub-stations have been thus equipped, containing 16 groups each of 1 200 kW. Each group consists of a pair of cylinders connected in parallel, and fed with 12-phase current produced by special transformers. The efficiency of these machines is high, and is practically independent of the load. Their overload capacity is equal to that of the rotary converters. Being static machines, they require little attendance. No difficulty is found in keeping the vacuum in the cylinders. The current generated, although slightly undulating, is well withstood by the traction motors. All sub-stations possess high-speed circuit breakers on each group. High-tension apparatus such as transformers and oil switches is usually placed out of doors.

The line equipment is of the double-catenary type, i.e., a steel messenger cable, an auxiliary messenger, and a contact wire, both made of 4/0 S.W.G. grooved copper. The distance between the supports varies from 300 ft. on straight sections to 150 ft. on curves under 2 600 ft. radius.

Various kinds of supports have been tried. The bracket type is generally used on single track, and in some cases for double track, with either steel or concrete poles. Chain insulators are used for the high-tension line, as far as clearance considerations allow. For d.c. lines, double insulation is the rule, either by rigid or suspended insulators, the latter being preferred.

High Tension Line Protection.

The high-tension lines are protected by selective relays and oil switches, which cut out automatically any section where a breakdown occurs. The system is earthed at one power house at the neutral point of a transformer. It is protected against pressure-rises by earthed reactance coils with iron cores, and against steep-front surges by Capart apparatus (mica condensers branched between two inductive coils, one shunted by a resistance). Direct-current machines in the sub-stations are also protected by inductive coils and by an earthing device composed of a condenser shunted by a resistance. Track bonding has been the object of much discussion. Short copper bonds, made either of cable or packed strips, connecting each end of the fish-plate with the corresponding rail, seem to give the best results.

The different lines to be electrified present diverse features. Nevertheless, the number of types of locomotives has been limited to four. The first electrical equipments were made in the English Electric Co.'s works at Preston, succeeding ones in the Lyons works of the Société des Constructions Electriques de France. The first two types of engines are a passenger and a freight locomotive, similar except for the gear ratio. They are mounted on two 4-wheel motor trucks. Each of the four axles is driven by a geared nose-suspended motor. These motors, of Dick-Kerr design, with 4 poles and commutating poles, are wound for 1 500 V. Under forced ventilation, their one-hour rating is 350 H.P. and

* Abstract of a paper read before the Institution of Electrical Engineers.

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their continuous rating 250 H.P. The total weight of the locomotive is 72 tons; and the speed limits are 55 miles per hour for the passenger engine and 40 for the freight engine. The motor control is the Dick-Kerr cam-shaft multiple-unit system. Different speeds are obtained through series-parallel and field-shunting combinations.

Standard Locomotive Drive.

Low-tension current for auxiliary service is produced by a 72 kW group, including a 1 500 V motor, two direct-current generators and two fans for ventilating the traction motors. One generator produces 120 V current for control circuits, train lighting and for feeding the air compressor. The second is a variable-pressure dynamo used for exciting the motor fields when regenerative braking is in action.

Owing to this arrangement the locomotive has but one auxiliary 1 500 V motor, which is an advantage, this being, as is well known, the delicate part of high-tension direct-current equipments.

Each motor drives its axle by two symmetrical gears. In order to avoid axle breaking, each gear wheel, instead of being mounted on the axle, consists of a cogged rim bolted on to the truck wheel-centre. The locomotive is equipped with both the Westinghouse automatic air brake and a straight air brake. An electric brake is also provided, which works on the regenerative principle. However, the saving of energy resulting from regenerative braking is small and does not justify the complication, and it has been abandoned for the future and rheostatic braking adopted in its place. Electric braking is to be used for going down long grades, so as to save the wear of brake shoes. The current-collecting apparatus has been designed with special care, in order to obtain a smooth contact and to avoid sparking. It consists of a pantograph fitted with ball bearings at each joint. Passenger trains are lighted and heated by the current obtained from the locomotive through special couplers. Heating is provided by 1 500 V current from the line, supplying radiators placed under the seats in the car compartments and protected by steel tubes and perforated steel plates. The freight locomotive is to haul trains up to 1 800 tons on the level. On mountain lines, this same engine can haul a 185-ton train on a 4 per cent. grade. A helping engine at the rear will be normally used on these lines. The motor-car for suburban and branch-line services is carried on two 4-wheel bogies of the swinging bolster type. Each of the four axles is driven by a series of nose-suspended geared motors. These motors are wound for 750 V and are connected two in series. They are self-cooling. The continuous rating of each is 125 H.P., and the one-hour rating 175 H.P. The maximum speed is 50 miles an hour.

Each axle has only one gear, similar in construction to those on the locomotives. The car is entirely of steel. The total weight of the vehicle is about 52 tons and the number of seats is 48, with 32 standing passengers.

Those three types of machines are sufficient to haul any kind of train either on mountain or level lines, up to 50 miles per hour; but for higher speeds a special type of express locomotive had to be designed.

The Midi Company has kept, for its high-speed locomotives, to the geared type, but with entirely suspended motors and quill drive. The particular feature is the use of a conical gear, which allows smaller pinions and a lower peripheral speed and, moreover, is easier to lubricate than a straight gear.

The six motors for this new type of engine are wound for 500 V and are connected three in series. They are 4-pole motors (2 active and 2 consequent poles) with commutating poles. The one-hour rating of each is 375 H.P., that is, 2 250 H.P. for the whole machine.

The machine has been tested up to a speed of 78 miles per hour, and keeps perfectly steady on the track, without any nosing. This experience may cause some surprise, but it is believed that it will reverse the verdict recently expressed against locomotives with a symmetrical wheel base.

This machine has been so designed as to avoid the three chief defects which have to be guarded against. It has a rigid wheel-base 13 ft. long, which keeps it steady on the track. The trucks are elastically centred through side springs; and, owing to the raised motors, which are set inside the cab, the height of the centre of gravity is similar to that on a steam engine.

This type has been adopted for a series of express machines which are being built for level lines; but a new and more powerful machine of similar construction with four driving axles and a normal rating of 3 200 H.P. is already under consideration. It will pull on the level a 600-ton train at 60 miles an hour, or a 380-ton train at 70 miles.

Although electric traction is already in use on 140 miles of the system, it is still too early to give figures as to its cost, as only 37 miles are being worked under standard conditions, whilst several hundreds of miles are under construction. Nevertheless, in many ways electrification has so far proved profitable. Drivers of electric locomotives get lower wages than steam locomotive engineers, yet their daily run is 30 per cent. longer, on account of less time being spent for engine-shed operations. The machines cover daily about 2.5 times the distance covered by a steam engine, which more than compensates for their higher price. The cost of hydro-electric energy is naturally much less than that of the coal it saves. Important economies are also realised on engine-shed and repair-shop expenses. Electric locomotives require much less labour for their maintenance than steam locomotives. Many daily operations, such as coal and cinder handling, water pumping, tube blowing, boiler washing, etc., are entirely eliminated, and repairs are greatly simplified through the suppression of the boiler and much mechanism.

Although most of our electrification work has been done under unfavourable price conditions, there is every reason to be confident that the operation will prove profitable. A strong support to this belief is the rapid increase in traffic and revenue on the electrified lines, consequent on faster and more frequent trains. Yet the technical advantages of electric traction are still more certain than the economical ones. It allows, especially on mountain lines, a higher commercial speed. For instance, on the main line from Bayonne to Toulouse, there is a grade of 1 in 30, 7½ miles long, which takes an express hauled by a steam locomotive 34 minutes to climb. The same train hauled by an electric machine gets to the top in 13 minutes. On the Transpyrenean lines long grades of 4 per cent. will be mounted by passenger trains at a speed of 25 miles an hour, whereas it is doubtful whether steam engines could work any effective service on such a line.

Even on level lines train schedules can be made quicker on account of a more regular and uniform speed being maintained by the electric locomotive, and of the suppression of those stops which are necessary only for taking in water. On the Bordeaux-Hendaye line, where the maximum grade is 1 in 200, our fastest train, the Southern Express, actually covers the 92 miles from Bordeaux to Dax in 1 hour and 49 minutes. With an electric locomotive it will run at an average speed of 65 miles, and gain about 25 minutes on the present schedule.

Better Service Possible.

Trains can also be made more frequent without prohibitive cost. During the war, when the strictest economy prevailed and the daily number of trains was reduced, on a great many of our lines, to two in each direction, four or five trains in each direction on the electrified lines could always be maintained without extra expense. The present programme is to establish around the mountains or seaside resorts a service of light and frequent trains similar to a suburban service, and this can only be accomplished by electric traction.

From the traveller's point of view, the suppression of smoke and cinders is naturally also a great improvement. This is particularly the case with lines such as the Transpyrenean running through tunnels several miles long. Electric traction will also prevent the costly forest fires which are started by locomotive sparks in the forest properties along the railway.

One of the greatest advantages, however, to be found in railway electrification as carried out in France is the construction of a close network of electric transmission lines. In many extensive agricultural areas the demand for electrical energy could scarcely justify the high expense involved in long transmission lines. On the other hand, a great many railway lines, on account of limited traffic, require only a small proportion of the current which the high-tension wires can carry, and this condition in general corresponds to cases where electrification could not be economical. In many cases the combination of these two unprofitable operations makes a profitable one, and the result will be not only to improve railway service considerably, but also to bring cheap electric current to every town and to a large number of small localities. While the 150 000 V main transmission lines supply large centres such as Bordeaux and Toulouse, the 60 000 V wires that follow the railway everywhere and feed step-down transformers in sub-stations spaced some 15 miles apart will leave but little to do in order to build distribution systems covering the whole country.

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MODERN STEEL WORKS ELECTRIFICATION.

Some "English Electric" Equipments Illustrated.

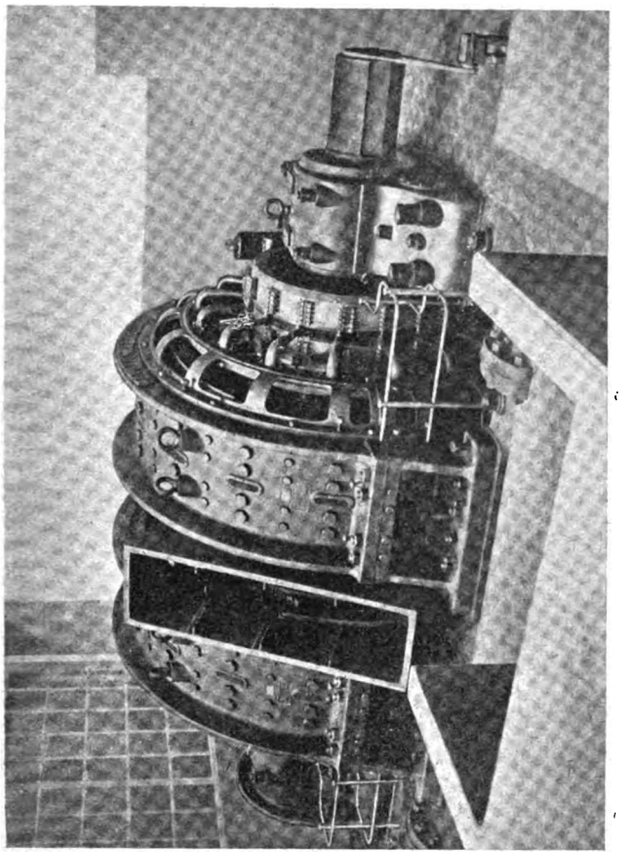

FIG. 2.—12 000 H.P. PEAK REVERSING MILL MOTOR, DRIVING 36 IN. COGGING AND TIN BAR FINISHING MILL, SPEED 0/60/120 REVS. PER MIN

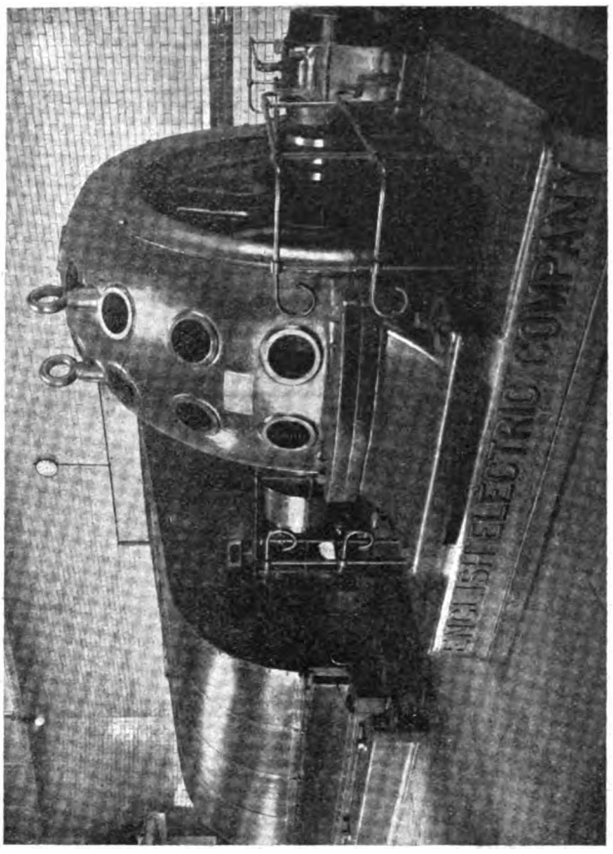

FIG. 4.—1 800 H.P. 2 750 V THREE-PHASE 40 CYCLE, 200 REVS. PER MIN. INDUCTION MOTOR DRIVING SHEET MILLS THROUGH ROPES.

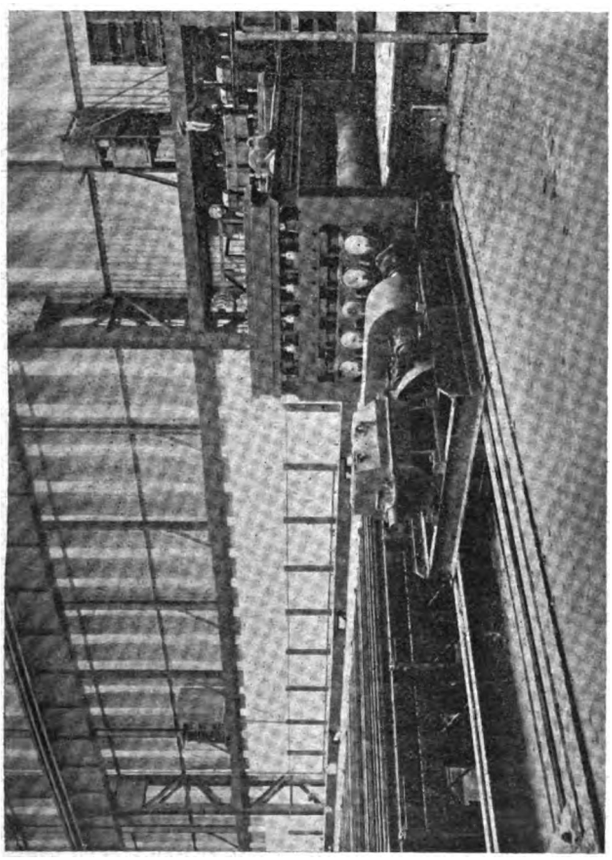

FIG. 1.—100 H.P. ENGLISH ELECTRIC MILL TYPE MOTOR DRIVING PLATE MANGLE.

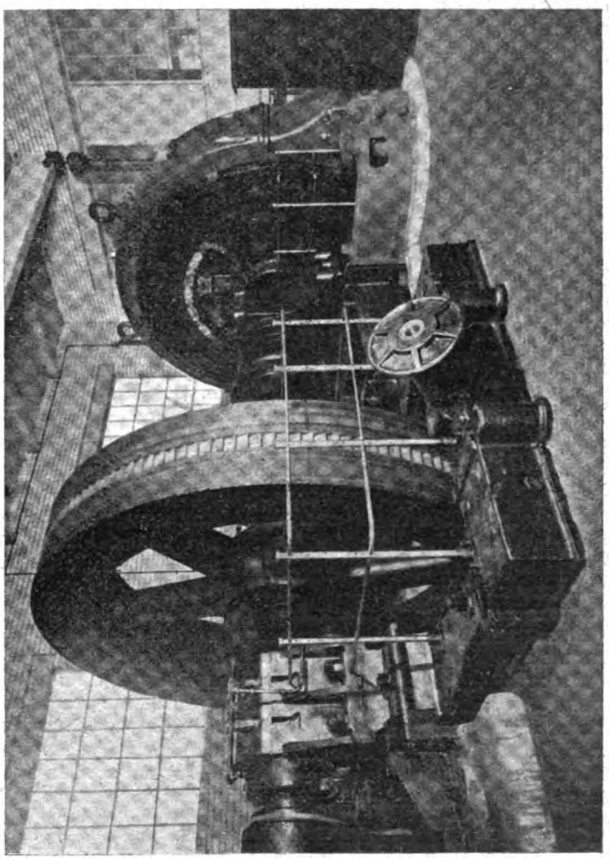

FIG. 3.—2 000 H.P. 460 V VARIABLE SPEED D.C. MOTOR 80/160 REVS. PER MIN., DRIVING 14 IN. MERCHANT MILL DIRECT.

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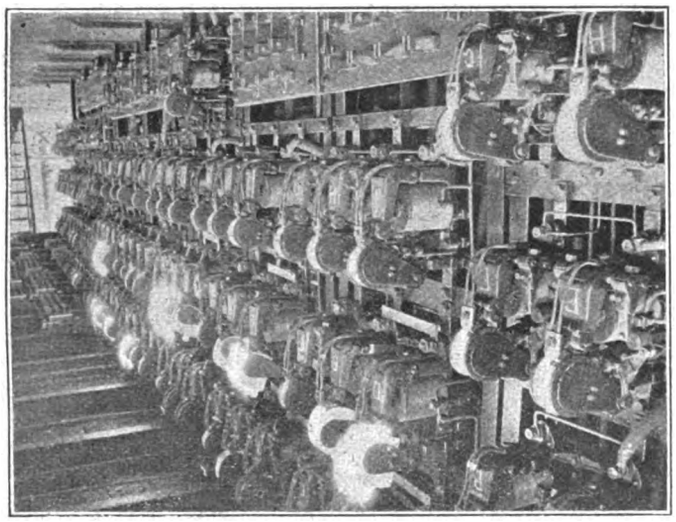
CONTROLLERS FOR STEEL MILLS.

Details of Automatic Contactor Equipment for Auxiliary Plant.

Steel works engineers are not all agreed as to whether alternating or direct current is most suitable for driving their auxiliaries. Each system has its advantages, but whichever is preferred, the severe service and frequency of operation necessitate the use of automatic controllers.

Control gear specialists with experience of steel works practice have long since realised that the ordinary commercial type of automatic controller, even of the so-called heavy duty pattern, is not suitable for steel works service. The conditions are exceptionally severe and demand a controller specially designed to operate satisfactorily against the heavy loads, the frequent operations and the rough handling, and with that adequate margin of reliability which is essential to the steel works engineer. Very often auxiliaries such as live rolls have to operate as frequently as 600 times an hour, starting and accelerating the motor from rest to full speed against heavy starting loads. Maximum torque is usually required at the moment of switching on, and the necessity of rapid reversals under such conditions imposes severe tests on both the motor and the controller.

Contactor type control gear is now universally adopted in all modern steel works and a typical installation of direct current contactor controllers operating auxiliaries is shown in the above illustration. The controllers were manufactured by



A Contactor Installation for the Automatic Control of Steel Works Auxiliaries (Electric Control, Ltd.)

Electric Control, Ltd., of Glasgow, and form part of an installation of over ninety controllers, some of which were for alternating current motors. The order for these controllers was obtained in the face of severe competition, American as well as home manufacturers being specially keen to secure the contract, which was for one of the largest steel works in the war devastated area.

A glance at the illustration will at once convey the mechanical robustness of the apparatus. The contactors are mounted on massive square steel bars insulated with mica, no slate being used. This form of mounting, besides considerably reducing the dead weight and making the arrangement of the controllers very compact, renders them and their connections far more accessible. The current accelerating relays are combined with the magnetic blow-out coils, which further reduces the space occupied and at the same time simplifies the design.

The operating coils are liberally designed to withstand full voltages so that no series or economy resistances are used. The method of fixing the coils to the contactor is specially rigid, the coils being supported on a strong base of insulating material. The armatures are of cast steel of massive construction and so balanced as to entirely eliminate any tendency to rebound. The bearing of the armature is solid and of exceptional length. The contacts are of hard drawn copper and both moving and stationary contacts are the same shape and size. On closing they touch at the tips first and the moving contact then rolls over the fixed one until, when finally closed, contact is made along a line lower than the original line of contact. By means of a special torsional spring the pressure on the contacts remains the same even after the contacts are considerably worn after long service. When opening, the contacts roll in the opposite direction so that the arc is broken at the tip. From life tests carried out, it requires over two million operations to reduce the contacts from $\frac{1}{16}$ to $\frac{5}{32}$ in.

Very powerful magnetic blow-outs are employed, the shields being lined with a special arc-resisting material and arranged to swivel upwards to allow of easy inspection of the contacts. The double round flexibles are of new design.

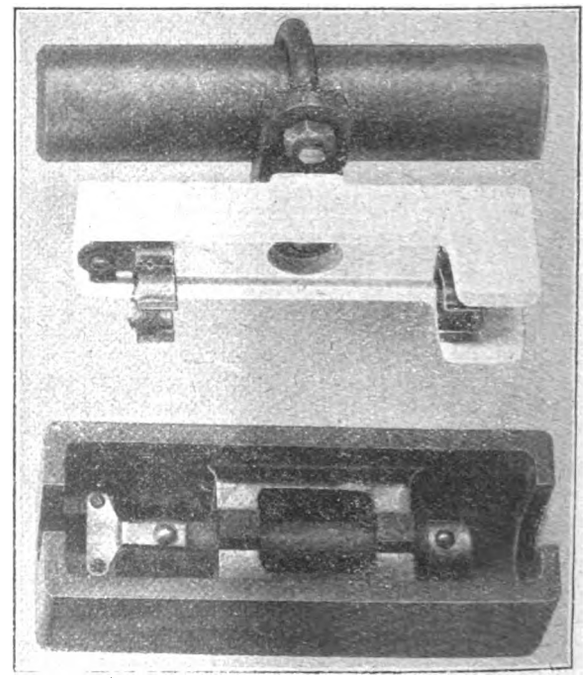
A glance at the relay interlocks, some of which are clearly seen on the left hand side of the photograph, will reveal the strong mechanical arrangement employed. The clever design, which ensures perfect contact at every stage and also enables the point of contact to be changed round as required, brings the interlocks into line with the massive construction of the rest of the controller.

The manufacturers have aimed at reducing the number of moving parts to a minimum and to produce a controller which provides a maximum of reliability for the extremely severe duty of controlling steel works auxiliaries.

POTENTIAL TRANSFORMER FUSES & FUSE BLOCKS FOR INDOOR USE.

The Westinghouse Electric and Manufacturing Co. has placed on the market a line of enclosed cartridge type potential transformer fuses and fuse blocks for voltages from 2 500 to 25 000 V for the protection of indoor potential transformers. They can also be used to protect circuits where the current does not exceed 0·5 A.

The fuses can be employed without preventive resistances in locations where the maximum short-circuit current does not exceed the interrupting capacity of the fuse. When a preventive resistance is used the short circuit current will be limited to a value within



A 2 500 V Fuse Block opened to show the Method of Mounting.

the interrupting capacity of the fuse. For 15 000 and 25 000 V service the same fuse is used, with a different preventive resistance to limit the current and a different fuse base for each of the two voltages. The 2 500 V fuse base is provided with a cover of moulded insulation which holds the fuse and provides for its safe handling. The higher voltage bases use corrugated post type insulators.

Some of the special features of these fuses and fuse blocks are their high interrupting capacities, strong non-absorbent fibre casings, and provisions for the proper venting of gases.

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INSTITUTION OF ELECTRICAL ENGINEERS.

There was a crowded meeting on Thursday, November 22nd, to hear the paper by Mr. A. Bachellery, chief engineer of the Midi Railway Co. of France, on the extensive electrification scheme which that company has in hand. This paper is given in abstract on p. 610 of this issue. In opening the meeting the President announced that the French Government had awarded to Mr. C. H. Wordingham and Mr. W. Noble Twelvetrees, past-presidents of the British Section of the Société des Ingénieurs Civils de France, the diploma of Officier de Public Construction. Unfortunately, Mr. Wordingham—who had been unwell—was not present.

Mr. T. J. GUERITTE, another past-president of the British Section of the French Institution of Civil Engineers, in presenting the diploma to Mr. Twelvetrees, said he had received a letter from the French Ambassador explaining that the French Government had been following with great interest the work of certain British engineers in establishing an *entente* between British and French engineers and was desirous of recognising that work.

Discussion.

Lieut.-Col. H. E. O'BRIEN said that one of the first lessons to be learned from the paper was that what had been done in France in the way of standardising railway electrification should be an example to us in this country. The French electrical industry had grasped the problem boldly and had come to definite decisions on what to do. It was to be hoped that we should follow their example. Although railway electrification in this country had a definite scope, that scope had as yet been but dimly appreciated by railway managements. Some information with regard to the working of the mercury arc rectifiers and the large single unit rotary converters and their relative economic results would be valuable. Another important problem was the cost of current. This was obtainable from water power and the cost would therefore become cheaper as larger quantities were used, whereas in our case the cost would not fall in the same ratio.

Mr. E. M. MALEK said that in the present scheme the French had scrapped everything they had done before and had taken in hand not only the railway electrification but the transmission of power for industrial purposes. They had been able to design and produce structural material of less weight almost than anybody else and with extraordinary cheapness and efficiency.

Lieut.-Col. F. A. CORTEZ LEIGH remarked that the method employed of preventing inductive interference with communication currents was interesting, but he would be glad to know whether the cost was cheaper than the cost of the method adopted on the Swiss railways. Seeing that overhead collector gear had been adopted, why was not a higher voltage than 1 500 V decided upon? Then it was stated that the 60 000 V transmission lines were carried on the same supporting structures as the collector wires. It would be interesting to know whether any difficulties had been experienced with the communication circuits for this reason. Reference was made to undulations in the voltage due to the use of the mercury arc rectifier, and he would like to know whether this had caused any interference with the telephone and telegraph circuits. On the L.M. and S. Railway the experience with regard to bonding had been the reverse of the author's, the long bond being found the most effective. The use of only one motor on the locomotives for auxiliary purposes seemed dangerous in case of breakdown.

Mr. STEVENS expressed his appreciation of the manner in which the French engineers had so definitely stated the voltage they would allow on the third rail. The voltage chosen was perfect as far as the safety of the public and the workmen on the line were concerned. On the Midi Railway steel earth wires were provided for protection. But did they really protect? A 20 per cent. drop in the line voltage was higher than that on the American railways. The author disregarded regeneration, but he would like to know the speed limits within which it had been possible to get regeneration on the earlier locomotives. Generally speaking, he believed that the cost of the application of regeneration was greater than the advantage, but it all depended on the nature of the line. In actual regular service the process worked splendidly, but as an emergency effect it was hopeless.

CORRESPONDENCE.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

INSULATION FAILURE.

[TO THE EDITOR.]

SIR,—Commenting on the recently published work of Wagner, Hayden and Steinmetz in your current issue, Mr. Fernie admits their general conclusions, but in view of certain experiments he has carried out, has difficulty in applying them universally. I suggest that before these results are admitted as evidence against the theory they be looked into very carefully.

The author's chief points may be put briefly as follows :—

1. The insulation resistance of some samples of dry impregnated cloth was found to be independent of temperature up to 130 deg. C. Such dielectric could not fail by the new theory.
2. No difference was found in the value of the insulation resistance at different points in a dielectric by moving a contact in the testing circuit over the surface of several samples.
3. Known partial punctures of insulation seem to show that solid insulation does not fail when the maximum gradient exceeds a critical value.
4. The galvanometer deflection, on submitting a piece of varnished cloth to unidirectional e.m.f., fell from 70 to zero in 150 hours. The initial conductivity is claimed to be due to moisture bridges which break during the electrification and produce a dielectric approaching perfection.

The full discussion of these four points would, of course, occupy much space, but I will refer to them in turn very briefly :—

1. Perfect dryness of a fibrous material at atmospheric pressure may require exposure to a temperature above 100 deg. C. for considerable time. Variation of either relative or absolute humidity of the surrounding air has considerable effect on dielectric resistance. When the temperature of a sample is steadily raised during a test the effect of electrical absorption and continued moisture loss may nullify the effect for a temperature coefficient.

If these and other important refinements have been fully considered the author's result is remarkable.

2. An average value only would be expected by the use of such a blunt instrument as a resistance box plug. I think that if the test were repeated with a fine needle the results would be quite different.
3. The maximum stress in a cylindrical condenser (e.g., a single core cable) by the logarithmic formula is at the surface of the central conductor. Can the author bring forward a single case where partial failure has occurred at the conductor only that can only be explained by the maximum stress theory?
4. Well-known absorption phenomena will explain this result. It is no evidence for or against the pyro-electric theory.

On the general thesis of Mr. Fernie's article, the dependence of dielectric strength on dielectric resistance, may I suggest in a word that as a deciding factor the dielectric losses under alternating e.m.f.'s are of much greater importance?

P. DUNSHEATH.

Research Laboratories,
W. T. Henley's Telegraph Works Co.
November 26th.

PITHEAD ELECTRICITY.

[TO THE EDITOR.]

SIR,—In view of recent statements in the daily Press, it should be pointed out that although the theorist thinks that the electrical generation of power at the pithead is the most economical way, it is not so, even if you leave out of the question the enormous cost of the electric mains and the high percentage of transmission losses for long distances. A coal mine is not a waterfall.

The ideal and economical way is to combine gas production with electric production in each large town or city, and in groups of smaller towns and villages. The by-products of gasworks, such as coke, tar, ammonia, and so on, pay the coal bill, and these products can usually be sold in the immediate neighbourhood, thus saving carriage.

Gas coke is used for heating houses, greenhouses and factories, for a large number of commercial purposes, and for motor-wagons.

The transit of coke is more costly than the transit of coal, as the former is more bulky.

I think that the facts I have given will prove that pithead production is not a practical proposition at the present time.—I am, etc., CHAS. J. MATHER.

Wellingborough, November 26th.

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NEWS IN A NUTSHELL.

"Wired wireless" is now available to 25 000 consumers in the U.S.A.

At least 300 million marks have been spent on the electrification of the Finnish countryside to date.

An electric rotary furnace for melting silver and nickel silver is, it is reported, the latest development in the Sheffield silver trade.

Hull municipal electrical workers have now withdrawn their demand for renumeration over and above the Whitley Council award.

It is proposed to grant a pension of 40 000 fr. to Madame Curie, payment to commence on the 25th anniversary of the discovery of radium.

What is to be the world's largest motor liner to be built at Belfast for the Union Castle Co., will have a very complete electrical installation.

Leeds Electricity Department is well represented at the Leeds Health and Municipal Services Exhibition, which closes to-morrow (Saturday).

We are informed that the scheme for the reconstruction and exploitation of a telephone system in Syria and the Lebanon has been postponed indefinitely.

Our electrical industry can give work to probably 100 000 additional workers if the industry is adequately developed, according to a writer in the "Daily Telegraph."

A special committee of the Independent Labour Party recommends that electric power and light for farming and for rural industries should be obtained from national power stations.

Mr. Fitzpatrick, the New South Wales Minister for Local Government, proposes to issue a bulletin containing a draft of an electricity franchise agreement, as a guide to councils.

Information as to the form of application for concessions to generate electric power in the Netherlands East Indies can be obtained on application at the Department of Overseas Trade.

Many members of the Incorporated Association of Retail Distributors are in favour of keeping their establishments open on Christmas Eve and of closing on Christmas and Boxing Days only.

A recent survey of Japanese hydro-electric resources has placed the total power available at about 8 million H.P., 1·4 million of which is in operation or under construction, and 3·3 millions projected.

The first auto-electric trailer built in this country is now being constructed for the Salvage Department of the City of Birmingham. The Department has placed 56 electric vehicles in commission since 1918.

At the annual dinner of the Kent section of the E.P.E.A., speakers expressed the determination of the Association to adhere to, and to see that others observed, the decisions and awards of the Joint Industrial Council.

French imports of electrical goods during the first nine months of 1923 were valued at 11 395 000 fr. more than in the corresponding period last year. In the same period, exports increased by 36 344 000 fr. to 170 759 000 fr.

Trouble has arisen between the Electrical Trades Union and contractors for the electrical installation at Somerset House, London, over the employment of non-union labour. The men concerned have threatened to withdraw their services.

The ratepayers of Beaufort West, Capetown, are scrapping their present electric lighting plant, which is running at a loss, and are going in for a new scheme of supplying electricity to the town, the cost to be covered for the present by the modest loan of £14 000.

Information has been received to the effect that an electric power commission overseas is considering important extensions to its plant. British firms who wish to follow the matter up are invited to apply to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, quoting the reference D.O.T./12,580/E.D./E.C.(2).

The registration of electrical contractors is to be undertaken by a concern with 100 members whose personal guarantee is limited to £5. The objects of the company are to afford the public means of distinguishing electrical contractors who have given evidence of their competency, to raise the status of such contractors, and to keep a register. The management is vested in a representative registration board.

Orders for new electric locomotives for the Mexican Railway have been placed in the U.S.A.

Electric lamps of 5 000 c.p. each have been installed in the tomb of Tutankhamen at Luxor.

The Niagara hydro-electric power station is said to have saved Ontario one hundred million dollars already.

The Metropolitan-Vickers concern is stated to have commenced work on a large electrical contract for the Russian Government.

New showroom premises acquired by the Sunderland Electricity Department will be opened during August or September next.

Of the total of 1 348 000 registered unemployed in this country at October 22nd last, 11 000 were electrical engineering and lamp workers.

The Engineers' Club has unanimously decided not to let part of the front of its premises for the display of illuminated advertisement signs.

It is reported that the State Petroleum Department at Buenos Aires is inviting offers for the erection of a central station in the Rivadavia district.

An extensive electric lighting, heating and cooking installation is included in the equipment of the ss. "Voltaire," which has just completed an official trial.

An aerial railway to be erected at the British Empire Exhibition will be driven by air screws, propulsion being either by electric motor or internal combustion engine.

The situation in Jaffa following the acceptance by the municipality of the Rutenberg electricity scheme shows signs of developing more seriously than had been anticipated.

Interviewed by a Press representative on Monday, Sir William Bragg pointed out that few people realised that electrical engineering originated at the Royal Institution.

The Tokyo Electrical Bureau is reported to have placed orders for tramcars and telegraph and telephone materials to make good part of the damage caused by the recent earthquake.

During the war America and Japan supplanted Germany as the leading supplier of electrical goods to the Netherlands East Indies, but the bulk of imports since then have again arrived from Germany.

Eagleston and Son, electrical engineers, of 78, St. Clement's and 102, The Plain, Oxford, and the Oxford Wireless Telephone Co., of 22, Queen Street, Oxford, had stands at the Oxford Trades Exhibition last week.

Mr. F. H. Hardin of the New York Central Railroad, predicts that in 25 years' time all trains will be electrically driven and controlled by automatic signals, with wireless communication between trains and stations.

Nearly 4 000 people visited the Paisley Electrical Exhibition last week. As the result of the show a large number of electric cookers and heaters has been sent out on hire. Electrical contractors who exhibited report good business.

It has been stated that 65 different bodies have the statutory right to pull up London's streets. This figure includes 15 electricity supply companies, 10 tramway companies, 28 metropolitan boroughs and the Postmaster-General.

A census of employers taken by the National Union of Manufacturers shows that work could be provided for 500 000 unemployed by the Government's tariff proposals and that eventually 1 000 000 workers would be absorbed into industry.

Addressing the Cambridge Rotary Club last week, Mr. R. C. Pierce, manager and engineer of the Cambridge Electric Supply Co., mentioned that the turbine was known in a simple form 2 000 years ago, although the first practical machine was not made until 1884.

At the November meeting of the Birmingham and District Electric Club, Mr. E. C. McKinnon lectured on storage batteries. It was shown that the many diseases from which batteries appear to suffer are caused by ignorance or negligence on the part of the attendant; seldom, if ever, by faulty design.

St. Pancras Electricity and Public Lighting Council report that all the firms tendering for the 5 000 kW steam turbine (for which the Brush Electrical Engineering Co.'s tender was accepted) required the model form of general conditions recommended by the Institution of Electrical Engineers to be incorporated in the contract.

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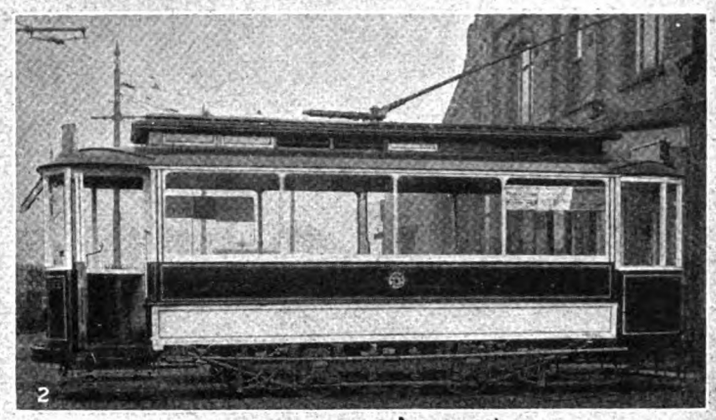

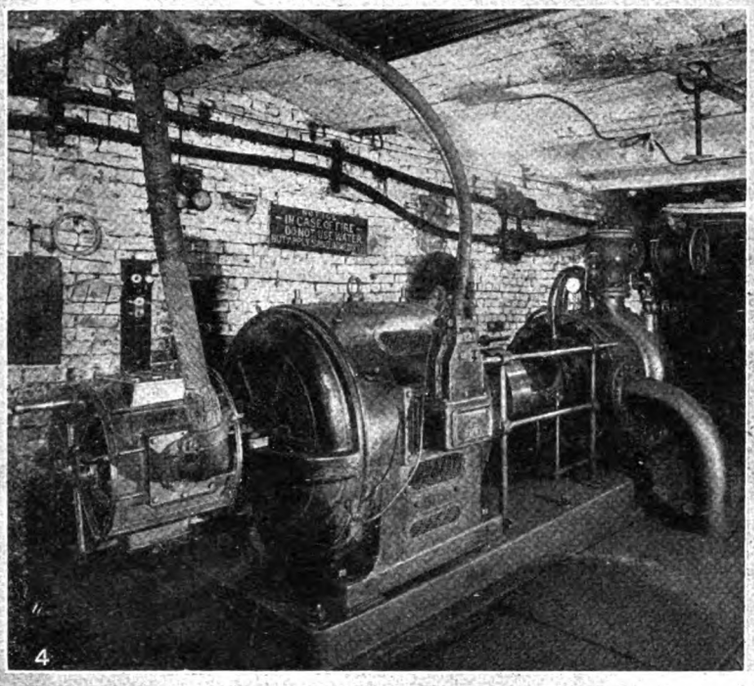

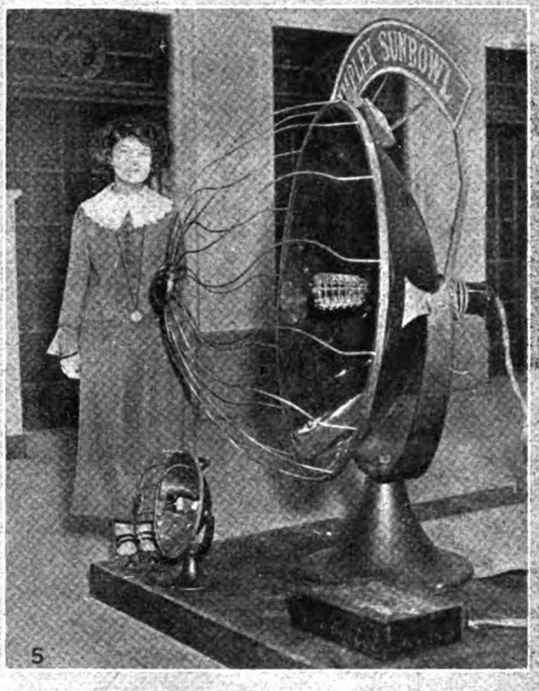

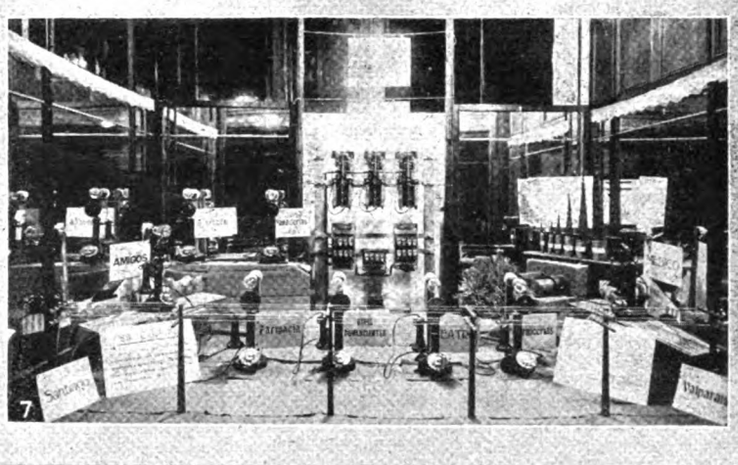

ELECTRICAL NEWS IN PICTURES.

1.—Mr. Jabez Smith, head of a Faversham firm of electrical contractors and dealers, whose death is announced (p. 617).

2.—A "one man" tram which is being tried for three months on the Hurst route of the Ashton-under-Lyne municipal tramway system (p. 621).

3.—Mr. J. Alex. Bell, city electrical engineer and manager of the Aberdeen Corporation Electricity Department, who has received a presentation from the electricity staffs in recognition of 25 years' continuous service at Aberdeen.

4.—One of two 375 H.P. 3-phase enclosed ventilation "Witton" motors recently installed in a South Wales colliery.

5.—Claimed to be the largest electric heater in the world, the subject of this photo was, needless to state, made in the U.S.A., and was shown at an electrical exhibition in New York. An ordinary heater, seen on the left, gives an idea of their comparative sizes.

6.—Stands at the Commercial Motor Exhibition at Olympia, where a range of electric and petrol-electric vehicles and trucks is on view (p. 618).

7.—The merits of automatic telephones were brought home to residents of Valparaiso last month by means of this striking window display, made by the Chili Telephone Co., in a shop in one of the main thoroughfares.

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LEGAL INTELLIGENCE.

Alleged Breach of Electricity Act.

Mr. Justice Romer, in the Chancery Division, last Friday, had before him a motion by the Attorney-General for an injunction restraining the Corporation of Ealing until judgment or further order from either completing the installation of a new electricity generating plant or operating or using the plant when completed, without the consent of the Electricity Commissioners.

Mr. Farwell, K.C., appearing with Mr. Dighton Pollock, for the Attorney-General, said the allegation was that in breach of the provisions of the Electricity Act, 1919, the defendants had extended their generating plant without the consent of the Commissioners, which consent was necessary. There might be two answers to that, viz.: (1) that the defendants had not extended their plant, and (2) that even if they had, the work was done and the defendants were supplying electricity, and if an injunction was granted it would plunge Ealing into darkness. In spite of that he would ask for an injunction, though his Lordship might think fit to suspend its operation so as to prevent inconvenience to the residents of the borough. Mr. Farwell said the matter was of some importance as there were other cases in which the same circumstances had arisen. In the view of the Commissioners it was urgent.

His Lordship said obviously the operation of any injunction granted would have to be postponed. He did not see any object in granting an injunction and postponing it until after the trial of the action.—Mr. Farwell said he would only ask for a suspension until some arrangement could be made. His submission would be that the defendants were doing a directly illegal act, one they were forbidden to do by statute. If that was so, the Attorney-General was entitled to apply for an injunction, which it was desired to have granted, but in such terms as would protect the public from inconvenience.—His Lordship said the whole object of an interlocutory motion was to keep matters *in statu quo*. He could not finally determine the rights of the parties except by consent. He had to consider the balance of convenience, and if granting an injunction would throw Ealing into darkness, the balance of convenience would seem strongly against granting the motion. He was willing to assist matters by granting a speedy trial.—Mr. Farwell replied that he was instructed that it was really important that the matter should be determined as soon as possible.

Mr. Hughes, K.C. (for the Corporation), said they only desired to do their duty to the ratepayers. He was proceeding to explain that the Corporation had some generating plant that was obsolete, and had substituted some new plant, when Mr. Farwell objected to Mr. Hughes going into the merits of the case before he had had an opportunity of stating the case for the Attorney-General.

His Lordship said he would grant facilities for a speedy trial, adding that Mr. Farwell could apply early next sittings for a date to be fixed.

B.T-H. Patent Litigation.

On the resumption of the case of the British Thomson-Houston Co. *v.* the British Insulated and Helsby Cables, the opening stages of which were reported in our issues of November 16th and 23rd, Mr. Gray stated that in their particulars of infringement plaintiffs complained of the sale by the defendants in or about December, 1922, to the Sturdy Electrical Co., Westbourne Grove, of 12-200 V 60 W electric incandescent lamps the filaments of which were constructed in accordance with plaintiffs' patent. He produced two of the lamps in question, and said that in addition he had been supplied by Messrs. Bristows, Cooke and Carpmael, plaintiffs' solicitors, with a reel of wire which they had received from the defendants.

Sir Duncan Kerley admitted that the lamp was one of the defendants'.

Continuing, witness added that he had received 12 lamps from plaintiffs similar to the one in question. He analysed the filaments in some of the lamps and found that the material was drawn tungsten wire, the tungsten being substantially pure. The percentage of tungsten was 99·70, the balance being impurities which were inevitable. In his opinion these lamps were made in accordance with the description in plaintiffs' specification.

At the resumed hearing on November 20th Mr. Gray repeated that at the date of the patent nobody believed that tungsten could ever be drawn into anything of a coherent nature.

Dr. Oberlander said he was aware in 1913 that the 1906 patent was unworkable and useless and he advised counsel to that effect. Counsel, however, put a certain interpretation on one of the claims and on that they wanted to fight the broad issue.

On November 21st, in cross-examination by Sir Duncan Kerley, Dr. Oberlander maintained that the 1909 process was the factory process of to-day. The working out of the highly developed process they had seen at Hammersmith was not all subsequent to the 1909 patent. It was the working of the 1909 patent which gave the success. Further improvements had been made which had been gradually embodied in it. He had seen the 1909 patent, as he understood it, put into operation in 1911.

The next witness called by plaintiffs (on November 22nd) was Prof. Thomas Gray, Professor of Chemistry at the Royal Technical College, Glasgow, who said he had first heard of drawn tungsten late in 1908 or 1909. About 18 months ago he inspected plaintiffs' process at their works at Rugby. He regarded as the most remarkable feature of plaintiffs' invention the announcement of a great discovery, that tungsten, which he knew as an excessively brittle material and entirely unworkable cold, could, by a process of mechanical working, be converted into an extremely ductile metal which could be worked and drawn through dies at ordinary temperature. This was a most remarkable discovery and one which revolutionised their ideas as to the quality of metals generally. He knew of no other metal the ductility of which was improved by mechanical working. Dealing with the directions in the specification for the elimination of the oxide of tungsten, witness said he knew of no other prior document in which any such precaution was set out.

At the resumption on November 23rd, Mr. John Dixon Brunton a partner in the firm of Bruntons, wire and wire rope manufacturers, of Musselburgh, next gave evidence. He said that it was the heating of the tungsten in the 1909 specification and the small reductions which impressed him. It had always been accepted that wire drawing was reducing the diameter of a metal cold.

Mr. Albert Cathles, chartered accountant and manager of Price, Waterhouse and Co., said that his firm were plaintiffs' accountants. He had examined the gross sales by plaintiffs and their licences under the patent, and the total sales from January 1st, 1914, to March 31st, 1923, were 148 867 198 lamps. These were all tungsten filament lamps.

Sir Duncan Kerley said the lamps sold under the 1906 patent were included.

On Monday, evidence was given by M. David Murdoch, an employee of Messrs. Brunton, of Musselburgh, as to unsuccessful attempts he had made to draw tungsten. He eventually came to the conclusion that it was not possible to draw it in the crude state.

Mr. E. A. Gimmingham, vice-chairman of the Electric Lamp Manufacturers' Association of Great Britain, and technical director of the Edison Swan Electric Co., gave evidence as to the manufacture by that firm of carbon filaments, and afterwards of squirted tungsten filaments. They were very discontented with the latter process and were constantly looking out for something to supersede it. They first heard at the end of 1910 that tungsten had been drawn in America. His firm regarded this as a wonderful achievement, their experience of tungsten being such that it precluded the idea that it could ever be made sufficiently ductile to be drawn into wire. When they heard of the discovery they began experimenting with tungsten. The matter affected them very vitally, and they could find no one in the United Kingdom who had any special knowledge of tungsten. At the commencement of 1912 they heard that tungsten wire was being drawn in Germany and they had an offer from Germany to teach them the process. They eventually obtained possession of the complete process for making tungsten wire ductile cold. They then gradually changed over their manufacture of tungsten filaments from the Just and Hannaman squirted process to the drawn wire process. The Edison Swan Co. were licensees under the 1909 patent, and the process they learnt from the German gentleman seemed to him exactly similar to the operations described in 1909 specification.

Summing up on behalf of plaintiffs, Mr. Hunter Gray submitted that the 1906 specification was full of conundrums which were insoluble, whereas the 1909 specification was a unique document containing complete instructions for carrying out the process described. Dealing with infringement, he said defendants had used a tungsten wire which had been rendered substantially ductile cold by someone else.

Sir Duncan Kerley opening the defendants' case said the action was something entirely new in patent cases. It might contain new law and it certainly had a new human aspect. Here they had plaintiffs owning a string of patents, of which 1906 was not the first and 1909 not the last, deliberately electing to sue on the 1906 patent, alleging that it worked, and now coming to the court with different experts to tell a different story from that told in the Duram case. Having maintained that the 1906 patent was perfectly good they now said the 1909 patent was the really important thing, and that they were entitled to a monopoly. There might even be a third law case in which plaintiffs would say both the 1906 and 1909 patents were wrong, and some other one right. His Lordship had heard a good deal about the difficulty of working tungsten, the object being to show the court what a surprising invention the 1909 specification was, but this was the same suit of clothes which were worn in the 1906 case. It was produced again not frayed and even more magnificent than before. Dealing with the Murdoch experiment, counsel said he was going to suggest that Murdoch succeeded. He was operating at a temperature at which he would have succeeded if he had had the proper apparatus. Defendants' case was that there was no subject matter for the 1909 patent. At the most it was a mere discovery of a consequence of working to produce a result which was there indicated and it was a necessary consequence. His next point was that the 1909 specification was open to the objection that it was only the application of a known process. The 1906 patent, he said, did disclose an effective process of drawing tungsten wire. He attached no commercial importance to the cold ductility of the wire. It might be convenient to draw the last two stages cold but defendants did all the drawing hot because it paid better.

The case is still proceeding as we go to press.

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PERSONAL GOSSIP.

Sir Joseph W. Isherwood has been elected President of the Engineers' Club for the ensuing year.

Mr. J. B. Taylor, formerly a London director of the Cape Electric Tramways, has now joined the company's local board in Cape Town.

Sir Charles Bright, F.R.S.E., wishes it to be understood that he has withdrawn from the board of Sir Charles Bright and Partners, Ltd.

Mr. J. L. Palmer has been appointed from Weston-super-Mare to the managership of the Bath Branch of the Bristol Tramways and Carriage Co.

Mr. Clifford Wilde, of the Llandrindod Wells Electric Light and Power Co., was married at Llandrindod Wells recently to Miss Gwendoline Nicholls, of that town.

Mr. C. H. Perrin, assistant engineer, has been appointed chief engineer of the Victorian Railways (in succession to Mr. W. Kernot, retired), at a salary of £1 000 a year.

Alderman E. Huntsman has been re-elected chairman of the Nottingham District Industrial Council for the Electricity Supply Industry. Mr. W. H. Gilkes is again to act as vice-chairman.

Mr. Benjamin Peter Turtle, son of Mr. Peter Turtle, electrical engineer, of Wandsworth, London, was married recently to Miss Elizabeth Juffs, daughter of Mr. William Juffs, Hall End, Clophill.

Mr. A. C. Bamford has been appointed to a seat on the board of Chadburn's (Ship) Telegraph Co., in succession to the late Mr. Thomas Orford, who had been a director of the company for fifteen years.

Alderman Parkinson is to be asked to act as chairman of the Preston Electricity Committee in the place of Alderman Astley-Bell, who resigned a short time ago. Councillor Heaney will be invited to act as vice-chairman.

Mr. George G. Terry, who has been on the Electric Power Commission of Ontario for 15 years as superintendent of lines, is reported to have arrived in Johannesburg on leave for the purpose of assisting the South African railway administration in the electrification of the railways.

Marylebone (London) Council is recommended by the Electric Supply Committee to increase the salary of Mr. C. C. Marsh, assistant generating engineer (beyond the rate due to him under the schedule approved by the National Joint Board on April 28th last), from £10 12s. 11d. to £11 12s. 11d. per week, subject to adjustments by reason of the cost-of-living figure.

Prof. Sir Arthur Schuster, narrowly escaped losing an eye while watching a game of golf at Yeldall, his home near Twyford, Berks. A woman player, in driving the ball, accidentally struck him in the face. His spectacles were smashed, and a piece of glass entered one of his eyes. An operation was performed and the glass removed. Sir Arthur is now progressing favourably, and it is believed his sight will be saved.

Mr. C. H. Merz, who has been in Johannesburg giving evidence for the South African Electricity Commission at the recent inquiry into the application of the Victoria Falls and Transvaal Power Co. for authority to proceed with the erection of the Witbank power station, is reported to be on his way back to this country. While in Johannesburg Mr. Merz was indisposed for several days, and the inquiry was adjourned pending his recovery.

One of the first directors of the Neverstop Railway (Wembley), Ltd., which has just been registered, is Mr. W. C. Bersey, controller of stadium and entertainments at the British Empire Exhibition. Mr. Bersey was one of the pioneers in the application of electricity to self-propelled vehicles in this country, having held the post of chief engineer to the Universal Electric Carriage Co. and the Electric Motive Power Co. nearly 30 years ago.

Mr. W. Corin has resigned his appointment as chief electrical engineer of the New South Wales Public Works Department to take up private practice as a consulting engineer with headquarters in Sydney. He has been appointed consulting engineer to the Cairns (Queensland) Hydro-Electric Investigation Board. It is understood that Mr. R. V. Morse, principal assistant to Mr. Corin, will act as chief, at least, until a permanent appointment is made.

Sir William Hepworth Mercer, who has been a member of the Pacific Cable Board since 1901, has been appointed chairman of that body in succession to the late Sir H. Babington Smith. After acting as assistant private secretary to Lord Ripon and to Mr. Chamberlain, he was appointed secretary to the Pacific Cable Committee in 1896 and principal clerk in 1898. During the war he acted as chairman of the West African Currency Board. Mr. M. F. Headlam, of the Treasury, has been nominated to succeed Sir William as one of the representatives of the Government on the Board.

All the Parliamentary candidates actually connected with the electrical industry, and included in the list of probable candidates in our previous issue, have been nominated. Sir T. R. Bethell, a former director of the Sterling Telephone and Electric Co., who was expected to contest Bury St. Edmunds, was not nominated. A prominent newcomer is Mr. Percy John Pybus, managing director of the English Electric Co., who has decided to contest the Shipley Division of Leeds in the Liberal interest. Mr. S. K. Lewis, a 28 years old employee of the South Staffordshire Tramways Co., at Darlaston, is standing as a Conservative candidate for Walsall. Sir William Bull, who, as stated last week, is again contesting South Hammersmith, has represented the borough for 23 years.

WIRELESS CHAT.

Recent Developments in Direction Finding at Sea.

The value of wireless direction finders on merchant ships, especially during bad weather, when it is difficult to obtain exact positions, has been demonstrated recently by instances in which this apparatus has guided vessels to the assistance of ships that have sent out the distress signal. Direction finding by wireless was first attempted from ships in 1912. The matter fell into abeyance during the war, but the Marconi Co. made a fresh start in 1919, and has since made much steady progress, for there are now over 100 British merchant vessels fitted with the Marconi marine direction finder, and nearly as many vessels sailing under foreign flags carrying the same apparatus. When discussing wireless direction finders for use at sea, distinction should be made between the three methods of application. First of all we have the direction finder mounted on board the ship herself, and used for taking bearings *of* land stations or of other ships. Secondly, the direction finder may be mounted on land and used at the request of a ship to take her bearing *from* the land station, this bearing being signalled to the ship. Thirdly, there is the possibility of transmitting signals in a definite direction so that any ship hearing the signal will know her bearing from the point of origin. This method has also been originated and developed by the Marconi Co. One such station is in operation at Inchkeith, in the Firth of Forth, and a second is now being erected at the South Foreland Lighthouse. This method necessitates the use of a very short wave (just over six metres), which in turn necessitates the use of special receivers. Thus this method of wireless directional working, which is called the "Wireless Beam," is absolutely independent of the ship's main wireless transmission and reception. The method of transmission adopted makes it unnecessary to use a skilled telegraphist to read the signals, and the accuracy of the bearing is said to be within 2 deg. At present it is only possible to use this method over comparatively short ranges, the original station at Inchkeith being reliable at 10 miles, and the new station at South Foreland is being designed for a range of 20 miles. This new wireless appliance will, doubtless, become a valuable aid to navigation.

Wireless Progress in China.

In his latest report on the industrial situation of China, Mr. H. J. Brett, of H.M. Legation, Shanghai, states that the only advance in wireless telegraphy to be recorded during the year 1922 was the completion of the installation of a wireless station at Urumtchi, one of the chain of stations connecting Peking with Kashgar. It is understood that the Kashgar station has just been installed, also, so that the chain is now complete. Attempts have been made by an American company to introduce broadcasting at Shanghai, but so far these efforts have not passed the stage of experiment and demonstration. Difficulties have been encountered owing to the refusal of the authorities to permit the importation of receiving sets pending the issue of new regulations, and for the time being the scheme appears to be in abeyance. As regards wireless communication with other countries no progress is to be recorded, chiefly owing to international difficulties between the various companies interested in the question.

OBITUARY.

T. Fogg.

The funeral took place at Heywood last Friday of Mr. Thomas Fogg, aged 43 years, who had for several years acted as permanent way engineer on the Lytham St. Anne's tramways. He was previously assistant surveyor to Heywood Corporation.

J. Patterson.

Mr. John Patterson, of Heaton, Newcastle-on-Tyne, whose death is annonnced at the age of 75 years, was employed in the drawing office of the Newcastle-on-Tyne Electric Supply Co. from 1917 until September, 1922. He was formerly in business as a builders' merchant.

J. Smith.

We regret to record the death, which took place on November 20th, of Mr. Jabez Smith, J.P., head of the firm of J. Smith and Son, electrical engineers, of Market Place, Faversham, and High Street, Sittingbourne. He was 68 years of age, had been in business at Faversham since 1878, and at Sittingbourne since 1889. He served on the Faversham Town Council for 15 years, and was twice Mayor.

H. M. Lake.

While motoring last Friday to the Walsall Corporation Electricity Supply Department, where he was employed, Mr. Harold Miller Lake collided with a motor lorry and received such injuries that he died almost immediately. Mr. Lake, who was 28 years old, leaves a widow and one son. At the inquest at Great Barr on Monday, the coroner returned a verdict of "accidental death," and exonerated the driver of the motor lorry. He said it seemed as though Mr. Lake could have got safely through if he had been cycling in the middle of the road instead of so closely on his proper side. Consequently his own care in a way contributed to the accident.

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ELECTRIC VEHICLES.

Interesting Display at Commercial Motor Exhibition.

As briefly reported in our previous issue, the Commercial Motor Transport and Roads Development Exhibition, which opened at Olympia, London, on November 22nd, and which closes to-morrow (Saturday) night, has several exhibits of electric and petrol-electric vehicles, although, as might be expected, the major portion of the space is occupied by petrol motors.

Among the new British-built battery vehicles is a range for which Walker Vehicles, Ltd., of Caxton House, Westminster, London, have acquired the manufacturing rights from the Walker Vehicle Co. of Chicago. The outstanding feature of the Walker vehicles is the special "balanced drive" back axle. The power unit and transmission gear are totally enclosed, but the whole unit is very accessible. The motor itself is of the single-series wound type, with the armature mounted on large ball bearings.

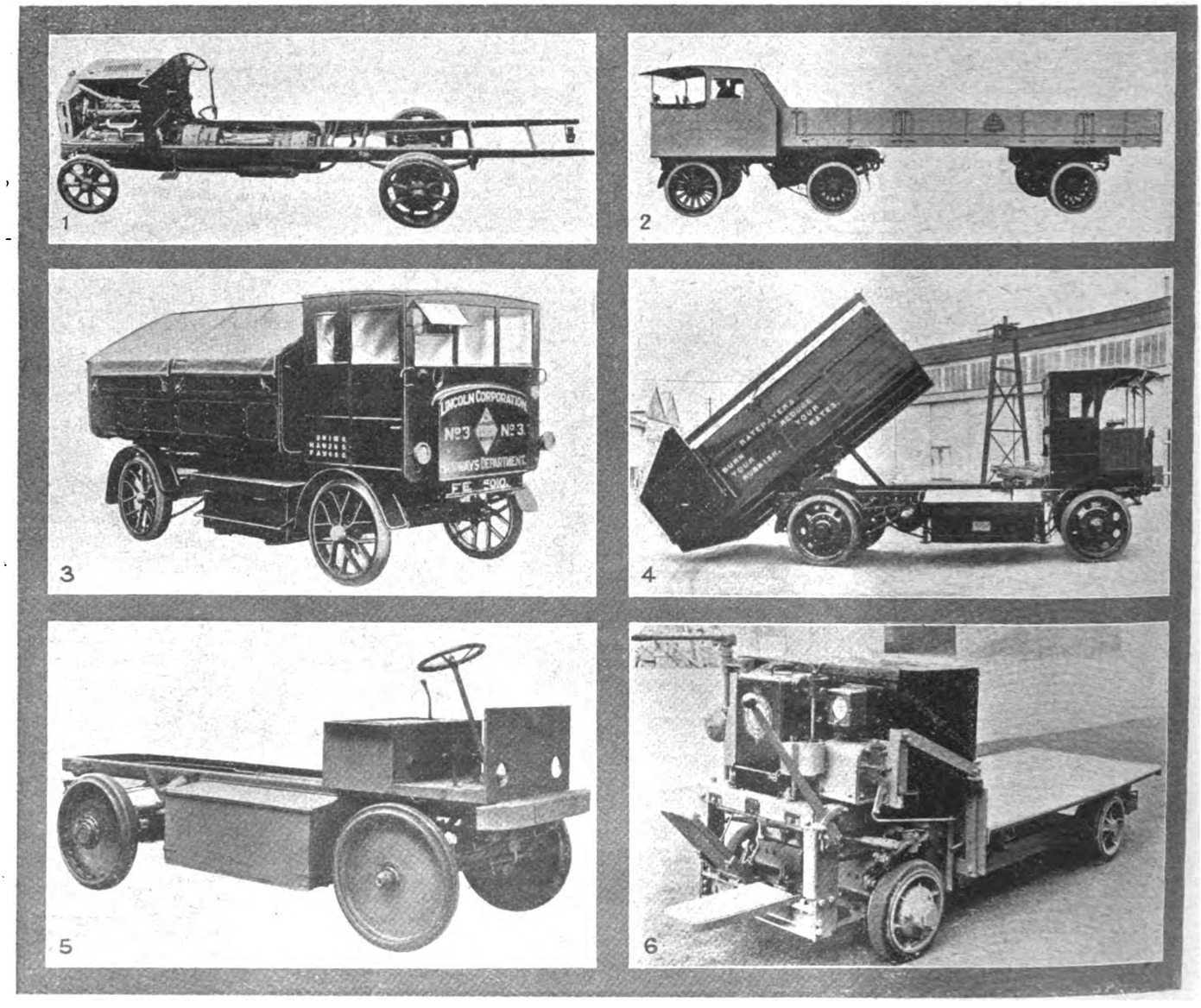
In the electric vehicles shown by Clayton Wagons, Ltd., of Lincoln, the electric motor is of special traction type, series wound, designed to give a wide range of horse-power, and claimed to be capable of taking—for short periods—an overload of 300 per cent. Combined with this unit is the countershaft, which is driven by reducing gear wheels enclosed in oil-proof casing. On the motor shaft is mounted the differential gear, enclosed but easily accessible. The driving chain sprocket wheels are mounted at each end of the countershaft. The controller is of the drum type, mounted in an accessible box in the driver's cab. It operates the motor on three speeds forward and two reverse. The standard equipment consists of an Exide Ironclad battery, having in the light model 44 cells with a capacity of 258 Ah at 5 hours' discharge rate, and in the heavy model, 44 cells with capacity of 323 Ah at 5 hours' discharge rate.

Ransomes, Sims and Jefferies, Ltd., of Ipswich, show specimens of their range of electric vehicles, as well as the "Orwell" electrical industrial truck. Built on the Mossay system, the vehicles are supplied with chain drive in the 2/2½, 3½/4 and 4½/5 ton models, but one type of 2/2½ ton vehicle has a front wheel drive. All types have two compound motors, and the battery equipment has a capacity of from 226 Ah for the lightest model to 323 Ah for the 4½/5 ton chassis. Of simple and robust construction the industrial trucks are now made in a range calculated to meet the requirements of many different classes of service. Type "B," a three-wheeler, designed for use on uneven road surfaces, or in places where a small turning radius is required, carries 3 000 lb. at 4-5 miles per hour on the level, while the "C" type will take a load of 2 tons at the same speed.

A giant ten-ton 6-wheeler, the chassis of which is priced at £1 250, shown by the General Vehicle Co., has a "Martin rocking fifth wheel" turntable on the tractor, in the cab of which is a quick release connector. The company also show the "G.V." 3½ ton model with electrically-operated tipping gear, a 2 ton chassis, 2 and 3 ton industrial electric trucks, and a 10 ton electric tractor.

In the "Stevens" petrol-electric vehicle, shown by Steven's Petrol-Electric Vehicles, Ltd., 68, Victoria Street, London, the place of the gear box and clutch is taken by a flexible electric transmission, which has the effect of reducing very considerably the maximum driving strains between the engine and back axle. In addition to its normal employment as a lorry, this vehicle can be used to provide a supply of electricity for arc-welding plant, lighting, heating, power transmission and battery charging. By means of a special control, the generator gives a continuous output of 300 or 230 A at voltages varying from 80 to 110 V respectively.

Tilling-Stevens Motors, Ltd., of Maidstone, are exhibiting their petrol electric double-deck omnibus and a specimen of their type TS 6 forward steering chassis.



Electric and Petrol-Electric Vehicles at the Commercial Motor Exhibition.

1.—Tilling-Stevens petrol-electric chassis; 2.—Six-wheeler electric by the General Vehicle Co.; 3.—Electric vehicle for municipal work, by Clayton Wagons, Ltd.; 4.—Electric tipping wagon, by Ransomes, Sims and Jefferies; 5.—Balanced-drive electric by Walker Vehicles, Ltd.; 6.—Ransome's "Orwell" type "O" electric truck.

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ELECTRICITY SUPPLY.

Extensions and Developments.

Templemore (Tipperary) Urban District Council is considering an electric lighting scheme; the town is now lighted by petrol vapour lamps.

Rhayader Electric Light and Power Co. has applied to the Electricity Commissioners for permission to establish a power station in the town.

Boston and District Electricity Supply Co. has applied to the Electricity Commissioners for permission to establish a power station close to the docks.

Buckhurst Hill Urban Council has decided to consent to the application of the County of London Electricity Supply Co. for an order to supply electricity in the town.

Adwick-le-Street Urban Council has agreed with the Colliery Co. for a supply of electricity for power at 1½d. per kWh. The Colliery Co. have undertaken to wire all the houses belonging to them in the district.

Woolwich (London) Borough Council has applied to the Unemployment Grants Committee for a grant in respect of proposals involving an expenditure of £88 517 for the development of the electricity undertaking.

Willesden Council is recommended by the Electricity Committee to take no action in regard to a further application from the Electrical Development Association for a contribution towards the cost of a display of electrical apparatus at the Wembley Exhibition.

Willesden Council's electrical engineer reports that during the five weeks ended November 9th three new electric lamps have been erected at the rear of the General Hospital, Harlesden Road, and 209 gas lamps, principally in the Kensal Rise and Harlesden areas, have been converted to electric lighting.

Rugby Urban Council has consented to the application of the Leicestershire and Warwickshire Electric Power Co., for permission to supply electricity to the British Thomson-Houston Co. Under an agreement any consumer in the area of the Urban Council who requires a load of 500 kW or over can take it direct from the Power Co.

A number of Bessecarr (Yorks) residents have formed a non-statutory company with the object of supplying the residential quarter of the parish with electricity, which will be drawn from colliery sources. No dividend will be paid, and only members or shareholders of the company will be entitled to a supply.

Marylebone (London) Council is recommended to approve the substitution of gas-filled white light lamps of 150 W each in twelve thoroughfares and 100 W each in four streets instead of the 60 W lamps at present in use. The additional cost for the present financial year will be £330, representing the first cost of the new lamps, and £75, half the estimated annual increased cost.

Alterations in Charges.

Barnstaple Town Council has revised the charges for electricity for cooking to 4d. per kWh, up to 200 kWh per quarter, and 3d. beyond; for heating there is a flat rate of 3d.

A London electricity consumer has been complaining to the Electricity Commissioners of the disparity between the prices charged by various supply companies, and suggests one flat rate for London. It has been pointed out to the complainer that it would be extremely difficult, if not impossible, to fix a flat rate for the whole of London, owing to varying costs of production.

Dewsbury Council has decided to supply electricity for shop window lighting at 2d. per kWh, plus 30s. per annum for rent of time switch and meter. As from the last meter readings other prices are reduced as follows: lighting, from 7d. to 6½d. per kWh; power, maximum demand, from 4½d. to 4d. per kWh for the first hour of maximum demand, and from 0·9d. to ¾d. per kWh for all other consumption.

A second big reduction in six months in the cost of electricity to all classes of consumers in the Liverpool district was confirmed by the Electricity Committee last Friday. The Committee was actuated by the belief that the lower the price the greater would be the consumption. The new charges for lighting for Liverpool, Bootle, and Litherland are only 25 per cent. above the pre-war rates. To the ordinary power consumer and to bulk supply consumers, the prices have now fallen to 10 per cent. above the pre-war price.

Inquiries and Orders.

The Minister of Transport proposes to confirm the Gorseinon Electricity (Extension) Special Order made by the Electricity Commissioners for the supply by the Gorseinon Electric Light Co. of electricity in Swansea Rural District. Objections to the Ministry of Transport, Whitehall Gardens, London, by December 15th.

With regard to the West Riding (Aire and Calder) Electricity District local inquiry, the Electricity Commissioners announce that in view of the forthcoming General Election and after consideration of representations made to them, they have decided to postpone the inquiry at Bradford which was fixed for December 4th and following days, until a new date to be announced later.

MUNICIPAL TRANSPORT.

Birmingham Favours Electric Vehicles for Refuse Collection.

In the course of an interesting paper on "Transport Work in the Salvage Department of the City of Birmingham," submitted last Saturday to the Public Works, Roads and Transport Congress, Mr. James Jackson, the Cleansing Superintendent at Birmingham, said the Department's first electric vehicle was purchased in 1918, and the fleet had been augmented yearly, until now 56 vehicles were in commission. Using large electrics, properly placed in selected districts 3 miles from the depot, the running cost had been brought down to the level of that of the horse working within a radius of 1¼ miles.

The lecturer described an auto-electric trailer which is being built for his Department. This trailer is, in effect, an electric vehicle which can be towed out to the collecting area by an ordinary electric vehicle. It will be moved from house to house under its own power, and filled with refuse by the loaders of the towing vehicle whilst that vehicle has gone to discharge its load. It will then be attached to the towing vehicle whilst the latter is being filled with its second load, and, finally, will be towed back loaded to the place of disposal. The trailer, designed to carry a 2-3 tons load, will have a hand-tipping body of 5 cubic yds. capacity, and be fitted with spring roller canvas covers. It is equipped with 40 I.M.V.4 Exide ironclad cells, and is driven from a platform 12 in. above ground level. The transmission is automatically de-clutched when the draw-bar is lifted for connection to the tractor.

As a proof of the reliability of electric vehicles and their freedom from serious breakdown, Mr. Jackson gave a table showing the percentage of days worked to possible working days during the year to August 1st, 1923: The strength of the fleet was 40, and days worked were 11 763, working days lost being 557. The percentage of working days lost was 4·52, while the percentage of efficiency was 95·48. All time expended on the painting of vehicles, and all days when the vehicles did not work, from whatever cause, were included, so that the percentage of time actually lost was remarkably small, and throughout several months the running efficiency reached 99 per cent. This high running efficiency had given them great confidence in electric traction.

The vehicles were garaged at four depots, at three of which the Department generated its own energy, and all vehicles were repaired at one depot. From a management point of view no effort had been spared to obtain the best results from the vehicles, and in order to maintain a high standard they had now prepared a prize scheme with the object of enlisting the co-operation of the garage workmen, electricians and drivers.

Mr. Jackson finds that approximately half the number of electrics are required as against horses, and supervision is facilitated by this reduction of units. His experience has also proved that owing to their easy running the electric vehicles are very light on tyres.

A.M.I.E.E. Examination Successes.

We give below a list of the successful candidates in the October examinations for associate membership of the Institution of Electrical Engineers:—Passed Whole Examination—Andress, P., Bailey, G. S., Barrett, H. E., Bellamy-Law, J. W., Boyland, H. J., Davies, J., Galliard, J. D., Godden, L. J., Peakin, C. J. W., Peasgood, F., Pidcock, E. E., Rostron, H. M., Sayers, A. J., Shaw, C. M., Smith, H. F., Stinchcomb, E. A., Tetley, A. C., West, F. W. J. Passed Part I only—Brakenridge, W. D., Morley, E.W. L. Passed Part II only—Buchanan, G. M., George, J. C., King, F. R. Successful Candidates (Officers of the Corps of Royal Engineers):—Anstruther, 2nd Lt. A. M., Bickford, 2nd Lt. E. N., Cobb, 2nd Lt. E. H. W., Conlay, 2nd Lt. R. A., Curry, 2nd Lt. W. J., Drewe, 2nd Lt. P. J. L., Floyer, 2nd Lt. M. du B., Francis, 2nd Lt. H. S., Hayden, Lt. A. B., Heard, 2nd Lt. H. T., Hill, 2nd Lt. A. J. R., Jenkins, 2nd Lt. J. V., Malcolm, 2nd Lt. G., Marsh, 2nd Lt. J. E., Miller, 2nd Lt. C. F. W., Pain, 2nd Lt. R. S., Paten, 2nd Lt. L. A. B., Perowne, 2nd Lieut. L. E. C. M., Stainer, 2nd Lt. C. G., Stoney, 2nd Lt. R. F. E., Toogood, 2nd Lieut. A. F., Whitman, 2nd Lt. B. E., Wilbraham, 2nd Lt. R. G. V., Young, 2nd Lt. G.A.D.

Result relating to candidates who sat for the examination abroad will be published later.

An Electric Heating Pad.

In a recent issue of the "Elektrotechnische Zeitschrift" Mr. A. Scherbius gives a description of an electric heating pad which consists of a bimetallic thermostat with an automatic break contact embedded in the pad itself. A special heating coil, separated from the main heating unit, controls the thermostat, so that a positive and fully reliable regulation of the heating-pad temperature is obtained. This arrangement, in connection with an additional fusible link of low melting alloy, will, it is asserted, prevent the danger from fire common to existing pads. A universal pad with two heat-controlled thermostats and two fuses is also described. This can be connected without any adjustments to either 110 V or 220 V systems, reaching with either voltage the same final temperature. The pad last mentioned is of particular advantage to the travelling public.

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BUSINESS OPPORTUNITIES AT HOME AND ABROAD.

Contracts Open.

STEWARTON TOWN COUNCIL.—Firms willing to undertake electric lighting work in connection with the erection of 12 tenement and 14 flatted houses and double cottages are invited to apply to the Town Clerk. Schedules and forms will be issued shortly.

BELFAST CORPORATION, December 1st.—Construction of 3 200 yards of single track tramway. Specification from the General Manager, Corporation Tramways, Belfast.

REIGATE CORPORATION, December 1st.—Electric wiring in the Old Town Hall, Market Place, Reigate. Particulars from Borough Surveyor.

TYNE IMPROVEMENT COMMISSIONERS, December 1st.—Thirteen sets of d.c. motors (about 4¾ h.p. each) and accessories, for driving dock-gate winches. Specifications from the Secretary, for £1 1s. deposit.

LONDON COUNTY COUNCIL, December 3rd.—About 3 400 tons (or, alternatively, about 5 100 tons) steel girder tram-rails, lipless track rails and renewable guard rails, with fastenings. Specification from Chief Engineer, Old County Hall, Spring Gardens, S.W.1; deposit £2.

SOUTHAMPTON CORPORATION, December 3rd.—Two e.h.p. switch cubicles, with control panels, indicating diagrams, etc. Specification from Borough Electrical Engineer. Deposit £1 1s. for each specification, to be paid to the Borough Treasurer.

EDINBURGH CORPORATION, December 4th.—Twenty top-covered tramcar bodies, 32 tramway trucks, and electrical equipment for cars. Specifications from the Tramway Manager, 2, St. James' Square, Edinburgh.

HEREFORD RURAL DISTRICT COUNCIL, December 4th.—Water mains, electric motor and pumps, poles for overhead wires, etc., in connection with Little Birch water supply. Specifications from Mr. J. Parker, 141, St. Owen Street, Hereford, on £2 2s. deposit.

MAIDENHEAD GUARDIANS, December 4th.—Electric light installation work at the infirmary block and St. Mark's Church. Particulars from Clerk, 1, Park Street, Maidenhead.

HULL CORPORATION, December 5th.—Renewal of about 1¼ miles double tramway track. Forms of tender, etc., from the City Engineer.

METROPOLITAN ASYLUMS BOARD, December 5th.—Electric light and power installation in new kitchen at Tooting Bec Mental Hospital. Specification from the office of the Board, Victoria Embankment, E.C.4, on £1 deposit.

ST. PANCRAS (LONDON) BOROUGH COUNCIL, December 6th.—Vertical electric motor-driven condensing water pump, capable of dealing with 750 000 gallons per hour. Specification from the Electricity Office, 57, Pratt Street, Camden Town, N.W.1, on £1 deposit.

GREENOCK CORPORATION, December 8th.—Three 3 000 kVA transformers, 22 000 V three-phase switchgear, transformers with boosters, etc. Specifications from the Burgh Electrical Engineer; deposit £2 2s.

EDINBURGH CORPORATION, December 10th.—Pavement box frames and covers, house service fuse boxes, underground conduits for electric cables. Specifications from the Engineer and Manager, Electricity Department, Dewar Place, Edinburgh.

BRAMLEY GUARDIANS, December 12th.—Electric light wiring and fitting at the Institution. Specifications from the Clerk, 1, Green Hill Road, Armley, Leeds.

DUBLIN PORT AND DOCKS BOARD, December 11th.—Electrical supplies, ironmongery, paints, oils, etc. Forms from the Secretary, Westmoreland Street, Dublin.

PORTHCAWL (GLAMORGAN) URBAN COUNCIL, December 15th.—Provision of electricity supply undertaking. Particulars from the Clerk to the Council.

ST. HELENS CORPORATION, December 15th.—Supply and installation at Cropper's Hill Power Station of (1) one 6 500 kW continuous maximum rated turbo-alternator with condensing plant and auxiliaries; and (2) two water-tube boilers, with superheaters, economisers, induced draught fan, and boiler accessories, steel chimney, structural steel boiler-house building, etc. Specifications from the Borough Electrical Engineer for £2 2s. deposit in each case.

BELFAST GUARDIANS, December 18th.—Schemes for centralised heating and lighting plant in Institution buildings. Further information from the Clerk, Workhouse, Belfast, on £5 5s. deposit.

LONDON COUNTY COUNCIL, December 31st.—One 3-ton three-motor overhead travelling crane, and one 30 cwt. motor-driven portable workshop crane for the tramway central repair depot, with six months' maintenance in both cases. Specifications from the General Manager, L.C.C. Tramways, Victoria Embankment, W.C., on £2 deposit.

Overseas.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS DEPARTMENT, December 5th.*—Transformers for White Bay power house. December 19th.*—Transformers for Meek's Road sub-station. February 6th.*—Equipment of two sub-stations. February 27th.*—Motor generator sets. February 27th.*—Motor-driven air compressors, and batteries for switch operating.

COMMONWEALTH OF AUSTRALIA, December 12th (in London), or December 15th (in Australia).—Cable terminal boxes (S.A. 676). December 17th (London).—Cable terminal boxes (S.A. 674). January 3rd (London).—Telephone and telegraph apparatus (T. 415). Tender forms, etc., from the Supply Officer, Australia House, Strand, London, W.C.2.

VICTORIAN ELECTRICITY COMMISSION, December 15th.—Four 1 000 kVA single phase transformers and spares. January 19th.—Transformers, switchgear and accessories for sub-station B. Specification (Nos. 23/145 and 24/2) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

VICTORIAN ELECTRICITY COMMISSION, December 19th.*—Fibre for insulators. January 3rd.*—Aluminium steel cored cable and accessories.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO, December 27th.* Electrical supplies, including cable, wrenches, insulating compound, lamp shades, also rubber belting, ironmongery, etc.

SYDNEY CITY COUNCIL, January 7th (in Australia).*—Electrically driven coal unloading and conveying plant at Darling Island power houses. February 25th (extended from November 19th.)—Stepdown transformers (Contract 758).

NEDERLANDSCHE HANDELMAATSCHAPPIJ, AMSTERDAM, January 3rd.—High and low voltage plant for new building. Specification from the company's offices, Heerengracht, Amsterdam, on payment of 35f.

VICTORIAN RAILWAYS COMMISSION, January 9th (in Australia).*—Spring coiling machine with electric motor, and taper rolling machine with electric motor (Contract 36 659); also two small induction motors with starting apparatus.

MELBOURNE CITY COUNCIL, January 14th.—Totally enclosed armoured type 6 600 V three-phase switchgear. Specifications from the City Electrical Engineer.

POST AND TELEGRAPH DEPARTMENT, WELLINGTON, N.Z., January 30th*.—30 000 galvanised iron earthrods.

SYDNEY HARBOUR TRUST COMMISSIONERS, February 11th.*—Two double-drum horizontal electric capstans or warping winches. (Contract 23/34.)

ARGENTINE STATE OILFIELDS ADMINISTRATION, February 14th.*—Erection and equipment of 11 250 kW electric power station.

SYDNEY CITY COUNCIL, February 18th.*—Armour-clad switchgear.

CITY OF TORONTO, January 15th.*—Centrifugal sludge pump, direct connected to 2 200 V 3-phase 25 cycle variable speed induction motor, running at about 730 revs. per min. at full load (Contract No. 58).

* Particulars from the Department of Overseas Trade.

Tenders Accepted.

WALSALL.—Babcock and Wilcox, boiler plant for the electricity department, £26 401.

PLYMOUTH CORPORATION.—Metropolitan-Vickers Electrical Co., turbo-alternator, etc., £29 515.

HARRATON PARISH COUNCIL.—Ray Electric Co., extensions to public lighting at Peartree, £48 10s.

UNDERGROUND RAILWAYS CO. OF LONDON.—Markham and Co., tunnel shields for tube extension work.

DUNDEE CORPORATION.—Macintosh Cable Co., cable, £223. One other tender received, £204 10s. 11d.

BIRMINGHAM CORPORATION.—Ferranti, Ltd., three 1 750 kVA, single phase, 33 000 V, 25 cycle transformers.

RIVOLI CINEMA, WORTHING.—Sloan Electrical Co. (agents for Peyton and Peyton), electric decorative fittings.

MONTREAL.—D. Adamson and Co., sewage ejector, driven by automatic electro-pneumatic air compressing plant.

LLANDUDNO.—D. Adamson and Co., sewage ejector, driven by automatic electro-pneumatic air compressing plant.

ESHER AND DITTONS URBAN COUNCIL.—J. B. Marr and Co., electric light wiring and fitting in new Council offices, £115.

FARNWORTH URBAN DISTRICT COUNCIL.—Metropolitan-Vickers Electrical Co., 50 kW rotary converter, transformer, switchgear, etc., £1 023.

LEEDS CORPORATION.—Enfield Cable Works, £2 714 6s.; W. T. Henley's Telegraph Works Co., £1 036 10s., and Hackbridge Cable Co., £700, for cables.

HACKNEY (LONDON) BOROUGH COUNCIL.—Chloride Electrical Storage Co., renewal of batteries in two 3½ ton electric vehicles, £196 13s. each (recommended).

SWINTON AND PENDLEBURY URBAN COUNCIL.—British Thomson-Houston Co., 300 kW rotary converter, with transformer, starting gear, h.t. switchgear, and l.t. control panel, £2 475 1s. 3d.

NIJNI-NOVGOROD (RUSSIA) POWER STATION.—Metropolitan-Vickers Electrical Co., three 10 000 kW turbo-alternators, with condensers, transformers and switchgear, estimated value £600 000

SOUTHERN RAILWAY.—J. Stone and Co., Lilliput electric lighting equipment for the new Folkestone and Dover boat train. Each coach has a separate installation and master switches are provided in the guards' vans.

UXBRIDGE URBAN DISTRICT COUNCIL.—Rees Roturbo Manufacturing Co., renewal of gas engines and pumps and installation of electrically driven turbine pump, electric motor and recording meter at the water-works, £1 200.

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ELECTRIC TRACTION.

Croydon is to have railless tramcars on certain routes.

Birkenhead Council is applying for permission to borrow £50 534 for renewals of tramway track, and is asking the Unemployed Grants Committee for a grant towards the cost.

London County Council Highways Committee propose to purchase an electrically-driven tower wagon for overhead line repairs, at an estimated cost of £1 750. Four similar wagons were purchased in 1920.

Plymouth Tramways Committee has instructed the engineer to report on the condition of the track throughout the tramway system, and to submit an estimate of the cost of the repairs necessary to put it into good condition.

Southport Corporation is applying to the Minister of Transport for an Order under the Light Railways Acts and the Railways Act (1921) authorising the construction and working of four lengths of light railways, total 5 furlongs, 14·4 chains, in the borough of Southport.

With a view to meeting the increased consumption of electrical energy consequent upon the electrification of the Sydney suburban railways, the New South Wales Railway Commissioners are extending the White Bay power house and duplicating the capacity of the generating plant.

The Council of the Municipal Tramways Association has appointed a sub-committee to prepare a standard form of detailed analysis of the cost of tramway track construction and renewals, which will be placed at the service of engineers and managers of municipal tramway undertakings.

A correspondent of the "Financial Times" reports that the question of a revision of the fares of the Anglo-Argentine Tramways is still *sub judice*. The Government is still withholding its assent to an increase of fares which is required to recoup the company for heavy expenditure on extensions and improvements.

In October last London County Council referred to the Highways Committee tenders for a 15 000 kW turbo-generator for the Greenwich power station. The estimate of £86 000 capital expenditure for this plant, including foundations, pipework and switchgear, was submitted to the Council on Tuesday for approval.

The Association of Municipal Corporations and the Municipal Tramways Association have asked the Minister of Transport to initiate legislation, to apply in other towns, to the same effect as the by-laws in force in Glasgow and Edinburgh requiring drivers of other vehicles to halt until any tramway stopping-place which they are approaching is clear of passengers. Manchester Corporation is including similar provisions in its Bill for the ensuing Session.

Ashton's "One Man" Cars.

On our picture page this week is an illustration of the "one man" car which has been put into operation on the Ashton-under-Lyne tramway system. The route upon which this car is being operated is a most unremunerative one and only warrants a 20 minutes service, but with the adoption of the "one man" car, Mr. C. I. Baker, the general manager, has been able to increase it to a 15 minutes service. The car was inspected by Lieut.-Col. Mount, of the Ministry of Transport, who have sanctioned the experimental working of the car for a period of three months. The conversion of the car was entirely carried out by the local tramway department under the personal direction of the manager, and we understand that it is the intention of the Tramways Committee to convert six cars of this type. Mr. Baker is of the opinion that there is a big future for "one man" operated tramcars.

In the third week of Bradford Corporation's experiment with weekly tramway passes, the number of passes sold was 12 443, an increase of 867 over the first week.

Electric Railway Items.

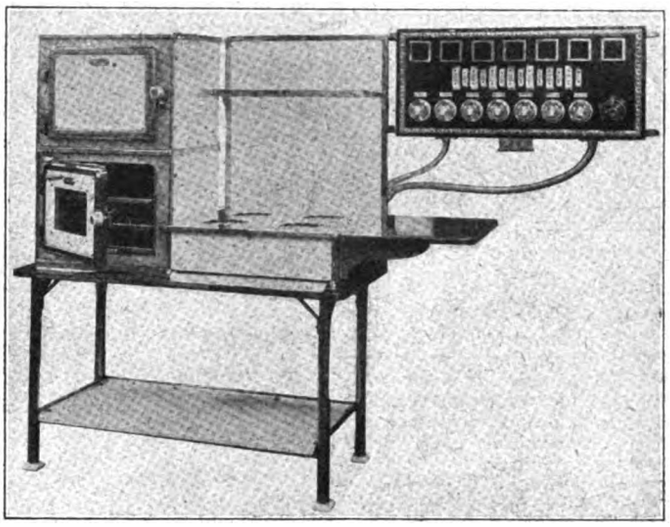
The first two-unit electric locomotive of the type which is to be used for shunting and for hauling goods trains on the suburban lines, has been completed at the Jolimont workshops of the Victorian Railways Department. The two units coupled have a hauling capacity equal to that of a class C engine, the most powerful type employed on the system.

A report by the Dominion Bureau of Statistics states that during last year the Canadian electric railways carried 738 908 949 passengers and earned a revenue of $45 766 639, of which $24 988 118 was paid in salaries and wages. The capital invested in the undertakings is $188 258 974. Passengers killed were six and employees ten, while the numbers injured were 2 260 and 873 respectively.

Traffic on the City and South London tube railway in the vicinity of the Elephant and Castle was stopped about six o'clock on Tuesday evening, as the result of a gas explosion in Newington Causeway. There was a loud report, and flames from the opening in the road reached about 30 ft. in height immediately under the Southern Railway (South-Eastern section) bridge. Fortunately a water main was also damaged, and this assisted in quenching the flames. A train on the City and South London tube passed just at the time of the explosion, and narrowly escaped serious damage, as some debris fell upon it, and a heavier fall completely blocked the line immediately after it had passed. For about 100 feet the tunnel is completely blocked with earth, and it will be some weeks before this section can be re-opened. An official inquiry is to be held at once.

COOKING "DE LUXE."

The accompanying illustration of a special cooker made up for a large private house by the Hotpoint Electric Appliance Co. is of interest as an example of a special piece of work turned out to a client's own requirements. It is a standard 5280 oven with warming cupboard on top, but in the top of the oven is a grill element. There are four open coil hot plates at the side and an extension piece which lifts up and down on a hinge so that any other piece of apparatus can be placed on it and connected to the plug; this is seen at the right with the switchboard. The whole of the metal work outside is either white enamel or nickel-plated while the interior of the oven and hot cupboard is also enamelled. The switchboard is a very handsome piece of work, and the teak board on which the fuses, indicating lamps and switches are mounted is black marble with nickel-plated mouldings.



ELECTRIC COOKER WITH BLACK MARBLE AND NICKEL PLATED FITTINGS.

Window Lighting and Sales.

The British Association of Display Men visited the Demonstration Rooms of the Lighting Service Department of the British Thomson-Houston Co., 15, Savoy Street, London, last Thursday evening, when Mr. W. Millner lectured on the lighting of shop windows.

Mr. Millner showed, by means of a specimen window, the progress that had been made in window lighting since the days of the carbon lamp, and pointed out that the dangling of lamps at eye level made it impossibile to examine the contents of a window in comfort.

Mr. Millner then demonstrated the use of coloured light and spotlights as an attractive medium. Three colours were used, and one rotary dimmer was connected to each circuit and colour. Each dimmer was controlled at a different speed, thus producing a variety of colour mixtures. Actual tests had proved, he said that the attracting power of a shop window was considerably increased under high intensities of illumination. By increasing illumination from 15 to 100 foot-candles, 78 per cent. more people stopped to examine a window. Using the same amount of energy in a window, but with colour effects, an increase of 18 per cent. in the number of people who stopped was recorded.

Dealing with daylight reflections in shop windows, he pointed out that they could be overcome partially by fitting inclined windows in the shop front so that the dark pavement was reflected on the glass instead of the sky or a building opposite, or by means of floodlight projectors fitted in such a manner that a beam of light was thrown upon the chief object of the display. This would cause it to stand out and be clearly visible from the street.

Question of Direct Trading.

At a meeting of the Council of the Birmingham Chamber of Commerce on Monday the Retail Section reported that the Corporation Electricity Department had opened a new show room for the sale of electrical appliances, and correspondence had taken place on the subject of direct trading. The Department stated that as a result of negotiations with the Electrical Contractors' Association a friendly arrangement had been made by which contractors and retailers introducing a customer should have a certain percentage of profit reserved, and that under no circumstances would the Department undertake wiring or installation work, or the sale of lamps except in cases of emergency. It was decided to refer the matter to the General Purposes Committee for further consideration.

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COMPANY NEWS.

Meetings, Reports and Dividends.

GENERAL ELECTRIC CO. OF NEW YORK.—A quarterly dividend of $2 has been declared.

MELBOURNE ELECTRIC SUPPLY CO.—A final dividend on the consolidated ordinary stock of 5 per cent., actual, British tax free, making 10 per cent. for the year ended August 31st, is announced.

BOURNEMOUTH AND POOLE ELECTRICITY SUPPLY CO.—The Bournemouth and Poole Electricity Supply Co. has made an issue of 150,000 £1 ordinary shares at £1 14s. per share, in order to pay off £133 300 7½ per cent. seven year notes.

CAPE ELECTRIC TRAMWAYS.—Mr. L. Breitmeyer, in submitting the directors' report and accounts (abstracted in our issue of November 16th) to the general meeting last week, said he attached little importance to the small falling off in the past year's revenue, as the current year's returns were fairly constant. Some new large double deck cars had been put into service at Port Elizabeth, and more had been ordered. Also six similar cars had been ordered for Cape Town. Mr. J. B. Taylor, formerly a London director, had joined the company's local board in Cape Town. The report and accounts and dividend were approved.

WESTERN TELEGRAPH CO.—Revenue for the year ended June 30th, as shown by the directors' report, was £1 403 174 2s. 9d., and working expenses were £906 474 0s. 4d. After providing £32 747 for debenture stock interest, and £196 711 7s. 8d. for income tax and corporation profits tax, there was a balance of £327 241 14s. 9d.; to this are added the sum of £200 000 transferred from provision on account of investment fluctuations, and £114 392 7s. 10d. brought forward from June 30th, 1922, making a total of £641 634 2s. 7d. Four dividends of 2½ per cent. each have been paid, amounting to £311 895, making a distribution of 10 per cent. tax free, for the year, £329 739 2s. 7d. being carried forward.

SOUTHERN BRAZIL ELECTRIC CO.—At the annual meeting last week the chairman, Mr. E. H. Tootal, said the hopes entertained a year ago that the company would be able to continue paying the interest on the debentures at the regular dates had not been realised, owing to further depreciation of the currency, the milreis having fallen to the record low value of slightly under 5d. The net result of the year's working was a loss of £8 982. The actual currency profits of the concerns in which the company was interested showed steady improvement. The only compensation for the low rate of exchange was that planters throughout Brazil were receiving enormously inflated prices in currency for their produce, and were able to spend more money on electric plant and current. Considerable building extensions were in progress in the City of Campinas which should give profitable employment to the electric services. The report and accounts were adopted.

CHADBURN'S (SHIP) TELEGRAPH CO.—The balance at credit of profit and loss account as shown by the figures just published, was £10 626 14s. 8d. for the year ended March 31st last, out of which sum directors' expenses, depreciation on properties, plant, etc., absorbed £3 172 4s. 4d., leaving a surplus of £7 454 10s. 4d., and adding this to the balance brought forward from March, 1922 (£10 363 7s. 4d.), makes a total of £17 817 17s. 8d. Two half-yearly dividends at the rate of £6 per cent. per annum on the preference shares and a dividend on the ordinary shares of £6 per cent. for the year ending March 31st (less tax) have been paid, the balance of £10 617 17s. 8d. being carried forward. While an agreement has been reached with the Admiralty regarding certain charges, a number of the amounts of the company's claims have not yet been agreed to, so that it is possible that minor adjustments may have to be contemplated in the balances treated as due by the Admiralty, and to the Inland Revenue Authorities.

MARCONI'S WIRELESS TELEGRAPH CO.—The accounts for the year ended December 31st, 1922, have just been issued. The directors state that many matters to which they have made reference in past years remain unsettled, so that the accounts do not reflect the true strength of the company's position. The credit balance of profit and loss account for the year was £302 948 0s. 4d., which, added to the balance brought forward, made a total to the credit of profit and loss account of £967 778 5s. 10d., subject to corporation profits tax and income tax. Dividends of 7 per cent. on preference shares, paid on February 1st, 1923, required £17 500, and interim dividend on ordinary shares of 5 per cent., paid on February 1st, 1923, £137 500, leaving available for distribution £812 778 5s. 10d. The directors recommend a further dividend on the ordinary shares of 10 per cent. (making 15 per cent. for the year), £275 006 10s., and on the preference shares 5 per cent. (making 12 per cent. for the year), £12 500, leaving balance to carry forward, £525 271 15s. 10d. The directors have carefully considered the value at which the shares and debts due by associated and other companies are entered in the balance sheet, and are of the opinion that in the aggregate they are not worth less than that amount. Patents and rights figure at £304 041 9s. The directors are of opinion that their value considerably exceeds that sum. The past year was again one of extreme difficulty. Unsettled political conditions, unstable exchanges and financial stringency have continued to prevail in most foreign countries. Business has consequently been very restricted and very difficult. Some of the associated companies have also felt the severe strain resulting from the continuance of these unprecedented conditions, and they have needed further substantial financial assistance from the company.

New Companies.

RICHSON AND CO., LTD.—Cap., £9 500. To adopt agreement with Richson and Co., and carry on business of manufacturers of and dealers in electric light fittings, glassware, etc. Reg. office: 113, Oxford Street, London, W.

NATIONAL REGISTER OF ELECTRICAL INSTALLATION CONTRACTORS (limited by guarantee and not having a capital divided into shares, with 100 members each liable for £5 in the event of winding up).—To afford to the public the means of distinguishing electrical installation contractors who have given evidence of their competency; to raise the efficiency and status of such contractors as a body in a manner consistent with the importance of their occupation, and in connection with the application and use of electricity for any purpose; to set up, issue and maintain a register of contractors qualified for registration in Great Britain, the Irish Free State and Northern Ireland, etc. The management is vested in a Registration Board, the first members of which are P. V. Hunter (vice-chairman), W. R. Rawlings, W. M. Selvey, C. H. Wordingham (chairman), S. E. Britton, E. Calvert, F. W. Purse, Lt.-Col. W. A. Vignoles, H. J. Cash, W. Cross, W. A. Shaw, W. H. Walton, A. Lindsay, D. S. Munro, A. B. Robertson, junr., A. E. Iliffe, H. W. Roberts, H. J. R. Burstall, A. H. Sykes, W. Harrison P. M. Millns, M. Clarke, A. E. Munby, A. G. Bruty, F. G. Sherwood. Solicitor: T. Trimnell, 1, Lincoln's Inn Fields, London, W.C.2.

Forty Years Ago.

"The Electrician," December 1st, 1883.

ELECTRIC LIGHTING ON WARSHIPS.—The French man-of-war "Richelieu," has been lighted by means of incandescent lamps. The installation was carried out by the well-known firm of Sautter, Lemonnier and Co., of Paris, and comprises 250 lamps, with the requisite machine, fittings, etc.

* * * *

A HINT FOR ENGLISH THEATRES.—An amusing adaptation of the Edison light has been made at the Bijou Theatre, Boston, U.S.A., in the last act of "Virginia." The two red horns on the devil contain 16-candle lamps, which, being connected to the Edison system in the theatre, are lighted when the devil disappears upward, producing a striking effect. The entire theatre is also lighted by Edison lamps.

* * * *

EARTH CURRENTS.—In a recent communication to the Academy of Sciences, M. Blavier states that the direction and strength of earth currents depend on the difference of potential between the two points where the telegraph wire is in contact with the earth, and not upon the length of the circuit. Between Paris and Nancy there are two circuits of very different natures; they have both given the same result, however. M. Blavier has also ascertained that subterranean lines are not more affected by earth currents than aerial lines.

METAL & CHEMICAL PRICES.

TUESDAY, November 27th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£64 5 0	—	10s.
Electro Wirebars ..	„	£67 0 0	—	£1 10s.
H.C. Wire, basis ..	per lb.	9⅝d.	—	1/16d.
Sheet	„	10 1/16d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 1⅝d.	—	1/16d.
Brass 60/40—				
Rod, basis	„	7½d.	—	—
Sheet, basis ..	„	10⅛d.	—	—
Wire, basis	„	10⅛d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 5 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
Lead Pig—				
English	„	£32 0 0	—	—
Foreign or Colonial	„	£30 10 0	5s.	—
Tin—				
Ingot	„	£231 5 0	£11	—
Wire, basis	per lb.	3s. 0d.	1½d.	—
Aluminium Ingots ..	per ton	£120 0 0	—	—
Spelter	„	£33 2 6	15s.	—
Mercury	per bottle	£9 17 6	—	—

Sulphur (Flowers)—Ton £8 0s. ***Sodium Chlorate***—Per lb. 2¾d.
„ (Roll-Brimstone)—„ £8 0s. ***Sulphuric Acid*** (Pyrites, 168°)
Copper Sulphate.. „ £25 per ton, £7 10s.
Boric Acid (Crystals). „ £48 ***Sodium Bichromate***.—Per lb. 4½d.
Rubber.—Para fine, 1s. 0¾d.; plantation 1st latex, 1s. 2¾d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co.

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COMMERCIAL INFORMATION

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

CUNNINGHAM SLATER, LTD., 146, High Street, Kensington, electrical engineers. £19 7s. 10d. October 18th.

LORD AND JAMISON, 280A, High Road, Ilford, electrical engineers. £39 4s. 8d. October 8th.

LUMENS, LTD., 11, Cathedral House, Long Millgate, Manchester, electrical engineers. £17 13s. 8d. October 19th.

RADIO STOCKS, LTD., 89, Newman Street, W., wireless apparatus manufacturers. £38 10s. 6d. October 17th.

SURREY WHOLESALE ELECTRICAL CO., Church Park, North End, Croydon. £37 13s. October 19th.

THOMPSON MANUFACTURING CO., LTD., Water Lane Works, Richmond, electrical instrument makers. £13 13s. 8d. October 16th.

WHALEY (R.), LTD., New Islington, Manchester, electrical engineers. £12 15s. 9d. September 25th.

Receiverships.

ELWELL (C. F.), LTD.—A. C. Lucas, of Aldermary House, 60, Watling Street, E.C.4, was appointed receiver on October 24th, 1923, under powers contained in mortgage debentures dated June 3rd and 30th, and October 29th, 1921.

SCIENTIFIC TRADERS, LTD.—A. Delo-Ford, of 12, North Row, Park Lane, W.1, was appointed receiver and manager on October 25th, 1923, under powers contained in debenture dated October 3rd, 1922.

Mortgage.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

INTERNATIONAL ELECTRIC CO., LTD., London, N.—Registered November 7th, Trust Deed dated November 7th, 1923 (by way of collateral security for £70 500 debentures already registered); charged on land and premises, etc., at Tottenham Hale. *£63 360. January 10th, 1923.

Satisfaction.

RADIO, PHONOPORE AND ELECTRICALS, LTD., London, E.C.—Satisfactions registered November 10th, £3 000 registered April 14th, 1923.

Private Meetings.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

CLARKSON, George Wilson, trading as CLARKSON AND CO., wireless dealer, etc., Biggar, Lanarkshire. Creditors interested were called together recently at Glasgow, when a statement of affairs was submitted showing liabilities £2 267 (£1 204 to the trade) and net assets of £356, a deficiency of £1 811. The accountant stated that the debtor's books were insufficient to enable a trading account to be prepared, but he had been able to ascertain that for the year to December, 1922, the receipts had amounted to £3 362 while against that the payments were £4 352. The debtor had no offer to make, and it was decided that the estate should be realised under a trust deed in favour of Mr. McMillan, of Glasgow, as trustee. A committee of creditors was also appointed to act with him.

SPREADBOROUGH, L., 14, Frith Street, Soho, and 539, High Road, Leytonstone, electrician and wireless dealer. A further meeting of creditors of the above was held last week at the Holborn Hall, Gray's Inn Road. According to the statement of affairs the liabilities totalled £360, while the debtor had various contracts in hand and had offered a composition of 5s. in the £. The meeting was adjourned with a view to an offer of not less than 10s. in the £ being forthcoming. (See ELECTRICIAN, 9/11/23, p. 532.) It was now reported that the debtor had been unsuccessful in obtaining sufficient support to enable him to pay 10s. in the £, but had been able to obtain assistance which would allow him to pay 7s. 6d. in the £ by 4s. in cash and 3s. 6d. in three months, and guaranteed. The representative of the largest creditors stated that they were not disposed to accept 7s. 6d. in the £, and it was eventually decided that the debtor should be granted further time within which to submit a composition of 10s. in the £. It was understood that the solicitors would inform the creditors whether the composition demanded would be forthcoming.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-up Voluntarily.

ELECTRIC WELDING CO., LTD. E. Hayes, 28, Basinghall Street, London, E.C.2, chartered accountant, appointed liquidator. Meeting of creditors at 28, Basinghall Street, London, on Friday, November 30th, at 12 noon.

Bankruptcy Information.

BILLINGTON, Raymond, 163, Walker Street, Kingston-upon-Hull, electrical contractor. Receiving order, November 17th. Debtor's petition.

BOOCOCK, Horace, lately trading as HARDWICK AND CO., 28, New Lane, Selby, in the county of York, electrician. Receiving order, November 19th. Debtor's petition.

HUGHES, Robert Ernest, and ALEXANDER, Robert McLuckie, trading at 129, Brockley Rise, S.E.23, as R. E. HUGHES, and at 51, Honor Oak Park, as HUGHES AND ALEXANDER, electrical wireless engineers. Receiving order, November 23rd. Debtor's petition.

Notice of Intended Dividend.

RUKIN, Pearson, Manchester Road Station, Bradford, electrical engineer. Last day for receiving proofs, December 11th. Trustee, J. Draper, 69, Swan Arcade, Bradford.

Application for Discharge.

CARPENTER, Charles Augustus, 4-5, Mason's Avenue, Basinghall Street, London, E.C., electrical engineer. Hearing, December 12th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

Partnerships Dissolved.

ADAMS, HUGHES AND CO. (Albert ADAMS and William Gower HUGHES), electrical engineers, 111, Clarendon Street, Hulme, Manchester, by mutual consent as from November 3rd, 1923. Debts received and paid by W. G. Hughes, 19, St. Bees Street, Moss Side, Manchester.

P. H. BOYS AND CO. (Percival Harold BOYS and George James IRONS), electrical and wireless engineers, 187, Goswell Road, London, by mutual consent as from November 17th, 1923. Debts received or paid by G. J. Irons, who continues the business.

UNITED ELECTRIC CO. (Harry Douglas JACKSON and Cyril BINNS), electrical engineers, 55, Low Briggate, Shipley, by mutual consent as from November 17th. Debts received and paid by C. Binns, who will carry on the business.

WHEELER AND PEARCE (Herbert WHEELER and William PEARCE), electrical engineers and contractors, 218, Rockingham Street, Sheffield, as from October 31st, 1923, by mutual consent. Debts received and paid by H. Wheeler.

Bankruptcy Proceedings.

WALTERS, William Nassau, 355, Finchley Road, London, N. This debtor, who had carried on business as an electrical engineer, attended at the London Bankruptcy Court last week for his public examination on a statement of affairs showing liabilities £442 and assets nil. In answer to the Official Receiver the debtor said that he retired from naval service in 1910 and then began business as an electrical engineer at 83, High Street, Gosport. He considered that he made from the business £500 per annum. During the war he rejoined the naval forces, but in 1917 he was discharged at his own request in order that he might return to his business, which had in the meantime been conducted under management. Early in 1920 he was joined in partnership by another person and they traded under the style of the Hampshire Electrical Co. About the end of 1920 the debtor disposed of his interest in the business to his partner for £3 000 payable by instalments. In the following March he opened premises at 355, Finchley Road, London, where he traded as an electrical engineer under the style of the Hampstead Electrical Co. But he found that it was a very different matter to trade in London and the business did not prove a success. In the following October it was converted into a limited company with a nominal capital of £1 000 divided into £1 shares of which 500 were allotted to him as vendor and 500 to another person who subscribed £200 in cash. Later on he bought this person's shares for £200. Shortly after the Finchley Road business was started one of his employees met with an accident and successfully brought against him an action under the Workmen's Compensation Act. The examination was concluded.

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PATENT RECORD.

Specifications Accepted.

203 880 British Thomson-Houston Co. (General Electric Co., N.Y.). Electric switches. (25/8/22.)
203 885 H. Wade (F. J. Kaehni and W. L. Kaehni). Electromagnetic sound-producing devices. (31/8/22.)
203 892 O. Lucas. Electric switches. (5/9/22.)
203 916 W. Holt and Brolt, Ltd. Electric switches and fuses for use in connection with dynamo lighting and battery-charging systems of motor vehicles and the like. (28/9/22.)
187 214 Metropolitan-Vickers Electrical Co. Electrically-operated elevators and the like. (10/10/21.)
203 918 J. A. Blackburn. Rotary distributors or commutators for internal combustion engine electric ignition systems. (30/9/22.)
197 904 C. G. Hill. Variable electric condenser. (20/5/22.)
203 939 F. H. Royce and Rolls-Royce, Ltd. Electrical ignition apparatus for internal-combustion engines. (26/10/22.)
203 947 General Electric Co., Ltd. (Hall Switch and Signal Co.). Electromagnetic apparatus for operating relay contacts, light signal mechanisms, and for similar purposes. (31/10/22.)
203 952 M. J. Railing and A. V. Cannon. Electrically-operated burglar alarms. (9/11/22.)
203 962 General Electric Co., Ltd., and C. G. Eden. Manufacture of electric discharge devices. (22/11/22.)
203 972 Waygood-Otis, Ltd. (Otis Elevator Co.). Electrically-controlled lifts and the like. (18/12/22.)
203 973 Veritys, Ltd., and F. W. Thorpe. Globe fittings of electric lamps. (19/12/22.)
203 974 Automatic Telephone Manufacturing Co. and S. R. Smith. Electromagnetic receivers. (19/12/22.)
193 027 E. Granat. Electric distant control system. (8/2/22.)
203 984 British Thomson-Houston Co. (General Electric Co., N.Y.). Methods of and apparatus for starting alternating-current motors. (5/2/23.)
197 644 Ateliers de Constructions Electriques de Charleroi Soc. Anon. Construction of stators for dynamo-electric machines. (9/5/22.)
194 724 Akt.-Ges. Brown, Boveri et Cie. Means for exciting and igniting the arcs in metal vapour rectifiers. (11/3/22.)
177 516 Norske Molybdenprodukter Aktieselskabet. Alloys of molybdenum with chemical, mechanical and electrical qualities. (26/3/21.)
204 072 A. A. Sandbrook. Electric lamps more especially for road vehicles. (22/3/22.)
204 084 British L. M. Ericsson Manufacturing Co. and W. M. Crowe. Telephone instrument circuits. (17/5/22.)
204 087 C. E. Iredell. Fusible cut-outs for electrically-heated articles. (22/5/22.)
204 091 C. L. Browne and S. H. Heywood and Co. Electric motor controllers. (2/3/23.)
204 094 L. Miller, J. P. Campbell, F. B. Holt and Metropolitan-Vickers Electrical Co. Electrically-operated valves. (15/6/22.)
181 731 Erda Ges. fur Wissenschaftliche Erderforschung and Dr. R. Ambronn. Devices for detecting and locating masses of dissimilar electric conductivity in the earth. (17/6/21.)
204 105 British Thomson-Houston Co., H. C. Hastings and G. O. Watson. Systems of electric motor control. (19/6/22.)
204 109 W. Langdon-Davies and A. Soames. Automatic electric current regulators. (19/6/22.)
204 118 W. Aitken. Automatic and semi-automatic telephone switching systems. (21/6/22.) (Cognate Application, 20 181/22.)
204 119 A. Onwood. Apparatus for wireless signalling and like purposes. (21/6/22.)

Applications for Patents.

November 12th.

28 408 B. Hesketh. Inductances for wireless telegraphy, etc.
28 427 D. S. B. Shannon. Grid leak fittings for wireless telegraphy, etc.
28 453 M. Wilderman. Diaphragms for electric batteries.
28 458 C. F. M. Hayes. Mounting of incandescent filaments.
28 460 A. H. Bretteli. Insulating panels for mounting or wiring electrical apparatus.
28 462 C. Jones. Electric conductor rails.
28 463 Siemens and Halske Akt.-Ges. Electrolyser. (15/11/22 Germany.)
28 465 Western Electric Co. Multiplex signalling systems.
28 466 Western Electric Co. Carrier wave transmission systems.
28 488 Landis and Gyn Akt.-Ges. Maximum demand indicators. (11/11/22 Switzerland.)
28 491, 28 492, 28 493. W. R. Bullimore. Filaments for electric lamps.
28 494 W. R. Bullimore. Electron emitting cathodes.
28 497 and 28 525 L. A. Levy. Thermionic valves, etc.
28 499 Metropolitan-Vickers Electrical Co., E. J. E. Hubbard, W. J. Brown, C. R. Burch and E. Y. Robinson. Electric relay apparatus.
285 01 28 502 and 28 503 J. E. Pollak (Maschinenbau Akt.-Ges. Seebach). Optical electrical measuring of distances.
28 520 Akt.-Ges. Brown, Boverie et Cie. Windings of high voltage transformers. (24/11/22 Germany.)
28 522 H. Flurscheim. Power plant. (5/12/22 France.)
28 531 W. S. Boughey and J. Sherman. Apparatus for driving dynamos.

November 13th.

28 533 A. Kur. Storage batteries, etc.
28 547 I. M. Chippindale. Induction motors.
28 561 A. J. and D. Boddington. Electric terminals or connectors.
28 563 H. Dinsdale. Commutator.
28 569 L. G. Russell and A. T. Thompson. Inductance coils for wireless telephony, etc.
28 572 L. Benson. Detectors for wireless receivers.
28 591 and 28 593 Coventry Automatic Telephones, Ltd., J. E. Collyer and C. W. Wilman. Telephone systems.
28 592 Coventry Automatic Telephones, Ltd. (Arter). Telephone exchange systems.
28 633 Automatic Telephone Manufacturing Co. Telephone systems. (14/3/23 U.S.)
28 635 Siemens Bros. and Co. and W. G. Patterson. Circuit arrangements for telephone systems.
28 638 R. W. Robins. Crystal detectors.
28 639 R. W. Robins. Variable grid leaks.
28 642 H. Melville-Smith and S. J. Tyrrell. Wireless inductance holders.
28 645 M. C. L. G. Fleischel. Power plant. (13/11/22 Belgium.)

November 14th.

28 642 Abbey Industries, Ltd. Wireless inductance holders.
28 653 W. Phillips. Anti-dazzle electric bulb.
28 673 T. F. Bouckley and W. H. Leeson. Electric oven light.
28 679 T. W. Broadbent and F. W. Davies. Alternating current motors.
28 680 W. J. Saunders. Terminal for electric wires.
28 691 C. J. Bond and W. Harding. Motors, dynamos, etc.
28 696 Highfield Electrical Co. and F. W. Highfield. Detachable electric connection devices.
28 710 Western Electric Co. Carrier transmission systems.
28 723 and 28 724 A. D. Cowper. Electric signalling systems.
28 728 Western Electric Co. Apparatus for translating pressure variations into electric variations. (14/11/22 U.S.)
28 730 W. P. Harris. Crystal detectors.
28 732 S. M. Sydenham. Electric terminals.
28 741 E. Schattner. Devices for indicating faults in ignition systems.
28 750 British-Thomson Houston Co., A. P. Young and J. H. Butcher. Telephone transmitters, etc.
28 752 Automatic Telephone Manufacturing Co. and J. E. Ostline. Automatic telephone systems, etc.
28 753 Automatic Telephone Manufacturing Co. and C. Remington. Arrangements for charging accumulators.
28 762 W. H. Priess. Electric amplifiers.
28 769 R. C. P. West. Low tension electric rotary distributor.
28 770 G. Moody and H. G. Wright. Apparatus for reception of wireless telephony, etc.

November 15th.

28 780 J. B. Tucker. Electric wall plugs.
28 782 M. Koopman. Crystal detectors, etc.
28 790 H. C. Baker. Electrically controlled lock for railway carriage doors.
28 792 J. J. Morck. Crystal detectors.
28 801 W. G. Heatly and S. Ward. Adjustable coil mountings for wireless telegraphy, etc.
28 840 W. E. Ellis and T. G. Weatherhead. Circuit for reception of wireless signals.
28 853 P. Reinhardt et Cie. Diaphragm for electrolytic processes. (28/11/22 Germany.)
28 854 Igranic Electric Co. and F. Bergmann. Switch operating mechanism.
28 859 Metropolitan-Vickers Electrical Co. Armature windings. (23/11/22 U.S.)
28 872 J. F. Monnot. Alkaline storage batteries.

November 16th.

28 860 G. Dumont. Electric relay switch. (8/12/22 Belgium.)
28 884 British Thomson-Houston Co. (General Electric Co., N.Y.). Variable condensers.
28 889 I. Guiducci. Safety devices for l.t. circuits.
28 906 A. Marr. Flexible tubes for telephones, etc.
28 908 G. B. Walker. Wireless sets.
28 932 M.L. Magneto Syndicate and E. A. Watson. Dynamo-electric machines.
28 945 Western Electric Co. Stuffing boxes for use in cable manufacture.
28 946 J. Backus. Electric switches.
28 947 A. P. Stockings. Contacts for electric switches, etc.
28 948 A. P. Stockings. Electric overhead switch, etc.
28 957 M. M. Houghton. Electrical indicators.
28 958 M. M. Houghton. Rheostats and potentiometers.
28 967 A. C. W. Aldis. Electric switches.
28 975 E. A. Graham. Telephone receivers.
28 979 British Thomson-Houston Co., A. P. Young and L. Griffiths. Magneto-electric machines.
28 980 British Thomson-Houston Co., E. Breivogel and C. A. Martin. Current collectors for dynamo-electric machines
28 981 C. F. Trippe and S. D. White. Electric resistance.
28 982 Landis and Gyr Akt.-Ges. Fine adjustment device for permanent magnets. (17/11/22 Switzerland.)
28 987, 28 988, 28 989 and 28 990. Scintillating Sign Co., C. E. H. Fitch and F. H. Waye. Electrically illuminated advertising devices, etc.
28 994 C. A. Pugh and R. J. Willis. Crystal detectors.
28 999 S. Lash. Disinfecting telephone mouthpieces.
29 003 and 29 005 Metropolitan-Vickers Electrical Co. Tanks for electrical apparatus, etc. (23/12/22 U.S.)
29 004 Metropolitan-Vickers Electrical Co. Governor mechanism for rotating machines. (29/11/22 U.S.)
29 006 Metropolitan-Vickers Electrical Co. Balancing machines. (21/4/23 U.S.)
29 010 E. Belin. Television. (27/12/22 France.)
29 011 British Thomson-Houston Co. and R. C. Clinker. Dynamic model of thermionic valve circuit.
29 014 C. Seymour and W. Ure. Electric condensers.

November 17th.

29 017 A. Kur. Storage batteries, etc.
29 026 W. G. and R. Goodchild. Adaptable ear protector for wireless headphones.
29 032 Telefunken, Ges. fur Drahtlose Telegraphie. High frequency telegraphy, etc. (18/11/22 Germany.)
29 047 G. Bowman. Actuating electric switches for internal combustion engines.
29 050 F. Earp and A. H. Ford. Means for engaging trolley wheel on overhead wire.
29 075 M. J. B. Barbaron. Control device for magnetos. (12/1/23 France.)
29 076 A. R. Angus. Devices for production and amplification of electrical oscillations.
29 082 British Thomson-Houston Co. Automatic control equipments. (17/11/22 U.S.)
29 094 R. Haddan (Huni). Electromagnetic cutouts.
29 096 S. G. Frost. Magneto-electric generators for signalling.
29 097 L. A. Carrera. Electrolytic tanks. (18/11/22 Spain.)

Arrangements for the Week.

Monday, December 3rd.

Institution of Electrical Engineers.
7 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.: Informal Meeting. Discussion on "Electrical Apparatus for the Deaf," opened by Mr. C. M. R. Balbi.

Tuesday, December 4th.

Institution of Electrical Engineers. (North-Western Centre.)
7 *p.m.* At the Engineers' Club, Albert Square, Manchester. Informal Meeting. Discussion on "Notes on Installing and Maintaining Electric Motors," introduced by Mr. B. Lakeman.

Wednesday, December 5th.

Institution of Electrical Engineers. (Wireless Section.)
6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.: Ordinary Meeting. Paper by Mr. L. B. Turner on "The Relation between Damping and Speed in Wireless Reception."

Thursday, December 6th.

The Newcomen Society.
5.15 *p.m.* At Caxton Hall, Westminster, S.W. Annual General Meeting.
The Institution of Electrical Engineers. (North-Eastern Centre.)
7.15 *p.m.* At the County Hotel, Newcastle. Smoking Concert.

Friday, December 7th.

Electrical Power Engineers' Association. (Southern Division.)
7 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, W.C.: Lecture by Mr. J. R. Hutchings on "The Brush Ljungstrom Turbine."
The Junior Institution of Engineers.
7.30 *p.m.* At Royal Society of Arts, John Street, Adelphi, W. Inaugural Meeting. Presidential Address by Sir J. Fortescue Flannery on "Marine Propulsion during Fifty Years."

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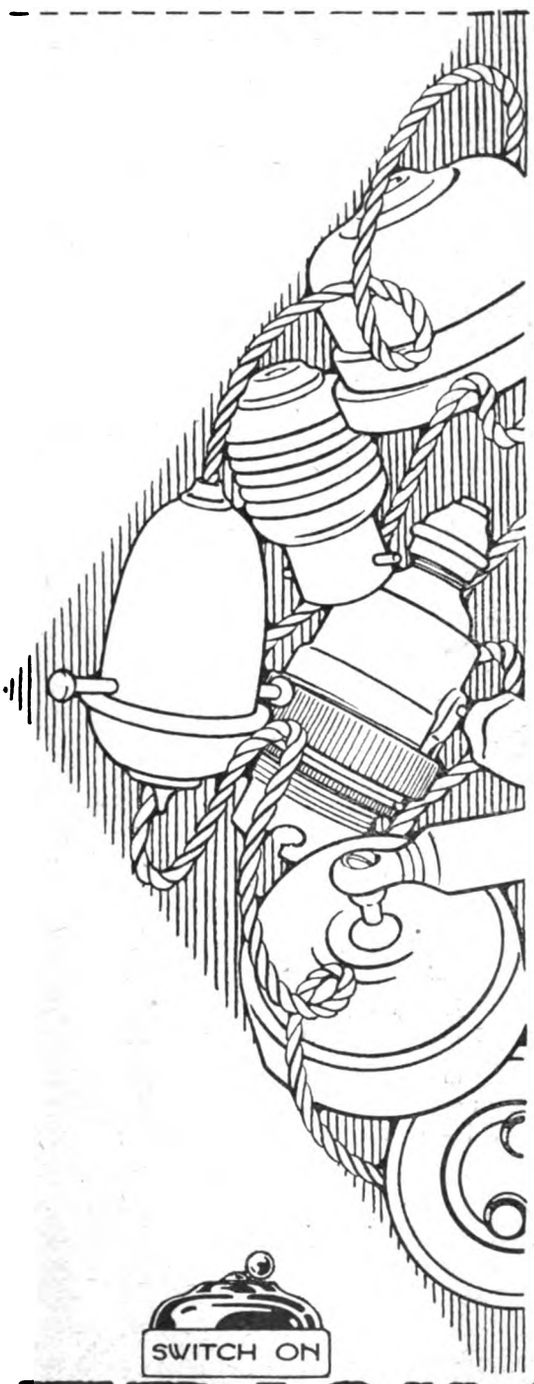

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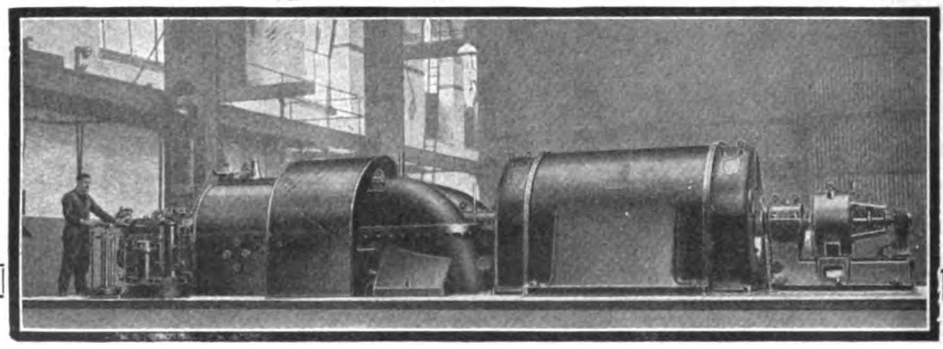

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LOUD SPEAKERS.

With admirable, though probably unpremeditated, stage management, the Institution of Electrical Engineers held a joint meeting with the Physical Society of London last week, at which the subject of "Loud Speakers" was discussed. There has been loud speaking in plenty during the last few weeks, and some of it has been conducted through loud speakers, notably by Mr. LLOYD GEORGE, who illustrated on one occasion a disadvantage of this form of communication when employed by the unwary. But quite apart from this fortuitousness of circumstance, it is right that attention should be drawn to the dawn of a new era in communication and of the means which are being taken to bring that new era to noontide. By means of broadcasting facilities a large portion of the nation can listen to a speaker whom they cannot see, while by the use of the public address system an orator may address a visible audience of many thousand people who can at least see the platform on which he is standing if they cannot see him. The interest that is taken in this matter in technical circles may well be gauged from the attendance at the meeting last week. About 550 people were present, and the attention of the audience was well sustained throughout both the afternoon and evening sessions.

The loud speaker problem cannot be better described than as, in the words of Dr. ECCLES, startling. It is to discover an instrument which will deal with the range of frequencies and energies with which the ear can cope. Speech employs frequencies ranging from 100 to 6 000, music from 400 to 10 000, and the ear is responsive up to 20 000 periods per sec. The ear is sensitive to vibrations from 1/1 000 dynes per sq. cm. to 1 000 dynes per sq. cm. —a range of one million fold. A first consideration of the subject is therefore sufficient to cast a gloom over the most optimistic temperament. Fortunately, in striving to produce sound over this tremendous range considerable latitude is permissible, 10 per cent. as the limit of distortion that could be present without being apparent to the ear was one figure mentioned. This is doubly fortunate, because, as has been pointed out in Lamb's "Dynamical Theory of Sound," among forced vibrations the only one which retains its character absolutely unchanged whenever it is transmitted from one system to another is the simple harmonic which is met with so often in theory and so seldom in practice. Distortion must therefore be regarded as inevitable, and the problem is to keep it within limits remembering that the two requirements of efficiency and purity are opposed to each other, so that a compromise between the two is necessary to get the best mean result.

Now, while mechanical and acoustical resources can be used to improve efficiency, their bad effects are so obvious that it is not surprising to find that two of the Papers read were directed to their elimination. Acoustical resonance is mainly to be found in diaphragms and horns. Prof. J. T. MACGREGOR MORRIS and Prof. E. MALLETT gave a demonstration which showed that no less than thirteen resonance frequencies exist in the overtones of a telephone diaphragm. Such resonance is increased by damping, though the effect of a load such as the column of air within the horn is to give a balance. Mr. L. C. POCOCK also showed that resonance is caused by horns at low frequencies, though he considered resonances in the mechanism to be of more importance. On the other hand, Mr. H. L. PORTER, in recounting some of his experiences in gramophone acoustics, stated that it is usual for peaks, due to various causes, to come very close together and so to produce a massing of response over certain tones out of all proportion to the others. Incidentally, the discussion showed that the function of the horn is to increase the total volume of sound, not merely to distribute it.

Bearing in mind that distortion cannot be avoided in practice, it is useful to discover what band of frequencies it is most important to preserve. Using Campbell high-pass and low-pass filters, Mr. E. K. SANDEMAN gave a demonstration of the effect upon speech of suppressing various frequencies. Cutting off all frequencies below 500 has only a small effect upon the intelligibility of speech though its naturalness is impaired. The importance of frequencies below 1 500 seems about equal to those above this figure, though if all above 1 700 are eliminated speech is unintelligible. Amplifiers are, of course, one of the most prolific sources of distortion. Prof. C. L. FORTESCUE classed the causes of inaccurate reproduction as (*a*) curvature of the valve characteristic, (*b*) intermediate circuits having natural periods, (*c*) reaction effects and (*d*) unsatisfactory last transformer.

A more purely acoustical problem is the effect of surroundings upon the results obtained from loud speakers. Some instructive charts were shewn by Mr. G. A. SUTHERLAND to illustrate the effect of reverberation and relative absorbing powers. In a room where there was a fairly high degree of echo only 40 per cent. of the sound reaching the ear was due to the syllable actually being uttered, the remaining 60 per cent. being due to the reverberations of previous syllables. The best absorber was found to be

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an audience, better even than cushions stuffed with cotton wool.

The meeting therefore provided us with a statement of the problems connected with loud speakers, and if not a solution at least an indication of the road that ought to be taken to find it. From this point of view it was most useful, and the attendance is indicative of the attention an Institution meeting can still attract when specialist subjects are discarded and the authors of the Papers come down to brass tacks. We hope the hint will be taken, and further meetings of this sort arranged.

Current Topics.

Electric Locomotives for Mines.

MR. CHARLES MARKHAM'S generous offer of a prize of £1 000 for an electric locomotive which shall satisfactorily fulfil the operating conditions in mines has drawn attention to the limitations of this equipment and has naturally caused great activity in the suggestion of improvements. For those reasons we have thought it well to obtain, from the pen of Mr. JOHN T. PRINGLE, a statement of the present position of the storage battery locomotive in this country together with the problems which will have to be solved before its development along the right lines can be expected. As will be seen from the article which we publish on another page of this issue, Mr. PRINGLE focusses our attention on the battery. At present we have no battery which will work continuously and efficiently for eight hours without recharging, the problem of gradients with all it implies has not been overcome, and the controllers available are not strictly explosion proof. Both the limitations of the battery and the effect of gradients make it necessary that arrangements should be available for the easy transhipment and recharging of the batteries, and the locomotives must be designed with this end in view. Mr. PRINGLE places the limiting gradient at ¾ of 1 per cent., and, if it is necessary that this figure should be exceeded, considers that locomotives should be abandoned in favour of some stationary haulage system.

Essentials of a First Class Locomotive.

THE problem of providing explosion proof controllers should be easy to solve, considering the experience that is constantly becoming available on this subject, and as far as contact arcing is concerned the matter has already been satisfactorily dealt with, so that the outstanding requirements do not really present any great difficulty. Mr. PRINGLE gives in some detail the essentials of a first class locomotive, and these should be helpful to those who propose entering for the competition. Briefly, they depend on the factors of overall size, strength, good engineering design in mechanical and electrical details with two 22 H.P. electric motors and sufficient accessory equipment to make the operation easy and safe. The cost of such a locomotive should be about £2 000. As Mr. PRINGLE points out, the field of competition is narrowed by the conditions, but we do not consider this a disadvantage. The result is likely to be something which can really be used, and not something which is only fit for the patent office or the museum. It should also point the way to that standardisation which is badly required.

Electro-Deposition Problems.

FROM the point of view of the heavy electrical engineer, electro-deposition may be looked upon as a subject of little interest. Yet it is one of the oldest of electrical applications, and from the scientific and technical points of view still offers many problems for solution. More than once in THE ELECTRICIAN Mr. W. E. HUGHES has reviewed recent progress in this direction, and on another page of this issue he deals with what has been done during the past two years. In this review he makes the important point that though the scientist and the practical man have been doing useful work in their own fields they have not joined forces in a way which will make the greatest development possible. On the other hand, he points out that some of the information put forward by the scientific man will be unintelligible to the worker, and makes a plea for a round table discussion on more practical lines. This hint might be taken in other circles of the electrical industry. Mr. HUGHES specially outlines the work that has been do neon the deposition of iron and chromium as well as nickel and zinc. The problems indicated are more chemical than electrical, but they are not the less worthy of attention for that reason.

Electricity and the League of Nations.

THE connection between the League of Nations and electric power supply may not at first sight seem very close, but the second general Conference on Communications and Transit, which was recently held at Geneva, considered among other things a draft convention whose special object is to solve certain international problems connected with electricity. The matter is not one of direct interest to this country, whose frontier is the sea, across which no proposal to transmit power has yet been made. But in that part of central Europe where France, Switzerland and Italy converge, as well as where the boundaries of Germany, Austria and Switzerland are contiguous, it is of importance, and it is well that some settlement of it should be made. The matter was brought up at the Conference held in Barcelona in 1921, and an Advisory and Technical Committee was appointed to consider it. They have reported that the only two aspects of the problem ripe for immediate treatment are: The transmission of electric power in transit, and the exploitation of hydraulic power on watercourses forming part of a basin situated in more than one country. "Electric power in transit" is not strictly defined, but it means apparently the transmission of power across a country in which it is not completely utilised or produced. The tone of the report has been determined by the resolution passed at Barcelona to the effect that States having an abundant supply of electric power should concede a part of it to States who were not in so fortunate a position.

A New International Question.

IT is pointed out that, although these two questions interest nations as a whole and lend themselves to treatment by means of definite international conventions, they are practically new problems from an international point of view, and the difficulty, therefore, arises of codifying in detail principles which will have to be tested in the light of future experience. The draft conventions and statutes on these subjects, therefore, do not contain any definite set of regulations, but only state certain governing principles of which the application can be dealt with later. For the same reason it is not proposed, in most cases of disputes arising, that appeal shall be made to the Permanent Court of International Justice. It is interesting to find recognition of the fact that exploitation of water power should only be based on technical considerations and that political frontiers should not be taken into account. Both questions should be settled by mutual agreement between the States concerned and dues are not to be levied for wayleaves. This convention is published by the information section of the Secretariat of the League of Nations in both French and English. We shall await its practical application with interest.

The Composition and Ageing of Insulating Materials.

IT is known that, during the drying and oxidation of varnishes, conducting materials may be formed, producing an appreciable lowering of the insulation resistance. These low resistance materials are chiefly acids of low molecular

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weight, which are volatile and form conducting solutions with water. In a paper read before the American Electro-chemical Society, Mr. H. C. P. WEBER presents some curves illustrating these progressive changes. These curves are based on experiments with strips of various insulating materials baked at 100 deg. C. From these curves it appears that the amount of acidity is a function of the time, increasing as oxidation progresses; for most varnishes the oxidation is complete after about 96 hours. Throughout the tests the order of value of the samples remained substantially the same, so that a 48 hour test is practically as good as one over a 96 hour period. So far as oils are concerned, linseed oil varnishes are the most acid (2·5 to 3·5 per cent.), China wood oil (1·5 to 1·8 per cent.) varnishes being distinctly better in this respect. Assuming the same type of oil, the acidity developed depends on the percentage of oil present.

Business Failures.

THERE is little doubt that, in part, the high figures shown in the Bankruptcy Returns just issued suggest that the severe testing period of the last year or so has been altogether too much for many of the firms included in what one may fairly regard as a toadstool growth encouraged by the hot-bed of wartime profiteering. There was little or no stability about such concerns, and perhaps there is even a sense of poetic justice in the fact that at this particular phase of the trade situation, when it is believed that the worst is over and that from now onwards a steady improvement will be experienced, this more or less rank growth is being cleared away. That, of course, is only one aspect of the figures, which, as usual, have behind them stories of hard, hopeless struggles by genuine traders and manufacturers for whom the whole circumstances of the last decade have gradually become too adverse. There are, too, the very numerous small men who have attempted to launch comparatively frail financial enterprises on the wireless wave. Had they possessed a more intimate knowledge of business shoals, they might not have ventured, and would thus have saved their too trusting creditors from what, in the aggregate, amount to very serious losses; but their case is by no means comparable with that of the case-hardened bankrupt who thrives on his wretched failures and who, if he were not so clever at the game, would long ago have been where he ought to be—inside the safe walls of a common gaol.

Methods of Barbarism.

AT the annual general meeting of the Western Telegraph Co. last week a shareholder, Mr. BISGOOD, made the extraordinary statement that holders of stock in the company and its associated concerns had been pestered during the last six or eight months to sell their shares and hold their money up, presumably so that it could be invested in the wireless industry. The result had been a considerable sale, and consequent fall in the value, of the shares, and he therefore thought that the company should go in for a little propaganda "to show how utterly futile wireless was as compared with the cable service." Without endorsing this last statement we may give it as our definite opinion that it is a profound mistake for the cable and wireless interests to decry each other's usefulness, and if any attempt to depreciate securities on the lines suggested by Mr. BISGOOD has really been made it will be rightly resented by all decent business men. It cannot be too often reiterated that efficient communication is necessary for the well-being and development of the Empire. That being so there will be room for years to come and probably for ever for both submarine and wireless telegraphy. The two methods of communication are not competitive, but complementary, and that should be recognised more generally than it seems to be. Were, however, the fields of these two means of communication directly antagonistic the rise of one and the fall of the other could only justly be brought about by clean commercial methods and with the assistance of the public. To do otherwise would be unnecessarily to injure the vital interest and would rightly deserve the greatest opprobrium.

The Advantages of Brighter Streets.

THE campaign which is now being undertaken by the British Electrical Development Association in favour of the long hour lighting of shop windows has as its corollary in a movement towards the brighter lighting of streets. The one means bigger business owing to its attractiveness, the other draws people to where business may be done, and makes it possible for them to go about their business or pleasure safely after dark. This is therefore a good argument for the better lighting of our streets, though it is by no means the end of the story In dealing with this subject in a paper read before the Association of Municipal Electricians in the United States, Mr. L. A. S. WOOD pointed out that the average street lighting in that country suffered from inadequacy, bad design, lack of standardisation, inattention to architectural requirements and too little application of effort, research and talent. Adequate street lighting is not costly and makes a town more pleasant to live in; it enhances the value of property, as figures from New York and Chicago show, and it keeps down crime and accidents.

Labour and the Levy.

IN our columns recently we gave a summary of an article which had appeared in "The Times" from the pen of Sir Ernest Benn, on the subject of the Labour Party's proposed Capital Levy. In this, Sir Ernest presented the very plain case of an ordinary manufacturing firm, and showed how seriously its operations would be retarded by the demands of a Capital Levy. Mr. Pethick Lawrence took up the challenge in an article in the "Daily Herald," in which he attempted to prove that a Capital Levy would really be a blessing in disguise to the manufacturer figuring in Sir Ernest's argument—that at the worst he would only have to pay £220 a year for 20 years, but that, on the other hand, he would receive income-tax relief to the extent of anything from £140 to £175 a year, beside enjoying reduced food taxes. To this Sir Ernest replied in a letter to the "Daily Herald," in which he asked: "Then what becomes of the Capital Levy? Is its purpose to strengthen the position of the £20 000 man? How does it reduce debt? I took it, and still take it, to be a serious proposal to get £3 000 out of the man who owns £20 000. If it won't do that, even Mr. Lawrence must admit its futility." But that letter was refused publication by the "Daily Herald," the columns of which, apparently, are only open to the opinions of those who agree with its weird beliefs and policies.

Useful Publication.

Among the multitudinous Blue Books, White Papers, Reports and so forth which are issued in a continuous stream by the Stationery Office, there is a certain number interesting to various industries, including electric supply, but it is often only by an accident that the ordinary man comes across the publications that interest him. For instance, it is probable that comparatively few of the large number of those interested in the Whitley Councils know of the "Report on the Establishment and Progress of Joint Industrial Councils" which was recently published, and which gives an exhaustive summary of the work of the various councils, including the electricity supply councils and boards from 1917 to 1922. For the benefit of those who wish to hear of these publications, the Stationery Office issues a little booklet called the "Municipal Circular," which gives a classified list of all the recent selected publications. This list is so carefully arranged an indexed that anyone can see in a moment whether the particular issue contains a notice of any publication in which he is interested. The Stationery Office circulates this publication regularly by post each month where desired, and so the business man can keep himself posted as to Government publications with merely fractional trouble.

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THE ELECTRO DEPOSITION OF METALS.

A Review of the Work Done During the Last Two Years.

By W. E. HUGHES, B.A. (Cantab), D.I.C.

During the last two years considerable work has been done and considerable progress has been made in connection with the electrolytic extraction and refining of metals, on the one hand, and electro-plating, on the other. Moreover, not only has the practical and commercial side of these processes been developed; but investigation has been proceeding rapidly—almost too rapidly—into their scientific foundations. This intensified dual attack in the field of electro-metallurgy is of happy augury. But, generally speaking, the work done on the scientific side has been done by the scientist, and that on the practical side by the practical man. There is not as yet that close relationship between the two which alone leads to real success. It does, however, exist in isolated instances. The work done by W. Blum and H. S. Rawdon[1] on the relation existing (in certain cases) between deposited metal and the base on which it is formed was inspired by an observation made by G. B. Hogaboom that in the cases of some silver deposits the crystals of the deposits appear to be continuous with those of the base metal, the usual line of demarcation and change of structure being absent. A recent paper by A. K. Graham[2] seems to confirm Hogaboom's observation; but, according to him, what he calls "reproduction" of the crystals of the base metal does not depend so much on the preliminary chemical treatment of the base metal as on the state of the metallic surface. The writer's view is that the causes determining whether the crystals of the base metal will or will not be enlarged by deposition—will "grow," that is to say—lie very much deeper than either Blum and Rawdon or Graham seem to suppose.

It is questionable whether some of the recent efforts made by the scientist to induce the practical man to work on more scientific lines have not overstepped the mark. M. R. Thompson, in a paper read to a recent meeting of the American Electro-Platers' Society, introduces Sörensen's *pH* notation. It is to be doubted whether the introduction of such terms does any good. "This system of nomenclature has certain obvious advantages if used with discretion; not seldom, however, it lends itself to obscuring the fact that the real agent at work is the actual hydrogen ion concentration, c.H.; it is difficult enough, even for the expert, to picture a quantity in terms of its negative logarithm, and it leads to confusion and suspicion on the part of the inexpert and beginner. . ."[3] It is to be hoped therefore, that such usages will be avoided by the scientific man who is intent on seeking the collaboration of the man in the shop. Far better is the attempt made by the American Electrochemical Society which, at its autumn meeting held in September last at Dayton, Ohio, promoted a round table discussion on subjects connected with electro-plating in which both types of worker were invited to take part. This practice will be continued at the Spring meeting of 1924, which is to be held at Philadelphia in April next.[4]

The principal of the recent work carried out in connection with the deposition of metals has been concerned with iron and chromium; some interesting work has been carried out in connection with the deposition of nickel and zinc also. As these are the four metals which are of most interest to manufacturers of iron and steel goods, it is proposed to limit the present review to them.

Iron.

H. D. Hineline has, in an essentially practical paper, described the method worked out by him for depositing iron upon non-conducting substances such as rubber.[5] This work is of further importance in that the method may be applied in the cases of other metals than iron; and the author is to be congratulated upon making his results public. The bath used by Hineline with best results was composed of equal parts of ferrous chloride and calcium chloride in such quantities as to make the solution saturated at a temperature of about 30 deg. C. The bath contained also 20 gms./lit. of chromous chloride and 5 gms./lit. of hydroquinone. The working temperature employed was 60 deg. to 70 deg. C. This bath is, of course, similar to the Fischer-Langbein solution; it differs from this in that it contains chromous chloride and hydroquinone. The "Brass World" has recently published some experiments carried out by the writer and designed to test the claims made for the Fischer-Langbein bath.[6] These results show that, for practical purposes, such as "building up work," this bath is, in general, the best one yet put together for the deposition of iron Other baths that have been proposed of late are not, in the writer's opinion, of the same general utility.[7]

Perhaps the most interesting of recent work on iron deposition is that carried out by F. A. Eustis and his co-workers at Milford, Conn., U.S.A. The Eustis process is one of both extraction and refining.[8] It is a cyclic process. Iron ores (pyrite and pyrrhotite, chiefly) are broken up and leached with acid; the leaching solution is passed through the depositing tanks, and the spent liquor is returned to the leaching tanks. Despite the fact that sulphur ores are used, the deposit is said to contain less than 0·005 per cent. of sulphur. A large sum of money has been spent on the development of this process, but results obtained with a pilot plant indicate that the expenditure will be justified.

Production of Magnet Cores.

Among the applications to which electrolytic iron has been put recently the most interesting, perhaps, is that fully described in a paper presented to a meeting of the American Institution of Electrical Engineers at Salt Lake City, June 21st to 24th, 1921. Briefly, the application consists in the use of electrolytic iron for the production of magnet cores. The iron is ground, sieved, insulated, and pressed in ring-shaped dies at a pressure of 200 000 lb./sq. in. of surface. The rings are pressed to a thickness of $\frac{1}{4}$ in., approximately, the inside and outside diameters depending upon the design of the coils. After pressing, the rings are baked at a temperature of 125 deg. C. in order to remove moisture. Ordinarily, several coils are stacked together to make a coil and covered with insulating tape before the copper winding is put on. In a conversation that the writer had lately with some members of the research staff of the Western Electric Co., Inc., New York, two interesting matters connected with this application were emphasised, namely, (1) the use of flaked zinc as a material with which to tumble the powdered iron during the process of insulating the particles of the powder; and (2) the iron required as material is not necessarily the purest iron obtainable by electro-deposition. As regards the former matter, the favourable result obtained by tumbling with zinc was discovered quite accidentally by J. C. Woodruff. He found that when a quantity of iron powder was tumbled in a galvanised iron drum for a few hours and *then* treated with a solution of shellac, the resulting product showed for

[1] Trans. Am. Electrochem. Soc., 1923, vol. 44.
[2] Read at Dayton, Ohio, Oct., 1923, before the Am. Electrochem. Soc.
[3] A. V. Hill, "Nature," 1923, vol. 111, p. 434. Cp. W. M. Bayliss, "General Physiology," 1915.
[4] Bull. Am. Electrochem. Soc., Sept., 1923.
[5] Trans. Am. Electrochem. Soc., 1923, vol. 43, p. 119.
[6] "Brass World," 1922, p. 261.
[7] V. U.S. Pat., 1444887 (1923, Feb. 13), and Eng. Pat., 197066.
[8] Bull. Min. and Met. Soc. of America, No. 157, 1922; B. Stoughton, "Chem. Age" (America), March, 1922; "Iron Age," Jan. 5, 1922; and E. C. Kreutzberg, "Iron Age," Aug. 30, 1923. V. also U.S. Pats. 1403237 (Jan. 10, 1922) and 1412174 (Apr. 11, 1922).

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corresponding permeabilities a higher specific resistance than had been obtained by tumbling in non-galvanised drums, or by any methods previously tried. It is not known how the zinc produces this favourable effect, but it seems likely that a coating of zinc oxide is produced on the iron particles and serves as an insulator. As regards purity, it seems that 100 per cent. material is not necessary: 95 per cent. iron, containing 2 to 3 per cent. of combined iron is used. The requisites of the iron for this application appear to be constant composition and low content of sulphur.

Pure Deposited Iron.

R. P. Neville and J. R. Cain have used a very pure deposited iron in their work on the preparation and mechanical properties of vacuum-fused alloys of iron with carbon and manganese.[9] These authors state that, as deposited, their iron contained the following percentages:—C, 0·004; S, 0·004; Si, 0·001; Cu, Ni and Co (together), 0·014. There is no mention of hydrogen or—even more important—of chlorine. This appears strange to the writer, since the authors used a 25 to 30 per cent. ferrous chloride bath, prepared by dissolving Armco iron in 1:1 chemically pure hydrochloric acid, and operated at room temperature and a current density of 10 A per dcm^2. It has long been known and has been recently shown by the writer[10] that iron deposited from chloride solutions rusts quickly and badly. Neville and Cain noticed that their iron rusted badly, and for that reason took very special precautions to wash and dry it thoroughly after removal from the vat. Since it is very probable that this liability to rust is due to the inclusion of chloride in the iron, and heat-treatment would not get rid of this impurity, the results obtained by Neville and Cain upon alloys made with such material must be suspect. A similar criticism may be directed to the results obtained by N. B. Pilling when investigating the effect of heat treatment on the hardness and microstructure of electro-deposited iron.[11] Pilling used a solution containing ferrous sulphate, ferrous chloride, ammonium sulphate, and ammonium oxalate. The high current density, 10 A per dcm^2 was employed at room temperature. Circulation was used. The composition of the deposited iron is given (in percentages) as:—S, 0·005; P, 0·005; C, 0·005; Mn, 0·001; Si, 0·022; Cu, trace; and H, 0·011. Here, too, no mention is made of chlorine. Pilling obtained the following results: (1) For complete and rapid softening, annealing at a relatively high temperature (800 deg. to 900 deg. C.) is necessary (2) By annealing at 300 deg. to 400 deg. C. the initial hardness may be considerably *increased*. With the present material the sclerometer hardness was increased from 26 to 45. (3) The brittleness of the material as deposited may be removed by annealing at 300 deg. to 400 deg. C. It will be noted that these results differ considerably from those obtained by J. Cournot,[12] though both authors are in agreement in expressing the opinion that some of the properties of electro-deposited iron, e.g., its hardness, are due to the presence of a hydride of iron. In regard to this view, however, it may be said that neither author has proved (or even shown the likelihood of) the existence of any such hydride. Cournot illustrates his paper by a micrograph that (he says) shows its presence—but does not; and Pilling speaks of his hydride as being "hypothetical."

Chromium.

A great deal of work is being done, in both Europe and America, in connection with the electro-deposition of chromium; some, but little, has been published. The paper[13] that gives most information is one read by K. W. Schwartz at the recent autumn meeting of the American Electro-chemical Society, held at Dayton, Ohio, U.S.A. This work was carried out under the direction of Prof. Colin Fink, of Columbia University, New York. As this paper has not yet appeared in the Transactions of the Society, the results may well be summarised here. The best results were obtained from G. J. Sargent's solution[14] which contains 3 gm. per lit. chromium sulphate and 245 gm. per lit. chromic acid. A current density of 13·4 A per dcm^2 was found favourable at room temperature. Chromium anodes were used; these showed no tendency to become passive, even after long continued deposition. The author states that simultaneous evolution of hydrogen with chromium deposition on iron is essential to good results. He believes that the gas protects the freshly discharged metal, and counteracts a tendency of the chromium to pass into the chromous ion state. The deposit is stated to possess a hard, bright, and silver-like surface; and iron or steel plated with it resists atmospheric corrosion indefinitely. The writer can confirm this last observation. Some steel tube plated by him with chromium seven years ago shows no trace of rust to-day. He was, too, recently shown some samples of iron sheet plated with chromium which had been contained in a humidity chamber for several months, and yet showed no sign of rust. Other reagents to which the deposited chromium is immune are, as stated by Schwartz, nitric acid fumes, hydrogen sulphide, ammonia, and molten brass, zinc and tin. The defect of Schwartz's method is that his cathode efficiency was low, being of the order 20 per cent. Better efficiencies than this have been obtained by other workers; for instance, W. G. Knox, of the Western Electric Research laboratories, has obtained a cathode efficiency of 30 per cent. The deposition of chromium has engaged the attention of E. Liebreich also.[15] This author describes some of the properties of the deposited metal, but no information of practical value is given by him.

There is no doubt that the deposition of chromium will in the near future become a workshop process; and it is certain that this process will be of great utility. It is believed that the Westinghouse Company, of America, is already employing a process whereby chromium is deposited on a semi-commercial scale for the purpose of plating lamp filaments. Other uses to which the deposited metal could be put have already been indicated above; not the least important would be its employment as a means of protecting iron or steel from corrosion. Indeed, chromium-plating could be put to so many useful and important uses that it is much to be hoped that the experimental work said to be in progress in Sheffield will be continued and extended in other places in this country.

Nickel.

A number of papers of general interest to those engaged in the deposition of nickel have been published during the last two years. V. Kohlschütter and H. Schödl have studied the structure of the deposited metal.[16] M. R. Thompson's work[17] on the acidity of nickel solutions is well worth study, though many will agree with C. P. Madsen that, in nickel deposition, other factors are far more important than degree of acidity, and that a condition can be established in the electro-deposition of nickel in which the degree of acidity plays but little part.[18] M. R. Thompson and C. T. Thomas[19] have considered the effects of the various impurities commonly found in nickel salts. Their paper contains some very useful information. Thompson has investigated[20] also the specific effects of a content of iron in the nickel bath. A paper that will be useful to many is one published by A. K. Graham which records results obtained by him when depositing nickel upon zinc.[21]

Zinc.

The work that has been done during the last two years in connection with the electro-deposition of zinc has been

[9] Trans. Am. Electrochem. Soc., 1922, vol. 42, p. 21.
[10] Chem. and Met. Eng., 1923, vol. 29, p. 536.
[11] Trans. Am. Electrochem. Soc., 1922, vol. 42, p. 1.
[12] "Compt. rend.", 1920, vol. 171, p. 170.
[13] This paper is not yet published.
[14] Trans. Am. Electrochem. Soc., 1920, vol. 37, p. 479.
[15] "Zeit. f. Metallkunde," 1922, vol. 14, p. 367, and "Zeit. f. Elektrochem.", 1923, vol. 29, p. 208. See also A. Gradenwitz, "Indian Ind. and Power," 1922, vol. 19, p. 441.
[16] "Helv. Chim. Acta," 1922, vol. 5, p. 490.
[17] Trans. Am. Electrochem. Soc., 1922, vol. 41, p. 333.
[18] Op. cit. note 17, at p. 361.
[19] Trans. Am. Electrochem. Soc., 1922, vol. 42, p. 79.
[20] In a paper not yet published.
[21] Trans. Am. Electrochem. Soc., 1923, vol. 44.

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concerned especially with the relative advantages of acid and alkaline (cyanide, particularly) solutions. The writer's view is that, especially when one bears in mind the use and purpose of electro-galvanising, nothing can be done in a cyanide solution that cannot be done at least as well in the acid (sulphate) bath. And, on the other hand, the cyanide bath has the following disadvantages:—(1) Cyanide baths, especially when used hot, are injurious to the health of the workers; (2) they are always undergoing chemical changes, even when not being worked; (3) the changes occurring during electrolysis result in products that are useless and, sometimes, harmful in a plating bath—hence waste and trouble; (4) as the result of (2) and (3), cyanide baths are difficult to work and control; (5) the electrode efficiencies are poor as compared with those of the sulphate bath; and (6) cyanide baths are always relatively costly in preparation and upkeep. The feature of the cyanide bath that seems to decide many in its favour is its "throwing power." Undoubtedly, cyanide baths do "throw" well; but so also do properly constituted sulphate baths. The writer has never had the least difficulty in effectively protecting articles of such irregular form as sad-irons, cast iron boshes, and the like, with zinc deposited from sulphate baths. Whatever one's views may be on this matter, a critical and experimental study of the "throwing power" and current efficiencies of zinc-plating solutions, published by W. G. Horsch and T. Fuwa, will be of interest and assistance.[22] These authors cite most of the work published up to 1921. They give the results of some very careful work, which was directed to the development of a zinc-plating bath of high "throwing power." Their conclusions from these are decidedly in favour of cyanide baths as regards "throwing power"; but they are silent as to what their experimental data show in regard to other features, and they show much that is against the value of cyanide baths.

It is well known that the process of zinc deposition and the resulting metal are greatly influenced and affected by any impurities the electrolyte may contain. S. Field has published much work of real importance on this subject,[23] and a recent paper by him and W. E. Harris (read at the Dayton Meeting of the American Electrochemical Society), on the use of mercury in the purification of sulphate solutions contains material of value. The effect of impurities upon the form and structure of electro-deposited zinc has been studied by J. T. Ellsworth[24] and by G. D. Scholl.[25] Scholl illustrates his paper by a very fine series of photographs that show the surfaces of deposits formes in baths containing known impurities in known amounts.

Perhaps the most important paper on the properties of electrolytic zinc that has appeared of late years is one by M. von Schwarz.[26] This paper is cited here for reference; the writer hopes to consider it critically in another place.

Finally, mention must be made of a paper by Gojon and Lemarchands[27] which will be of much use to those engaged on the deposition of zinc. It contains a full bibliography of the subject and a critical comparison of the methods that have been employed to deposit zinc.

Books Received.

"Wireless for the Amateur." By J. Roussel. (London: Constable and Co.) Pp. 270. 14s. net.

"The Alternating Current Circuit." By Philip Kemp. (London: Sir Isaac Pitman and Sons.) Pp. 87. 2s. 6d. net.

"Electric Arc and Oxy-Acetylene Welding." By E. A. Atkins. (London: Sir Isaac Pitman and Sons.) Pp. 316. 7s. 6d. net.

"The Essentials of Transformer Practice." By Emerson G. Reed. (London: Sir Isaac Pitman and Sons.) Pp. 265. 12s. 6d. net.

[22] Trans. Am. Electrochem. Soc., 1922, vol. 41, p. 363.

[23] Trans. Far. Soc., 1921, vol. 16, p. 492; and ib., 1922, vol. 17, p. 400.

[24] Trans. Am. Electrochem. Soc., 1922, vol. 42, p. 63.

[25] Chem. and Met. Eng., 1922, vol. 26, p. 595. See also C. A. Hansen's remarks on Scholl's work. Chem. and Met. Eng., 1922, vol. 27, p. 100.

[26] "Zeit. f. Elektrochem," 1922, vol. 29, p. 198.

[27] "Chim. et Ind.," 1922, vol. 8, p. 506.

NON-FERROUS METALS

Applications of Electricity in American Practice.

In the course of a lecture to the London Section of the Institute of Metals, Dr. W. Rosenhain, F.R.S., emphasised the great extent to which electricity had been applied to various processes in non-ferrous metallurgy. His remarks were based on information gained during his recent American visit. Electrolytic refining of copper was carried on at the works of the Anaconda Co. at Raritan (Perth Amboy), in the State of New Jersey, where there were no exceptional facilities in the way of cheap power, etc. The crude metal reached the plant in the form of plates, which were used as anodes in the electrolytic refining process. The refining was carried out in a number of cells, operating simultaneously, connected in series—parallel, and literally occupying acres. After being refined in this way the copper was retained in the form of cathode plates, which were stripped, and, as far as the greater part of them was concerned, were re-melted in furnaces. A number of by-products were obtained, including selenium and tellurium, as well as gold, silver, platinum, uridium and molybdenum, and these again were carefully separated and refined. He believed that the recovery of these by-products had a good deal to do with the success of the whole operation.

Labour-Saving Devices.

After describing the various labour-saving and other mechanical devices adopted in regard to copper and other metallurgical practice, and commenting on the fact that the keynote of American industry generally was production on an enormous scale, a production which was rendered possible by the thorough application of efficient methods and the use of scientific instruments—not so much because they were scientific instruments, but because of their labour-saving possibilities—he referred to the brass industry, the most striking feature of which was the extensive use of the electric melting furnace. The brass industry was centred around Waterbury, Connecticut, but there were no natural sources of power in the neighbourhood, and electricity had to be generated from coal or oil, so that it was not particularly cheap. At first sight it was surprising that electricity was used so extensively, but actually it paid to melt by this means, the slightly higher cost of energy being counterbalanced by uniformity of working and product, and diminution of loss of metal by volatilisation, through complete avoidance of overheating. The Ajax-Wyatt induction type of furnace was used largely, and was rapidly ousting all others from the brass foundry. Only one man was employed to look after two furnaces and to pour the metal direct into the moulds at perfectly regular intervals. The furnaces had to be worked day and night, because they must not be allowed to get cold, but that disadvantage did not appear to weigh heavily under American conditions. The Ajax-Wyatt furnace was not used for high-copper alloys, and he believed the reason was that the conductivity was wrong.

He described a process for the annealing of brass tubes which employed an electric current sufficient to heat the tubes to the softening temperature while they were under a moderate tension. The tube was clamped at both ends into an electrical contact device. At one end the clamp was held rigidly, and at the other end the clamp slid on rails, and had a weight attached over a pulley, which applied a slight tension to the tube. The heavy electric current passing through the tube made it soft enough to yield to the pull at one end, and it gradually straightened out. When it was stretched to precisely the right amount, the movement of the clamp disconnected the current, the clamp was opened, and the tube fell out on to a grid, and passed on for inspection.

In spite of the marked depression of the nickel industry, owing to armaments reduction, a new electrically-driven rolling mill for dealing with nickel had been installed by the International Nickel Co. at Huntington (West Virginia), whilst also electric furnaces were used largely in the works.

An important work on "Railway Amalgamation in Great Britain" by Major W. E. Simnett, is about to be published by the "Railway Gazette." The work will deal with the whole course of railway amalgamation from the earliest years up to 1923, and will describe the Government control during and after the war, the railway agreements and compensation, the Railways Act, the Ministry of Transport, the work of the Tribunal, and the new railway system and its organisation.

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STORAGE BATTERY LOCOMOTIVES FOR MINES.

By JOHN T PRINGLE

The adaptation of storage battery locomotives for underground use in mines has for some little time been under consideration by several eminent mining engineers, and at present the problems involved in the production of suitable machines are being pondered over by mechanical and electrical engineers alike.

It is probably due to Mr. Charles Markham's offer of £1 000 that both operating and manufacturing engineers have of late paid such careful attention to the development of the storage battery machine as employed for commercial and general use on the surface, and its success for this purpose for short intermittent journeys has directed their attention to the usefulness of similarly propelled machines in the mines of other countries. For many years now the battery locomotive has been used in America with varied success, and whatever success it has had is due to the inventive genius of Thomas Alva Edison and others who have produced and improved the various forms of storage batteries until to-day we have an electrical reservoir that will at least supply sufficient energy to do useful work for short intervals of time.

There are probably three important items that govern the successful installation of battery locomotives in mines, and these are as follows :—

1. We have not at present a storage battery that will give, without charging, an efficient output for a continuous duty for a working day of 8 hours.

2. We have the question of gradients, which affects the proposition in different ways, as these must be overcome by adding power to the locomotive, which in turn means additional weight to ensure adhesive force with a further demand on the battery capacity.

3. We have not a controller that can be considered absolutely explosion proof when dealing with the heavy direct currents experienced in traction work. It is admitted that many are stated to be explosion proof, and suitable for working in gaseous mines, and approved by the Mines Department, but it is strange that many of the largest and most reputable manufacturing firms in the country who make similar controllers will not guarantee them to be suitable for working in a gaseous atmosphere.

Types of Battery Available.

In the first case I think it is admitted by most users that the best storage batteries for locomotive use are the Edison nickel-iron-alkali, and the ironclad Exide type. It is difficult to chose between these two excellent batteries because when initial cost is considered the latter will be selected, and when a certain amount of skilled attention is not available the former will no doubt be favoured. The electrical efficiency of the former is somewhat lower than the lead plate cell, but it possesses inherent advantages, which make it sometimes the more desirable type to employ. For instance, it is not injured by overcharging so long as the safe temperature is not exceeded (although continuous and violent gassing wastes electrical energy) no permanent injury is done to it, if it is so completely discharged that nothing more can be got out of it, or if left standing in a discharged state for any length of time.

These are important advantages when it has to work an underground locomotive, which will not at all times be properly treated. It is, however, true that the greater percentage voltage drop of the Edison cells means that machines with which they are fitted show a greater decrease in speed as the battery becomes discharged or when ascending gradients, than is the case with the lead-plate cell.

The ironclad Exide cells are heavier than the Edison type, 40 cells of the former being equal in voltage and weight to 60 cells of the latter. This is in favour of the ironclad Exide when rail adhesion is desired, but against this type there is its lower guaranteed life of two years as against eight years for the Edison cell. The cost of the two types being approximately for equal duties, £400 for the ironclad Exide and about £1 000 more for the Edison. There is, however, an intermediate type known as the Ni-fe cell, which is really the English Edison cell; it has a guaranteed life of four years, and is a little over twice the cost of the ironclad Exide.

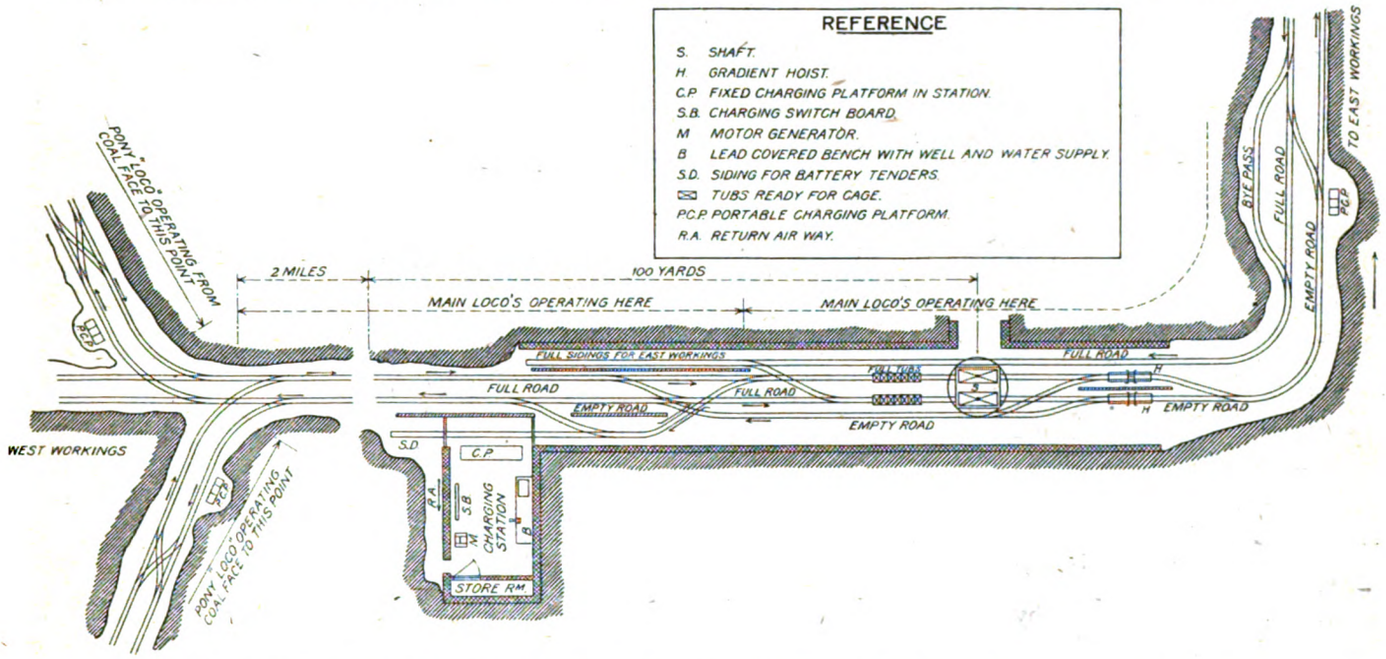

FIG. 1.—PROPOSED ARRANGEMENT OF PIT BOTTOM SUITABLE FOR BATTERY LOCOMOTIVE HAULAGE IN A GASEOUS MINE (CHARGING STATION WOULD BE ON THE SURFACE).

All these types are suitable for locomotive work, but, as already stated, there is yet much to be desired before they can be considered suitable for underground work that requires continuous service for long periods. The future success of the battery locomotive will undoubtedly depend upon the production by the chemical engineer of a battery that will store for equal cubical capacity at least five times the electrical energy obtainable at present. It is, however, true that there are in mines to-day several types of storage battery locomotives that are using all three forms of batteries previously mentioned, and many more types of batteries perhaps not so popular or so much tried, but it is an acknowledged fact in the minds of prospective users, of users, and of many firms who produce battery locomotives, that they will never be successful to the degree necessary for displacing the main and subsidiary haulages in mines, until a storage battery is invented that will be of small dimensions and will store a charge capable of feeding the locomotive for at least a full working day.

It is stated by makers of batteries that although the above is desirable, it is by no means necessary, as the present type of battery is made in so portable a form that it can be re-

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charged or replaced on the locomotive several times a day, but even these admit that it is very expensive to have a series of batteries that can be in use or on charge as occasion arises, and it is only necessary to ask a mine manager "What is the greatest factor against increased output at a colliery that has workings a long distance from the shaft, and where haulages are most needed?" and he will reply that *time* is the factor. This is obviously true, for with the shortened working day every minute must be used in speeding up the removal of the mineral from the face, and the transference of empty trams to the miner.

The Charging Problem.

Assuming that locomotives are installed with the best obtainable battery, which will need many refreshing charges, we must in the first place endeavour to discover some system whereby the locomotive can be kept as continuously at work as possible throughout the whole day. How is this to be done? Dealing first with pony locomotives we must have steel tenders or trams that will carry enclosed a complete battery for the locomotive, these can be hitched on to the main haulage for conveyance from the charging station (at the pit bottom in a non-gaseous, or on the surface of a gaseous mine) to the locomotive in the distant workings. These trams should be made of strong pressed steel, light in weight, and designed to take the main track in the mine with all the necessary curves; they should have roller or ball bearing axles with spring buffers and efficiently sprung frame to protect the battery during conveyance.

The battery box of the tram should be of suitable height equal to that of the locomotive, and be fitted with sliding doors on each side, so that the battery can be easily run out on to a platform in the charging station or on the side of the track where the locomotive operates. The battery must be fixed on a steel tray mounted on ball or roller bearings which will be made as one unit. The platforms in the charging station should be fixed, whilst those near the workings should be portable for easy removal as the districts are changed or as the workings extend. The latter can be made of light pressed steel designed to be rigid when the battery is being rolled on to them from the battery tender, but they must be of such weight that one can be carried by two men.

The tender should be of dimensions suitable for going easily into the cage, usually not more than 9 ft. long by 3 ft. wide, and of heights equal to that of the locomotive. With a number of batteries equal to the number of charges required by the locomotive per working day it is possible by this system to keep a number of pony locomotives running efficiently, the time of battery charging to overlap the time when the locomotive is running, so ensuring a full charge to each battery before transferring it in-bye, and it would be possible to have all batteries excepting the one in the locomotive on charge in the station during the greater part of the time that the locomotive is in use and standing.

For main haulage locomotives in gaseous mines a similar arrangement should be employed, but the platform could be at the shaft bottom with another at the in-bye end of the track, and one tender would be required. In a non-gaseous mine the system generally employed is where a suitable charging station is arranged near the shaft bottom, and this is fitted with steel benches. A suitable charging set and switchboard with all the necessary instruments, water supply and chemicals for dealing with the replenishment and boosting up of the batteries. The main haulage locomotives are run into the station where their batteries are either changed or boosted up as time will permit.

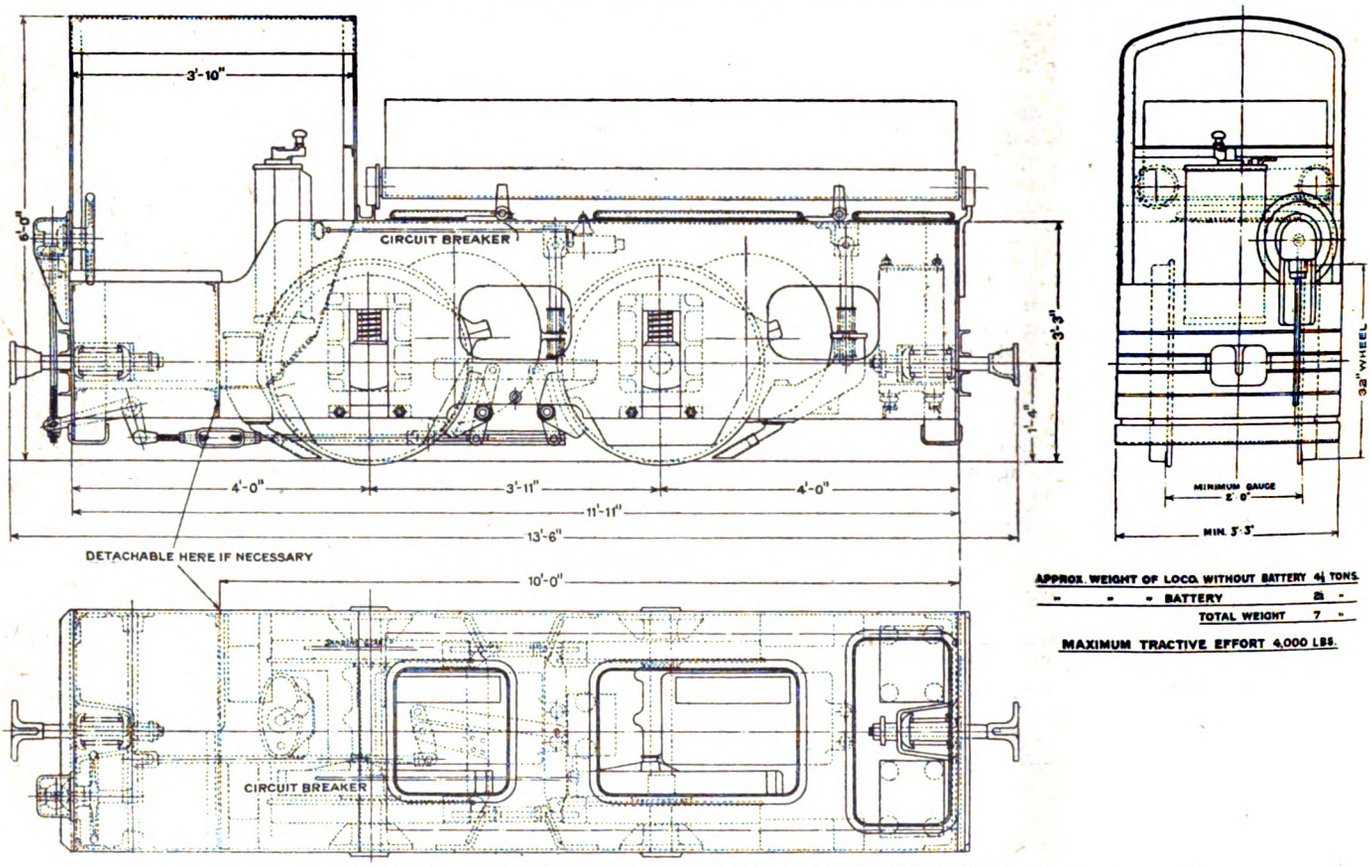

FIG. 2.—STORAGE BATTERY MINING LOCOMOTIVE FOR MAIN HAULAGE.

This essential boosting up of the batteries must have due consideration in the installation of all storage battery locomotives as their efficiency can only be maintained when this is done in a systematic manner.

The Effect of Gradients.

Let us now consider the second case, which is the question of gradients. Storage battery locomotives in common with other types are not economical on steep gradients for any distance owing to the fact that so much of their power must be used in taking the locomotives up the gradient. They may be run, however, for short distances on gradients as steep as 1 in 15, but it is not advisable to run them on a grade of this kind if it can be avoided, because by prolonged use it would prove itself to be cheaper to ease the grade than work the locomotive. On a level mine track the co-efficient of rolling friction is usually 30 to 40 lb. per ton, but this can be taken as 20 lb. per ton with the mine track in good condition; and the grade resistance for 1 per cent. grade can be taken as 25 lb. per ton. The distribution of grades is often such that the maximum load is not the resistance of the loaded trains, which are often hauled on slight down grades, but

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that of the return trains of empty cars on adverse gradients. For most economical work gradients should not exceed ½ to ¾ of 1 per cent. in favour of the loaded trains. With ordinary track and rolling stock, and a grade of 10 to 12 in. per 200 ft., the coefficient of rolling friction is nearly the same for a loaded train hauled down as for an empty train of the same number of cars hauled up the grade, 2½ to 3 per cent. adverse grades are sometimes necessary, but these should be avoided because the maximum tractive force of a locomotive falls off rapidly. For instance, on a non-slippery track a locomotive can only haul about four times its own weight on a 2½ per cent. adverse grade.

For a grade approaching 2 per cent. the tracks must be well laid with 30 to 40 lb. per yd. rails for main track locomotives, and 25 to 28 lb. rails for pony locomotives, the track being laid on firm ground with easy curves not less than 15 ft. radius and properly checked. It can be clearly observed that many mine tracks are not well laid, and that when a storage battery locomotive is required to run on old tracks not in good condition, and with an unfavourable gradient the battery will be required to do a heavier duty, will be heavier in weight and more costly; all of which act adversely against the installation, consequently there is a limit beyond which it is not economical to install battery locomotives, but this limit cannot be stated generally as it will vary according to the conditions and cost at different places.

Another important item directly connected with the gradients is the load to be hauled, this must be limited to a comparatively small figure when storage battery locomotives are to be employed for main haulage underground.

It might be conceivable that they will be required to run on old track, which consists of 25 lb. rails well laid. This would limit the weight of the locomotive that could be employed to probably 3 tons, and in turn limit the total load that could be hauled. An ordinary electrically driven stationary haulage of 150 to 200 H.P. could haul by the main and tail system a train weighing 60 to 80 tons easily on an adverse grade of 1 in 36 over a track of this kind, but it would take a battery locomotive to be considerably over three times the weight suitable for operating on a 25 lb. rail to deal with a similar load. It will be clearly observed that it is doubtful whether a battery locomotive haulage as against an efficient electrical stationary gear is a paying proposition when heavy loads have to be dealt with on gradients. Several leading manufacturers take this view, and it is undoubtedly correct, because for duties of this kind the sales of trolley type locomotives are as 6 to 1 of the battery type.

Some manufacturers attempt to overcome the difficulty of unsuitable rails by introducing a locomotive built up in separate units with a partly flexible coupling between each, or an articulated locomotive with two pairs of wheels on each section and with a motor on one pair of wheels per section, the whole coupled in series parallel and operated from an end or central position on the machine.

A locomotive of this type is very portable for getting into the mine and having less dead weight per axle will run on a lighter section rail, but when the loss of tractive effort on curves and at points of changing gradient is considered the loss of adhesion due to having one axle per unit driven, or if both axles per unit are driven the additional gearing to be employed and the lack of rigidity of the whole unit, no one who has studied the problem closely would adopt it for underground use except under very exceptional circumstances and only then when no other type of traction could be employed. It is as well to bear in mind that the drawbar pull of a battery locomotive should not in any way be diminished by departures from well tried designs of the main unit, the more so when gradients have to be overcome, because the drawbar pull on a gradient is determined by deducting from the drawbar pull expressed in pounds on the level, 60 lb. per ton of weight for each inch per yard of gradient.

Explosion Proof Controllers.

The third case is that of explosion proof controllers. Taking it that we have attained to a high degree of perfection in the manufacture of explosion proof motors and switchgear, as many types are already employed in gaseous mines, although there are yet some who question this assumption, we have to consider the more difficult problem of the controller which must deal with heavy direct currents when used for battery locomotive work, and must have at least some degree of ventilation. The controller used on the best types of mining locomotives is of the magnetic blow-out type, in which contracts are broken in a magnetic field, the strength of which varies as the strength of the amount of current to be broken. The arc composed of copper vapour is analogous to a wire carrying current in a magnetic field, and is forced across the field away from the contact until it is broken or blown out. The resistance of this action is so slight that it cannot be measured, so that the blow out is extremely rapid. There can be no arc of any consequence in a controller of this kind, except when the controller cylinder is moved very slightly, barely separating the contact fingers in such a case the arc is so short that it will not blow out, and the contact tips are burnt. With this type of controller it is impossible to reverse the motors unless the current is completely cut off, and the reversing switch must be in its proper position before the current can be switched on to the motors. The controller usually has a dead man's handle to ensure interruption of the circuit when the driver is not in control.

It is obvious that there is sure to be arcing in the controller, and many manufacturers will not state their machines to be suitable for gaseous mines because they consider that the controller along with the motors must be partially ventilated and, therefore, not absolutely explosion proof. Many of these machines are just as explosion proof as are those sometimes stated to be so by others, and passed for use in gaseous mines, but the problem always gets back to that of "flameproof enclosure." To comply with Part II, Section A, General Regulation Mines Act.—Parts of the equipment subject to sparking in ordinary use must be dealt with under this head, and all parts which may entail danger should be similarly enclosed. Flame proof enclosure means enclosure within a containing case, which is capable of withstanding without injury any explosion that may occur within the case, and which will not transmit sparks or flame sufficient to ignite gas or dust external to the case under any conditions of operation of the apparatus.

(To be concluded.)

INDUSTRIAL RESEARCH.

At the meeting of the North Eastern Centre of the Institution of Electrical Engineers, which took place on November 12th, Mr. W. Wilson read a paper on "Industrial Research." This paper was read in London on November 1st, and an abstract was given in our issue of November 9th. We give below an account of the discussion in Newcastle.

Mr. B. H. LEESON, who opened the discussion, said that research development had come to the front enormously of late because the large manufacturing firms now realised that it was a business and commercial proposition. He considered the term development to be a misnomer, and preferred to call it technical research. A salesman had to sell apparatus to-day on two principal bases; first, price, and second, his technical mastery of the data of the article which he was selling, and for such information he was dependent upon the research and development department. For this department to be successful it was essential that there should be the closest possible association, of the most friendly kind, between it and all the other departments. It was the duty of a research and development department to consider all suggestions for improvements or developments, however humble their origin. Broadmindedness and an analytical turn of mind were essential attributes to the staff of such a department.

Mr. E. FAWSSETT considered that the British tendency was to abandon enterprises when they began to be profitable and that this was particularly the case in pre-war days. There was, even now, a tendency to go back to individual activities, but he hoped that all such tendencies would be effectively scotched and that the many co-operating research associations recently formed would continue to flourish. With regard to the training of research workers, he held that they were born and not made. Ample common sense, tact and a sound knowledge of general principles were essential for research purposes.

Mr. T. CARTER said that the setting up and maintenance of a research department presented varying difficulties according to the size of the firm and the nature of the work. Generally, the larger the firm the less the expense would be felt, and this logically led to the desirability of common research for the whole industry. He regarded development as being the systematising of the work done in any factory, and considered that the present position was due to a belated realisation of the fact that business was business.

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THE INSTITUTION OF ELECTRICAL ENGINEERS.

Theoretical and Practical Features of Loud Speakers Discussed with Physical Society.

The attendance at the Institution of Electrical Engineers on Thursday, November 29th, must have been a record. Not only was the lecture theatre full but the audience overflowed into the hall. The occasion was a joint meeting with the Physical Society of London to discuss loud speakers for wireless and other purposes. Dr. Alexander Russell was in the chair, and the meeting was divided into two sessions, one lasting from 5.30 to 7 p.m., and the other, according to the programme, from 8 to 9.30 p.m., though, in fact, it went on much later. Reversing the Squeers method an opportunity was given during the afternoon for parties to visit the studios of the British Broadcasting Co. in Savoy Street.

The first paper on the programme was by Prof. A. O. Rankine, and dealt with "General Principles involved in the Accurate Reproduction of Sound," by means of a Loud Speaker." The author remarked that reproduction of sound by good quality telephone receivers, applied close to the ear gave little ground for complaint. Imperfections in reproduction occurred mainly when magnification was attempted, each stage of the process giving rise to distortion. Theoretically, absolutely perfect reproduction in the physical sense appeared scarcely possible owing to the variety of transformations, but acoustically very good results were practicable. In aiming at loudness there was a temptation to resort to resonance, giving preferential treatment to certain components, a defect only partially rectified by damping. Alternatively, the natural frequency might be set at values either much below or much above the range of audibility; where loudness was not important the former method had proved satisfactory. An apparatus exemplifing the latter method consisted of a strip of thin metal foil suspended between the poles of an electromagnet, with a fundamental period of about two sec. In the latter sections of the paper the author dealt generally with the treatment of aerial vibrations after development. Visible records of sound might furnish a useful mode of scientific investigation, but in practice the ultimate judgment must be based on the impression received by the ear.

Some Theoretical Points.

Mr. L. C. Pocock, dealing with "The Theory of Loud Speaker Design," also pointed out that electromagnetic loud-speakers represented a compromise between good efficiency and quality, and that the use of resonance must not be pushed too far. He discussed the operation of the horn in some detail, drawing an analogy with electric transformers and transmission lines. Resonances of varying degree were found in all horns used in private houses. In very large horns the degree of resonance was much less. Receivers without horns, but with very large vibrating surfaces involved difficulties in securing requisite lightness of moving parts. Faithfulness in reproduction could not be obtained without sacrifice of efficiency through the use of filters, etc., and the overall efficiency of modern loud speakers was usually less than 1 per cent.

Prof. C. L. Fortescue dealt with "Sources of Distortion in the Amplifier," including (*a*) Curvature of the Valve characteristics, (*b*) Use of intermediate circuits with more or less clearly defined natural frequencies, (*c*) Unavoidable reaction effected in most designs of note magnifiers, (*d*) Unsatisfactory reproduction in the last (or output) transformer. These various effects were discussed in detail by the aid of numerous diagrams. It appeared that with properly designed valves and circuits serious distortion could not be charged against the amplifier. But valves giving considerable power output must be used in the last stage; and some resonance effect seemed unavoidable in transformers. This might be accentuated by reaction, but the effect might to some extent compensate for defects in other parts of the equipment.

Mr. H. L. Porter's paper dealt with the "Acoustical Problems of the Gramophone." There were many factors leading to imperfect reproduction. The acoustics of the recording room were an unknown and complicated factor. Tones were complex and rarely uniform in intensity and the characteristic curve was further modified by recording on wax. Also no needle could pass along the large-amplitude waves in high peaks, and this caused further modifications and loss. Finally, the reproducing apparatus had its own characteristics. In the circumstances it was surprising that gramophone reproduction was as good as it was, and doubtless the ear was generous in this respect. The author described experiments made to trace the effects of various elements including the placing of peaks. Occasionally two peaks might fall together giving a large massing of response and reduction of response in regions near at hand. Also the recording apparatus reacted upon the source of sound and modified its pitch. Attempts had been made to eliminate undesirable peaks, but this proved to be a very difficult and complex problem.

Ear Sensitiveness.

This afternoon session was brought to a close with a speech by Dr. W. H. Eccles, President of the Radio Society of London, who called attention to the difference in the problem of designing loud speakers for use in small rooms and halls on the one hand, and for such purposes as conveying speech to a large concourse of people in the open air. Dr. Eccles also commented on the public advantage of having political speeches broadcasted if only as an offset to the possible danger of "a great ignorant populace" having its opinions formed for it by the Press upon such matters. The remarkable sensitiveness of the ear demonstrated the difficulty of the problem to be tackled and the enormous range over which loud speakers must be capable of working. At first sight it might be thought that no loud speaker could be made which would perform the tasks demanded of it, but loud speakers were actually in existence which did. There had been an enormous advance in the design of loud speakers, and the laboratory of the Western Electric Co. of New York had probably done more than any other establishment in the accomplishment of this task. So perfect were some of these loud speakers that it was difficult to imagine that the actual speaker was not in the room. The three principal problems connected with loud speakers were how (1) to amplify every frequency equally or substantially equally; (2) to prevent the introduction of any asymmetrical distortion, and (3) to damp out the impulsive sounds and trains of oscillations in the diaphragm. Measured in the ordinary way that one measured electrical efficiency, he believed that the average efficiency of the loud speaker to-day was only of the order of 0·1 of one per cent. If that were true, it indicated that a great deal of attention must still be given to the problem.

At the evening session Mr. E. K. Sandeman dealt with "The Relative Importance of Each Frequency Region in the Audible Spectrum." The main characteristics of reproduction included (1) Intelligibility of Speech; (2) Natural reproduction of both speech and music, and (3) Reproduction of sound with sufficient volume. The importance of a frequency region as regards (1) might not be the same for (3). From theoretical considerations the author derived curves showing energy and articulation functions in relation to frequency. There was as yet no information on the function portraying "naturalness." This introductory work enabled one to interpret, to some extent, the meaning of the response from a loud-speaker system. On the whole a direct measurement of the response characteristic was most informative and this could be done by the aid of a calibrated microphone —i.e., one in which ratio of output electrical energy to maximum excess pressure due to sound energy is known. A typical calibration curve was shown in the original paper. Absolute calibration enabled the power-efficiency of a loud-speaker to be measured. But if we were concerned with frequency distortion we only needed to know the relative efficiency of transmission with each frequency. In practice difficulties were introduced by "standing waves" which could, however, be partially eliminated by suitable damping material on the walls of the room.

Prof. J. T. MacGregor-Morris and Prof. E. Mallett briefly discussed the "Overtones of the Diaphragm of a Telephone Receiver." Plates and diaphragms in vibration exhibited resonance at various frequencies, as illustrated by Chladni's figures. Most loud-speakers utilised a diaphragm of some form to which certain resonance frequencies must be ascribed. Hence judicious damping was necessary. The authors presented a table, based on experiments undertaken with a

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standard receiver, to show that the frequencies at which resonance occurs were within the necessary range in music.

Mr. G. A. Sutherland dealt with one very important element, "Auditorium Acoustics." Uniform loudness was in practice associated with the absence of curved walls, which had defined foci and, unless suitably covered acted as a menace to good acoustics. With flat walls distribution become sensibly uniform in a short interval of time. An equation for average energy density had been given by Jager's equation. The value of maximum energy varied directly as the rate of emission of energy and inversely as the total absorbing power of the room. If a room was large, with extensive surfaces, this naturally increased absorption and attempts must be made to obtain the right characteristics in other respects. Reverberation, the slow decay of a speaker's voice, must also be guarded against, but the period might be different for speech from that characteristic of orchestral music. The most effective damping surfaces were porous materials. An audience was also one of the best absorbers of sound. With loud speakers better results were obtained by distributing an audience in small rooms, each separately treated, than by speaking to a large audience in a vast hall. Nothing was to be gained from a loud-speaker with a rate of energy-emission many times that of the human voice. Most halls suffered from excessive reverberation and the greater the initial sound the greater the confusion produced. Absorbing mediums might have a selective effect and thus produce distortion. If the sound from a loud speaker tended to excessive richness in the higher-pitched notes, then the presence of an audience had a useful corrective effect.

The Loud-speaking Telephone.

The final paper by Mr. S. G. Brown, dealt with "Some Directions of Improvement in the Loud-speaking Telephone." Owing to want of a perfect transmission system it was not possible to determine the real inefficiency of a present-day loud-speaker. It was only known that the electrical transmission did not approach the perfection of listening direct. The output of the loud-speaker depended on the size of the hole through which sound-energy emerges, but the air enclosed by a trumpet had a natural period similar to that of an unstopped organ-pipe. This natural vibration could be removed by drilling holes $\frac{1}{4}$ and $\frac{1}{8}$ of the way along the axial length, and the resulting improvement could be recognised by a trained ear. The material for the funnel should be rigid and not too thin and the sound-producing element should be insulated from trumpet and casing. A larger diaphragm, or alternatively a device based on the "Frenophone" principle, might possibly give less distortion.

All the demonstrations were reserved for the evening session, and particularly interesting was that given by Mr. Sutherland, who spoke to the audience from another part of the building through loud speakers in order to demonstrate the relative importance of each frequency region in the audible spectrum.

After the reading of the papers a demonstration was given of the Brown Frenophone, by turning on to the performance of "Carmen" from the "Old Vic.," whilst Capt. Eckersley, the chief engineer of the British Broadcasting Co., showed a small loud speaker.

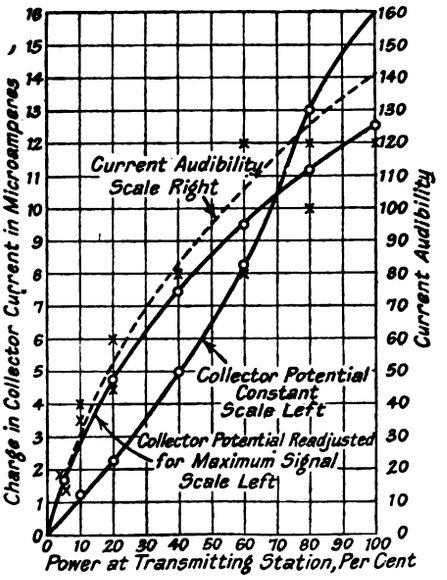
Speaking in his usual facetious manner, Capt. Eckersley said the weakest link in broadcasting was the receiver, and the weakest link in the receiver was the loud speaker. If the loud speakers were designed properly, amazingly good results would be obtained. There might be imperfections at the transmitting but these could be corrected at the receiving end by proper design. In regard to loud speakers the difficulty was whether the aim should be to obtain an instrument which would give satisfaction to the person in a small room or whether it should be to obtain such instruments as those used for open air work in America. These were two distinct problems, and perhaps the more important for the moment was the former. It had been pointed out in the papers that it was impossible to get the highest efficiency and at the same time perfect quality. It was in this connection that he was going to show one of the most inefficient loud speakers he had ever seen, but the quality of the result was such that it would please in the ordinary home and if that were the case it did not matter whether it required many watts of input to give only milliwatts of output. If loud speakers, even on this basis, could be turned out which would give that warmth in regard to music, for instance, which was so pleasing to the ear, then he should regard it as the greatest achievement that had been accomplished. As long as the sound transference was absolutely perfect, he did not think efficiency mattered much.

THE "SODION" RADIO DETECTOR TUBE.

In a paper read before a recent meeting of the Radio Institute, Mr. H. P. Doule described a new type of "sodion" detector tube in which no liquid sodium electrode is used. This tube is said to be highly sensitive (about two stages greater than the hard grid tube detector), to give pure tone reproduction and to be entirely non-oscillatory and non-regenerative.

Like the previous type, this tube has no grid but utilises a tough-shaped piece of nickel, partially surrounding the filament and open toward the anode, as its control electrode. A glass shell contains the anode or plate, the filament and the collutor or control electrode. A heater is wrapped non-magnetically round the outside of the tube and a second external glass shell is placed over all the elements for protection and to conserve heat. The tube is exhausted to the highest possible vacuum and is internally treated with sodium to provide the stable ionizing material that plays an important part in its sensitiveness.

When the potentials are properly adjusted the currents build up automatically to an equilibrium value fixed by the voltage applied to the collector. This building up is composed



of a number of successive increases of current in the collector and anode circuits and reaches its delicate balance point after a time which is long compared with a radio frequency period. Any sustained radio electromotive force applied to the collector circuit produces a marked yet proportional drop in the equilibrium current, causing a signal in the telephone.

This proportional drop in collector current is shown in the accompanying illustration, which shows the amount of current change produced by the reception of a uniformly modulated wave at varying intensities. The lower curve was taken without readjustment of the detector, and its general inferiority to the other solid line indicates the advisability of choosing the best collector potential for varying signal intensities. A comparison of the upper solid line with the dotted line brings out the interesting fact that the change in current produced by an incoming signal is proportional to its audibility. It is clear that the tube thus gives an apparatus for reading audibility of weak signals directly from a meter. The scattering of observed points of the dotted line, shown by the crosses, is characteristic of the ordinary audibility measurements, while the way in which the points lie directly on the other curves shows the high accuracy of the new method. Thus, apart from its radio receiving application, the tube should prove of great value in the laboratory for measuring very small currents.

The relation of input radio-frequency and output audio-frequency power for the tube is a straight-line ratio, which is a desirable relation for reproduction of high-quality reception.

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ELECTRICITY SUPPLY.*

Its Present Position and Future Possibilities.

[By R. B. MITCHELL.

The subject of electricity supply is so wide that it cannot be considered in all its bearings in one evening. We in this country are considerably behind America so far as the uses of electricity are concerned. In Chicago, for instance, up to 700 kWh per head of population are consumed, but in Glasgow only 130 kWh per head, and there are few undertakings in the country which have gone beyond this figure. American engineers scout the idea that in their case the saturation point has been approached. From curves tracing the growth of the electricity supply in Chicago one observes that for a long

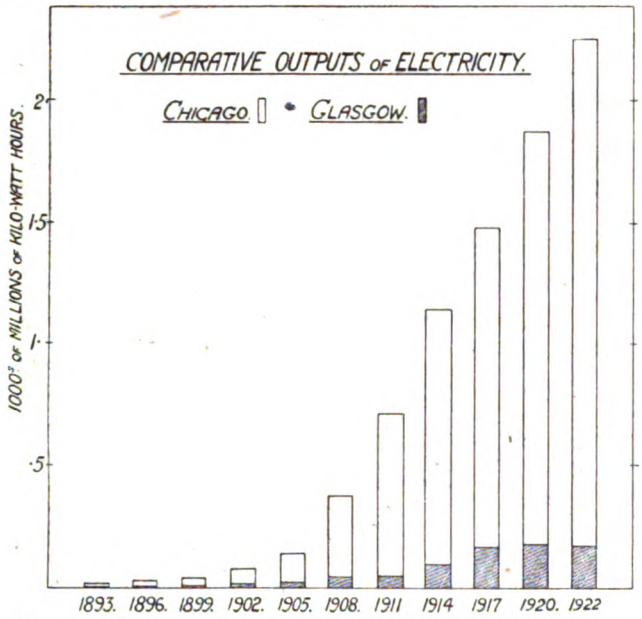

FIG. 1.—THE OUTPUTS OF ELECTRICITY IN GLASGOW AND CHICAGO COMPARED.

period of years the line is horizontal, later on trending upwards to the enormous outputs of the present day. The curve for Glasgow (Fig. 1) shows very badly in comparison. After the boom year of 1920–21 came a rapid falling off, but in the present year there has been a turn for the better, the output during the first four months exceeding that of 1920–21, the boom year (Fig. 2).

As regards generating stations steam must continue to bear the most important share of the load in this country. The work of the Electricity Commissioners will gradually bring about the closing down of small and uneconomical stations and the concentration of power in large ones, with better load factors. Economy of operation is the first essential. Amongst other problems to consider are high-pressure boilers, methods of firing, pulverised fuel and gas firing. Ash removal is likewise of importance, and all possible heat in flue gases should be utilised. Other questions are the choice of turbines, methods of driving auxiliaries and feed water treatment. In the boiler house the trend is towards bigger units and higher pressures, up to 3 500 lb. per sq. in. being mentioned. Development here is still in the experimental stage. Turbine designers anticipate no great difficulty in designing machines for 1 200 to 1 500 lb. per sq. in.; in such machines two cyclinders will doubtless be used.

Stokers are likewise increasing in size. The provision of two or even one stoker for a boiler of 50 000 lb. per hour capacity is now considered practicable. Firing of boilers by low-grade gas, as a bye-product from coke ovens or smokeless fuel processes, is only limited by the supply of gas available. Glasgow is taking a lead in the movement towards smokeless fuels. A supply of such gas sufficient for large stations can hardly be expected, but on a limited scale the system is quite feasible. Of pulverised fuel, an alternative method of firing, much remains to be learned before we can say if the improved efficiency of combustion makes up for the increased cost of operation and maintenance.

* Abstract of Chairman's inaugural address, delivered before the Scottish Centre of the Institution of Electrical Engineers.

Much attention is being devoted to stack-temperature and the recovery of heat from the entering gases. Air preheated to a moderate degree before entering the furnace is a good thing, and it has been argued that an increase in furnace temperature generally increases the rate of radiant heat transfer to all boiler surfaces exposed to the direct ray of the fire. Hence it seems likely that air heaters, together with economisers, will be used to ensure stack-temperatures not exceeding 300° F. However, difficulties from brickwork of combustion chambers need careful attention.

Parallel operation of all plant is the ideal method from the standpoint of efficiency, but, with complete interconnection the re-establishment of the supply after a serious fault is difficult. The use of reactances to limit short-circuit currents is expensive and cumbersome. In Glasgow, with 60 000 kW on the busbars, sub-station oil switches are found capable of rupturing the currents produced. It has been arranged that when the load exceeds this value the busbars will be sectionalised. In addition the 6 000 V distribution systems will be divided into networks of approximately 20 000 kW capacity.

Improvement in load factor is all important. Engineers should concentrate attention on appliances which will consume energy during periods of light load, such as those heating by night the water required during the day, and other forms of heat storage. Much business might be developed on these lines. The domestic load (other than lighting) is now receiving the attention it deserves owing to its stability. Not only heating and cooking, but water-heating in bulk should be catered for. The E.D.A. is doing excellent work in encouraging domestic propaganda. The revenue from many consumers might be increased five or six times by the introduction of cooking and heating appliances. The belief that electricity is expensive and only for the wealthy dies hard. The consumer must be shown that by using electricity for cooking and heating he is cutting out other expenses, such as coal, gas, firewood, etc.

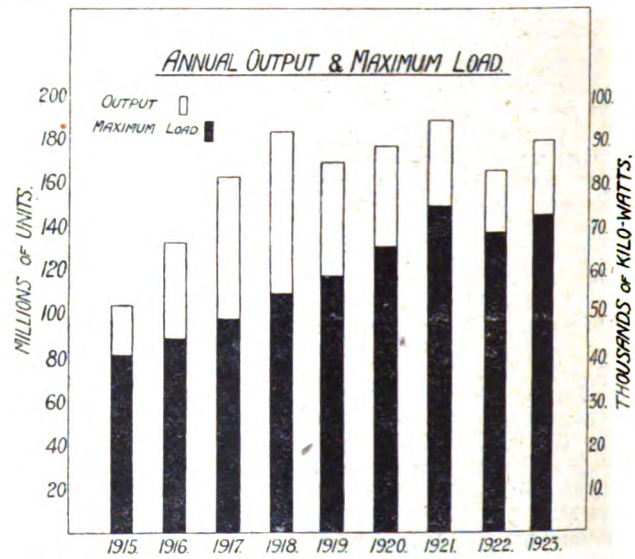

FIG. 2.—ELECTRICAL DEVELOPMENT IN GLASGOW, 1915-1923.

It is apparent that there is to be a general adoption of the two-part tariff—viz., a fixed charge based on rental, floor, cubic capacity or number of rooms, and a running charge per unit—the latter fixed as low as possible. Another tariff should be offered as an alternative to the small user; this should assess the consumer at a certain number of units at ordinary lighting rates, and all units above this at a much lower rate. On both tariffs only one meter is necessary. The hiring of apparatus is another important step. Propaganda and demonstrations are essential for success in this field. In Glasgow as a result of a recent demonstration 166 fires and 38 cookers were hired within a fortnight. In some towns undertakings may with advantage go even further and inaugurate a scheme of wiring on hire or hire-purchase terms. By municipal undertakings especially, this scheme might well be adopted.

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CORRESPONDENCE.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

INSULATION FAILURE.

[To the Editor.]

Sir,—In reply to Capt. Dunsheath's interesting letter commenting on my article, I may first point out that the article ended with an unanswered question, indicating that no finality of conclusion was intended.

Taking Capt. Dunsheath's four points in order :—

No. 1.—Special care was taken to exclude all variables, except the desired one of temperature, and there was no doubt as to the samples being dry. On p. 141 of Turner and Hobart's "Insulation of Electric Machines" is a reference to this particular cloth confirming the writer's experiment. It reads: "Its insulating qualities are unaffected by very great heat."

No. 2.—The writer hopes to take an early opportunity of testing Capt. Dunsheath's suggestion.

No. 3.—The writer can only repeat that he has several times seen partial pin-hole punctures of paper, in the specific case Capt. Dunsheath mentions, next the core of single core cables that have been broken down. He would be greatly interested to hear of any suggested cause other than the maximum stress theory. These pin-hole punctures have also been noticed on high tension motor windings. There are generally a considerable number of them, both adjacent to and comparatively distant from the complete breakdown point.

No. 4.—This experiment was given, not as an argument for or against the pyro-electric theory, but as illustrating the suggestion that conductivity in good dielectrics is largely due to impurities. The intention was to point out that *if* Wagner's theory be accepted, *then* insulation resistance becomes of primary importance.

As to the relative importance of dielectric losses and insulation resistance, they are probably dependent on each other (see G. L. Addenbrooke, Proc. Physical Society, vol. xxvii, part iii, April 15, 1915).

Capt. Dunsheath seems rather inclined to make a fetish of "absorption effects." The writer remembers during his earliest experience with alternating currents, the existence of a mysterious Ju-Ju, whose name was "Kapacity-Effeck," and to whose malign influence was attributed every phenomenon not readily understood. He remembers indeed an eccentric genius—a much harassed charge engineer—who being pressed for the cause of some trouble with a boiler feed pump, replied that he thought it was a "sanguinary capacity effect."

—I am, etc.,

F. Fernie.

Hayes, Middlesex.

NON-TECHNICAL EXPLANATION OF "POWER FACTOR."

[To the Editor.]

Sir,—The great extensions in electricity supply which are now taking place, and the increased length of cables through which electrical energy is being transmitted, together with high capital cost of generating plant, have combined to bring the question of power factor very much to the fore. Hardly a paper is written on subjects connected with the transmission, distribution, use and measurement of electrical energy which does not deal at length with this important subject.

Notwithstanding the mass of literature which is available from the technical point of view, it is nevertheless difficult, if not almost impossible, to give a satisfactory explanation of power factor to a non-technical user of electrical energy, and after an attempted explanation the consumer more often than not comes to the conclusion that power factor is a dodge, cunningly invented and kept a mystery by the electrical fraternity for the purpose of extracting more money from him than the supply authority is entitled to.

The problem of finding a simple explanation which will satisfy the average user is a difficult one. It is, however, a matter of considerable importance to supply authorities and to those of us who are interested in the manufacture of relevant apparatus.

In view of the difficulty of the problem, it occurs to me that the best method of seeking a solution would be to appeal to the profession as a whole, and to offer prizes for the best explanations.

If, therefore, you will extend the hospitality of your columns, I should like to offer, on behalf of my company, prizes of £5 5s., £3 3s., and £2 2s. for three explanations of power factor calculated to convince a non-technical power consumer of the propriety and fairness of supplying energy on a basis of charging dependent on the power factor of the installation.

The offer of prizes is subject to the following conditions :—

1. The solutions to be addressed to "Power Factor," c/o The Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, London, S.W.8.

2. Solutions should not exceed 1 200 words in length, and must be received not later than last post on December 31st, 1923.

3. An independent adjudicator will be appointed to judge the competition, and his decision must be accepted as final.—I am, etc.,

R. Amberton,
Director,
Electrical Apparatus Co.

London, W.8.

[We quite agree with Major Amberton as to the importance of this matter. We congratulate his company on their enterprise, and hope it will result in a satisfactory solution being forthcoming.—Ed. Electrician.]

GOVERNMENT POLICY OF ELECTRICITY SUPPLY.

[To the Editor.]

Sir,—Much is being written in the Press at present about the work the Electricity Commissioners are doing in the interest of lowering power generation costs by the division of the country into areas, and the establishment of large central super power stations in each of these areas. This policy is very welcome to manufacturers of large steam turbines and electrical plant as it gives them practically the monopoly of future power developments in this country. Such plant is almost entirely manufactured by very powerful engineering companies, who also doubtless have considerable political influence.

The closing down of small power stations and their substitution by large central stations covering extensive areas means that heavy transmission losses are incurred which must be added to the cost of generation. Further, any failure of plant or cables would throw a very large area into darkness. The avoidance of high transmission costs can only be obtained by each community having its own generating station. Some super-power stations have shown economies, but transmission losses have not always been allowed for, similar gains would no doubt have been recorded by many of the smaller stations had they been allowed to modernise their plant. We are told the next war will take place in the air. What splendid key targets these super stations will be for our enemies to locate and bomb, and thus paralyse large areas of the country with comparative ease. During the war this danger was forcibly demonstrated and suggestions were made that the future safety of the country would be greatly increased if power stations were built underground.

There are many small power stations operating with Diesel engines quite as economically as the largest super turbine stations, yet these are faced with extinction by the present policy of the Electricity Commissioners, it being very difficult for such stations to get permission from the Commissioners to increase or improve their plant. Relief of unemployment is most important at present and would to a material degree be helped by the Commissioners granting to these small stations permission to extend, and thus relief would be immediate and not delayed over a long period. Such extensions would help to reduce the cost of electricity for the reasons stated above.

The writer of this letter thinks that more co-operation is urgently wanted between the various makers of internal combustion engines to ensure that the economies obtained by the use of such engines are properly recognised and that the present grandiose electricity policy is adjusted to allow of more economical and immediate developments.—I am, etc.,

H. T. Day.

7, Grosvenor Gardens, S.W.1.

It is understood that on his return to the U.S.A. Sir Auckland Geddes will negotiate for an agreement between the States and Canada for the development of the hydro-electric power resources of the St. Lawrence River. It is estimated that 1 400 000 H.P. could be developed with a power plant costing about £28 200 000.

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BRITISH EMPIRE EXHIBITION.

Details of Power Supply and Decorative Lighting—Arrangementts for the Electrical Section—A Colour Lighting Sub-station.

On Thursday in last week representatives of the Technical Press were given an opportunity of seeing the progress that is being made with the erection of the Palace of Machinery at the British Empire Exhibition at Wembley, and with the arrangements that are being carried out for ensuring the artistic and adequate illumination of the grounds and the exteriors of the buildings.

Anyone casually viewing the exhibition and its grounds as they now stand may be forgiven for wondering whether they will be finished in time for the opening. There is a tremendous amount of work still to be completed, and the worst of the winter is before us. But on this score, at any rate, no qualm need be felt for that portion of the exhibition in which readers of THE ELECTRICIAN will find most interest. For the buildings of the Palace of Engineering are practically completed, the foundations for the power station plant are well forward, and matters have almost reached the stage when the erection of the stands could be commenced.

General Electricity Supply.

It may, therefore, be opportune to give some details of how the electricity supply for the exhibition will be carried out, as this will mainly be derived from the power station in the Palace of Engineering.

The general electricity supply throughout the grounds and buildings will be given from a three-phase four-wire network at 415 V three-phase, or at 240 V single phase. A three-wire direct current supply at 240 V and 440 V will be given in the Palace of Engineering, to a section of the Amusements Park, and to one or two special consumers, such as the Never-stop Railway. A supply of 3 000 V three-phase energy will be given to a limited number of large power users. The applications received for power to the end of November aggregate 10 000 kW, of which 850 kW will be required for lighting the grounds and the exterior of the buildings exclusive of the Amusements Park.

As is well known, an interesting feature of the Palace of Engineering will be a power station in action. This power station will contain three turbo-alternators with an aggregate capacity of 4 500 kW. They will be manufactured and supplied by the British Thomson-Houston Co., the English Electric Co., and the General Electric Co., respectively. A further supply will be obtained from the North Metropolitan Electric Power Co.'s sub-station in the grounds. This will contain static transformers of an aggregate capacity of 2 000 kW, while a third source will be d.c. reciprocating plant with an aggregate capacity of 1 000 kW. This latter will consist of a Paxman-Lenz steam engine, a Blackstone horizontal crude oil engine, a Ruston and Hornsby vertical cold starting oil engine and a Garratt semi-stationary combined boiler and engine installation. All this generating and transformer plant will supply into a common network.

The steam raising plant will consist of four water-tube boilers providing steam at 220 lb. per sq. in. at a superheat of 600 deg. F. Two of these boilers will be supplied by Babcock and Wilcox and two by John Thompson Water Tube Boilers, Ltd. Each boiler will be capable of supplying 20 000 lb. of steam per hour. In both cases the boilers will be fitted with economisers and induced draught installations, chain grate stokers, coal meters, etc.

Coal will be supplied by a Mitchell conveyer installation, consisting of a wagon tippler, conveyers and skip hoist, and the ashes will be dealt with by an automatic installation of Babcock and Wilcox manufacture. A very complete range of the usual auxiliary equipment will also be provided.

Power Station Equipment.

The switch gear in the power station will consist of a 15-panel Reyrolle board for controlling the generators, feeders and the main sub-station plant. This board will be electrically operated from a 115 Ah battery. The power-house sub-station will contain one B.E.T. 1 000 kVA 11 000/3 300 V transformer, which will step down the energy supplied from the North Metropolitan Co.'s mains to the pressure of the main exhibition supply. On the high tension side this transformer will be controlled by G.E.C. truck type switch gear, and on the low tension side will be connected to the main Reyrolle switchboard. This sub-station will also contain four 500 kVA transformers made by the British Electric Transformer Co., the Brush Electrical Engineering Co., Ferranti, Ltd., and Johnson and Phillips, respectively. These will be used for stepping down 3 300 V energy to 415 V, for use in the exhibition. This low tension supply will be controlled by a 19-panel switchboard of Allen West and Co.'s manufacture. Direct current will be supplied by 500 kW rotary converters made by the British Thomson-Houston Co., and the English Electric Co. respectively in the main sub-station, and by a rotary of the same output on the stand of the General Electric Co. On the alternating current side, these are connected to the main power station switchboard through transformers. These machines will be controlled on the direct current side by an 8-panel Park Royal Engineering Co. board, which will also control the current from the d.c. generators mentioned above.

A sub-station (No. 1) in the Palace of Industry will contain a 15-panel George Ellison board, which will be supplied from the North Metropolitan Co.'s sub-station adjoining. A supply from this board will be given to a 1 000 kVA interconnecting transformer in the power house sub-station and to a bank of four 11 000/415 V 500 kVA transformers which feed into the general supply. This sub-station will also contain a special low tension change-over board made by the General Electric Co., so that four of the exhibition feeders can be supplied either from the North Metropolitan Electric Power Co.'s mains or from the exhibition supply.

No. 2 sub-station will contain a 7-panel B.T.-H. truck typeswitch board through which four 500 kVA transformers will be supplied. It will also contain a switchboard controlling the low tension side of these transformers and a change-over board similar to that in No. 1 sub-station. No. 3 sub-station will contain a 4-panel Ferguson Pailin board, which will control two 500 kVA transformers, whose low tension output will be dealt with by an 8-panel G.E.C. board.

Colour Lighting Arrangements.

An interesting feature in connection with the lighting of the exhibition will be a special colour lighting sub-station which will be fed by three 250 kW three-phase feeders at 450 V from No. 2 sub-station. Each incoming feeder will be connected to a switch pillar, which will control the supply to one unit consisting of three single phase liquid dimmers. Three such dimming equipments will be installed, each of which will be capable of absorbing 40 per cent. of the voltage at 250 kW. The colour lighting circuits will be connected to feeders controlled by these dimmers.

The cables for the supply of the exhibition will be laid in stoneware ducts, those in the main exhibition grounds and in the Palaces of Engineering and Industry being supplied by the Cable Makers' Association and those in the Amusement Park by the General Electric Co.

The question of providing an adequate outside lighting scheme for the exhibition has been carefully considered by the authorities, in conjunction with Mr. Haydn Harrison, and efforts have been made to prevent the dazzle effect so often noticed in other exhibitions, by considering the ground lighting separately from the lighting of the buildings.

The area of the grounds is such that they could not be conveniently lighted except by a source inside them, and to place such lighting source high enough to be out of the field of vision would have been impossible. It was therefore decided to use numerous lighting sources of low intrinsic brilliancy, and this has been effected by employing lamps contained in numerous lanterns, each having a surface area of over 1 500 sq. in. In this way a brilliancy less than that of a candle flame is obtained, and no unpleasant effect from glare is produced. The exteriors of the buildings will be lighted by utilising the concentrated light of lamps placed at considerable distances apart, in places where their installation is invisible to the public in the grounds. These flood lights will be erected on the roofs of the buildings and will illuminate the whole of the buildings to the skyline, so that they will stand out in colour against the darkness. The central lake is to be lighted from floating gardens, lights of varying colour being thrown on the surface of the water so as to make it a part of the general colour scheme.

With reference to the rubber insulating gloves made by the St. Helens Cable and Rubber Co., we are informed that the gloves are each tested separately in water for five minutes to 2 500, 5 000 and 10 000 V, according to price.

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NEWS IN A NUTSHELL.

The new Ljungstrom turbine locomotive has been tested on the Swedish railways.

It has been estimated that a fog costs London nearly £100 000 a day in electric light alone.

An improved type of electric scaling hammer was demonstrated on a ship at Liverpool last week.

An expenditure of £10 000 000 would be necessary to electrify the Southern Railway Co.'s line to Brighton.

A machine claimed to remove effectively corrugations on tramlines has been invented by a Sheffield file maker.

To increase the sphere of operation of electric battery vehicles it has been suggested that a small petrol engine be added.

The Paisley Association of Electrical Engineers last week discussed a paper by Mr. G. Morrison on "Small Private Plants."

Questioned at the Marylebone County Court as to her husband's occupation, a woman said he was a "dynamite attendant."

Glasgow Corporation has purchased its electricity showrooms in Sauchiehall Street, for £17 500, as the lease would have expired shortly.

Edinburgh's electricity supply was the subject of a paper read by Mr. F. A. Newington at the last meeting of the Royal Scottish Society of Arts.

Dundee Corporation has again turned down a foreign tender for cable, although the price quoted was slightly lower than the British firm's tender.

During his visit to Lancashire Mr. S. M. Bruce, Prime Minister of Australia, visited the Metropolitan-Vickers Company's works at Trafford Park.

Mr. W. Wilson read a paper on the "Production and Employment of Hydro-Electricity" at a meeting of the Birmingham and Midland Institute Scientific Society last week.

According to the American Commercial Attaché at Santiago, the electrification of the Ferro Carril del Llano de Maipo has been commenced by a firm of Chilean contractors.

Negotiations are said to have been completed between the Mitsubishi Takata Concern and the Westinghouse Co. for the formation of the Mitsubishi Electric Co., with a capital of 15 000 000 yen.

The International Electric Power Congress now meeting in Paris is considering two reports by representatives of the U.S.A. concerning material for the production and conversion of electrical energy.

The inquiry concerning the application of the Victoria Falls and Transvaal Power Co. for authority to proceed with its £1,000,000 power station at Witbank has again been adjourned for a month.

The Home Secretary has directed the suspension from Monday, December 17th, to Monday, December 24th, both days inclusive, of the General Early Closing Order for shops, in force under the Shops (Early Closing) Act, 1920.

To the question, "Are you in favour of the Prime Minister's policy of protecting our manufacturing industries in the home market?" the British Engineers' Association has received 1 769 replies, of which 81·5 per cent. are in the affirmative.

At the Scientific Novelties Exhibition to be held at King's College, London, from December 29th to January 9th, Commander J. A. Slee will lecture on "Wireless at Sea," and Prof. E. N. da C. Andrade on "Atoms and Electrons." The proceeds will be given to King Edward's Hospital Fund.

Negotiations are almost completed for a loan under the Trade Facilities Act for the erection of a power station for Malayan Tin Dredging, Ltd., said Sir E. Birch, at the company's annual meeting. He added that the electrification of their dredges should effect considerable economies in working costs.

Twenty-two firms have notified the National Union of Manufacturers of their intention to employ extra labour if Mr. Baldwin's proposals to protect the home market become operative. Electrical firms in this list, with the number of extra employees they would require, are: Telephone Manufacturing Co., 300; Ward and Goldstone, 550; General Electric Co., 5 000; and members of the British Electrical and Allied Manufacturers' Association, 15 000.

Woolwich (London) Council is to erect four all-electric houses.

Austrian electrical workers are threatening to strike for increased pay.

Over 800 000 people a day are travelling on the partially restored Tokyo tramway services.

Swiss firms sent in the three lowest tenders for plant for the Greenwich tramway power station.

The Austrian electrical industry is said to be withstanding the period of deflation better than most others in that country.

Suggestions for utilising tramway standards for advertising purposes have been negatived by Burnley Tramways Committee.

Through the bursting of a dam in the valley of the Scalve, north of Brescia, in Italy, five power stations have been destroyed.

A paper on "Electrical Measuring Instruments" was read by Mr. G. E. Duke before the Walsall Engineering Society last Friday.

An exhibition demonstrating the advances made in physics in general, and wireless and electricity in particular, is being held at the Grand Palais in Paris.

"We must not allow ourselves to be blinded by the brilliant development of electricity."—Mr. G. Keillor before the Scottish Gas Salesmen's Circle at Edinburgh.

A 10 000 kW turbo-alternator purchased by Swansea Electricity Committee last week cost over £12 000 less than a similar machine supplied by the same firm two years ago.

A Vienna newspaper reports that the manager of the "Union of British Electrotechnicians" has notified the Polish electrotechnical firms that an English credit of £1 250 000 has been granted to them.

In order to obtain the latest information of large electricity supply undertakings in Great Britain and the U.S.A., it is proposed that an official of the Sydney (N.S.W.) Electricity Department be sent on a seven months' tour.

On learning that there was no electric power available in the town, many manufacturers who had inquired for land for works' sites had gone elsewhere, stated the Town Clerk of Retford at a dinner of the Retford Traders' Association.

Addressing a meeting at Toronto, Sir Adam Beck, chairman of the Ontario Hydro-Electric Power Commission, said an average expenditure of 10 million dollars annually would be necessary during the next decade if power developments were to keep pace with the growing demand.

The issue of periodical progress reports has been discontinued by the British Electrical and Allied Industries Research Association. Members desiring information in regard to the Association's work should apply to the Director of the Association, 19, Tothill Street, Westminster, S.W.1.

After all recognised means of removing scale from water-cooling coils in transformers in a U.S.A. sub-station had failed, the discharge of water was increased considerably after removing the coils separately and tapping them with a hammer while a stream of water was passed through them.

Lecturing to the South Wales Institute of Engineers last Friday, Mr. E. L. Mann, general manager of the Powell Duffryn Coal Co., one of the pioneers in the use of electric power in South Wales, said the company was supplying energy to new all-electric collieries at Llanharran and Llantrisant.

Intending competitors for the Cooper's Hill War Memorial Medal and Premium are reminded that the latest date for receiving papers is December 31st. Full particulars can be obtained from the Secretary of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2.

Exhibits will be on view at the British Empire Exhibition from 10 a.m. to 10 p.m. daily, except Sunday. No exhibitor will be required to keep machinery moving or full staff in attendance after 8.30 p.m. from Mondays to Fridays inclusive, or after 9.30 p.m. on Saturdays, but otherwise exhibitors will be expected to keep their exhibits fully on show between 10 a.m. to 10 p.m. Exhibitors will be permitted to arrange their own hours for sales between 10 a.m. and 10 p.m., subject to the provision of the Shop Hours Act.

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ELECTRICAL CHRISTMAS PRESENTS.

Cultivating Seasonal Trade—Ideas for Unusual Gifts—Wide Range of Choice—What the Manufacturers are Offering.

Christmas merchandising is a department in which the electrical trade appears to have something still to learn. To an inquisitive stranger the position would appear to be that the manufacturers have heaps of good things for the traders to sell but the latter are either shy of displaying them, or else they do not realise what the manufacturers have to sell.

So many people have been brought up with the idea that Christmas presents must consist of bread knives, cake dishes, methylated spirit kettles, gloves, and the like, that there are few who know the use of an electric shaving mug, and the fragrance of a cup of coffee made in an electric percolator.

In order to give some indication of the variety of electrical merchandise which will appeal to the buyer of Christmas presents we cannot do better than name a few items:—*For the wife:* Flat iron; griller; toaster; radiant bowl fire; hot plate; vacuum cleaner; floor or table standard lamp; egg whisk; silk or glass lamp shade. *For the husband:* Pipe and cigar lighter; electric shaving mug; adjustable lamp for shaving mirror; immersion heater; wireless set. *For the boy:* Pocket lamp; bicycle lamp; torch; Christmas tree lighting outfit; bell buzzer; medical coil; wireless set; and a small regulating transformer "to work toys off the electric light." *For the girl:* Hair dryer; adjustable lamp for sewing; electro-vibro massage set; electric curling iron and comb; table lamp of fancy design; violet-ray apparatus; electric boudoir set. This is but a brief list and could be extended indefinitely, but it will at least indicate that the electrical trade has a wide range of goods with which to appeal to the large mass of Christmas buyers.

It may be as well to anticipate any criticism regarding the late appearance of these notes by saying that the following are purposely "last minute" notes, because—however much we may deplore the fact—the greatest percentage of the Christmas turnover is due to "last minute" buying. That being so, let us keep on buying and selling right up to 12 p.m. on December 24th.

Electric Fires, Ltd.

It is perhaps natural that people should lose sight of the gift possibilities of familiar household articles. For this reason a suggestion that an electric fire is a good Christmas gift will be regarded by some as radical. But Christmas gift buyers are on the look out for something different, and of the many things electrical a fire is probably the most useful at this time. In the catalogue published by Electric Fires, Ltd., will be found a number of designs which, if well displayed, will excite more than just a cursory interest. One fire of good design, both from the point of view of art and utility, is the "Teatime" model shown in Fig. 1 opposite. As will be seen from the illustration this fire has a separate heating unit which can be used as a boiling ring.

Telephone Manufacturing Co.

Among the most popular items that manufacturers can offer for Christmas is a line of electric kettles. The T.M.C. markets these kettles under the name of "Soutterware," and the design shown in Fig. 3 is selected at random from their list. The T.M.C. have also many other appliances suitable for the Christmas trade, such as immersion heaters, warming plates, coffee percolators, egg boilers and toasters. Fig. 2 shows a table standard in metal of choice and original design.

The General Electric Co.

It is impossible in a limited space to do justice to the enormous number of lines which the General Electric Co. offer the retailer in the way of Christmas merchandise. There is something electrical for every one. For a lady there are curling tongs, cookers, toasters, grillers, hot plates, warming plates, kettles, bowl fires, fires in dainty sheet metal cases, millinery iron sets, alabaster vase standards, and cut glass table standards, electric table fountains and candle-sticks. This is a very incomplete list, but it must suffice. Of equal importance is the service which the company renders to the trade in the way of publicity. They have at least ten attractive folders, which, if properly distributed, must influence the public to think of electrical gifts for Christmas. Fig. 4 shows a vase standard in English alabaster, admittedly a most charming gift. English cut glass never loses its attraction, and Fig. 7 is a fine example in the shape of a table standard. In Fig. 5 we illustrate a millinery electric iron set. One of these irons, displayed in a prominent position in a shop or showroom with a simple show card explaining the method of working, will attract a lot of attention. It is hardly necessary to mention the choice there is in the range of "Magnet" kettles, shaving mugs, and, of course, the standard quality 4 lb. "Magnet" iron listed at 16s. is a ready seller. For the mere man, the G.E.C. can offer a "Magnet" pipe and cigar lighter, shaving mirror, shaving mug, and many other devices.

The Efandem Co.

Pocket lamps and torches are a familiar line and they are accepted as a matter of course as good "merchandise to sell and profit by" at Christmas. The market need not be limited, however, to the cheaper pocket, lamps which sell at about 2s. each. If a good display is made of the more expensive utility devices, there is no doubt that they will go well; in this connection we would cite the case of the wall bracket lamp illustrated in Fig. 6. This Christmas gift suggestion is only one of the many devices of this kind manufactured by the Efandem Co., in whose list will be found a wide range of "giveable" and acceptable presents.

Best and Lloyd.

It is no easy task to make a selection from the catalogue of Best and Lloyd. Turning the pages we find table standards, piano and desk standards, floor standards, candlesticks and a score of other items to appeal to every taste and every pocket. Table standards have always been a favourite selection for Christmas gifts and the discriminating purchaser will welcome the suggestion of a bracket such as we illustrate in Fig. 8. It deliberately encourages the habit of reading in bed, and by a simple adjustment the device can be converted into a table standard when it is not required as a bed rail bracket.

Siemens and English Electric Lamp Co.

For the modest expenditure of 27s. 6d. a pleasing and utilitarian article can be purchased in the shape of a Siemens electric toaster which, being heavily electro-plated and highly finished, can be used in conjunction with other high-class table services. The current consumption is approximately 400 W and it can be used on the lighting circuit (with a B.C. adaptor), the cost of operation being exceptionally low. This model (Fig. 9) is designed so that crumbs will not accumulate, and the toast grip is under effective spring tension. A heavy base ensures stability and four highly polished ebonite buttons are fitted on the base for the protection of the table linen.

Credenda Conduits Co.

The "Non-pariel" series of appliances which the Credenda Conduits Co. recently placed upon the market, consists of three popularly priced devices which should find a ready sale during the Christmas period. The series consists of a two-pint kettle (Fig. 10), a 6 lb. iron, and a bowl fire. Distinctively shaped and finished in polished copper, the kettle sells at 22s. 6d.; in nickel plate the price is 25s., both prices including flexible cord and adaptor. The 6 lb. iron referred to has the now popular thumb rest and sells at 17s. 6d. Already well known to the trade, the "Creda" bowl fire is a piece of electrical apparatus which cannot fail to interest buyers.

May and Padmore.

It must be admitted that few people would think of boiling plates as Christmas gifts. Nevertheless, they are a very useful device for the housewife, and from this standpoint they may well take their place in the list of gifts. The boiling plate which we illustrate in Fig. 11 is manufactured by May and Padmore, and it will be seen that the designer has made a fair compromise between the need for utility and the desirability of pleasing the eye. The cast iron top is machined dead flat and polished, and the legs are finished nickel-plate. The boiling plate has a diameter of 8 in. and lists at 35s. The "Maymore" immersion heater at the popular price of 21s. is also worthy of note.

(*To be continued.*)

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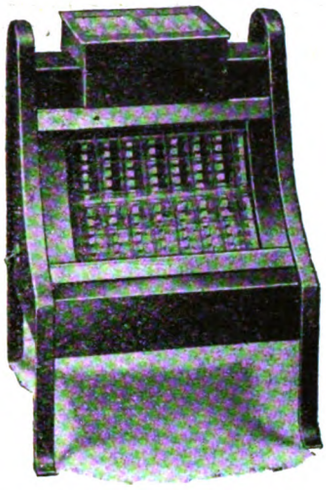

FIG. 1.—BY ELECTRIC FIRES, LTD.

FIG. 2.—BY TELEPHONE MANUFACTURING CO.

FIG. 3.—BY TELEPHONE MANUFACTURING CO.

FIG. 4.—BY THE GENERAL ELECTRIC CO.

FIG 5.—BY THE GENERAL ELECTRIC CO.

FIG. 7.—BY THE GENERAL ELECTRIC CO.

FIG. 8.—BY BEST AND LLOYD.

FIG. 6.—BY EFANDEM CO.

FIG. 9.—BY SIEMENS AND ENGLISH ELECTRIC LAMP CO.

FIG. 10.—BY CREDENDA CONDUITS CO.

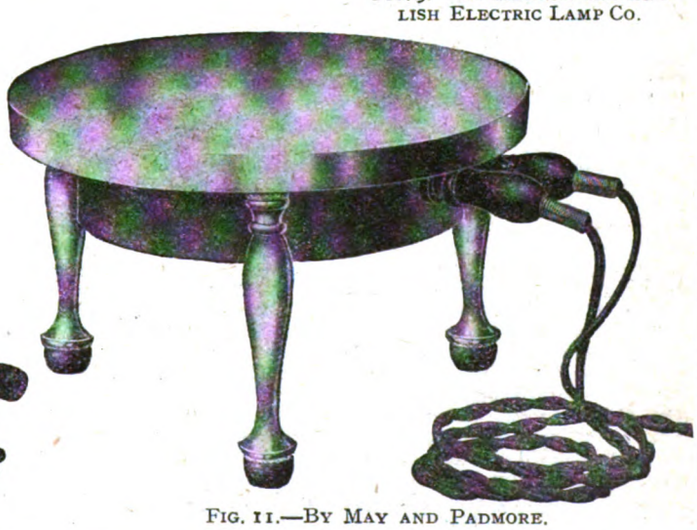

FIG. 11.—BY MAY AND PADMORE.

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LEGAL INTELLIGENCE.

Electrical Contractors' Claim.

In the Mayor's and City of London Court, on November 29, before Judge Shewell Cooper, a claim was made by Leonard G. Tate and Co., electrical contractors, 11, Queen Victoria Street, London, E.C., against Messrs. Geraldine, costumiers, Queens Road, Watford, for £11 18s. 3d. for electrical work done. The defendant sraised a counterclaim in respect of alleged bad work and overcharges. Mr. C. L. Blunt, managing director of the plaintiff company, said in November, 1922, he gave the defendants an estimate for fixing eleven points complete with bowl fittings for the defendants' showrooms at Watford. Their estimate for £38 was accepted, but they were told that the premises were to be opened in four days' time and the light would have to be completed for the first day's sale. The system used was the Clicquot lead-covered Callender wire system. While the work was proceeding instructions were given for further work. It was also discovered that they could not get eleven bowl fittings to match, but the defendants agreed to accept other bowl fittings as substitutes. Before the job was completed they had to instal 26 points, including outside illumination, and a radiator heating point, the account coming to £99 4s. 6d. Upon requesting payment the defendants forwarded £50 on account while investigating the account, and in March a further sum of £25 was paid on account. Plaintiffs then at the request of the defendants offered to deduct £5 if the balance of account was paid within seven days. This was not done. Their charges were fair and reasonable, although the defendants had complained they were far from satisfied with them.—The defendants now complained that the plaintiffs' work had been carried out in a far from satisfactory manner. The fuse boxes and switchboard should have had an asbestos sheet backing to protect the matchboarding, to comply with the insurance company's test. The temporary bowl fittings which had been fixed originally had never been matched and were not such as should have been fixed in a ladies' costumiers show room.—Plaintiffs gave evidence to show that the asbestos sheet backing was an extra precaution, but not a necessary one. Judgment was given for the plaintiffs for £11 18s. 3d. on the claim, and for the defendants on the counterclaim for £1 15s.

Compensation Awards.

In the Nisi Prius Court at the West Riding Assizes last week, Leeds Corporation consented to awards of compensation to the widows of three men who were killed in the disaster on Churwell Hill in June last when a Corporation tramcar got out of control and was derailed. The respective amounts were £810, £600 and £700, with costs in each case. A fourth claimant, who had been offered £800 in respect of the death of her husband, sued for a higher award, but judgment was given for the Corporation, with costs, and the plaintiff was awarded only £150 compensation.

Liability of Municipal Undertakings.

At the Manchester Assizes on November 29th, J. Redhead was awarded £500 damages against the Rawtenstall Corporation for the death of his daughter last December. It appeared that the girl, while walking in the snow, came in contact with an overhead line which had been brought to the ground by a heavy fall of snow, and was killed. For the plaintiff it was contended that the wires had been very negligently suspended, that they might have been brought down at any time by the wind, and that the consequences might have been still more serious. Mr. Kyffin, for the Corporation, admitted liability, but demurred to the full claim of the father.

B.T.-H. Patent Litigation.

When the case of the British Thomson-Houston Co. *v.* the British Insulated and Helsby Cables was resumed on November 27th Mr. Horatio Ballantyne, Vice-President of the Institute of Chemistry, giving evidence for the defendants, said that for the last 15 years he had been engaged almost continuously on questions relating to the manufacture of tungsten filaments and tungsten filament lamps and he was a technical director of the Continuous Reaction Co., who were manufacturers of tungsten alloys, and of Thermit, Ltd., engineers and metallurgists. He was a witness in the Pope action over the Just and Hanaman patent. For the manufacture of these squirted filament lamps a black amorphous tungsten powder was used. At the date of the 1906 patent the grey tungsten powder was the tungsten powder commonly known. The black powder was a curiosity and he doubted whether 1 lb. of it had been made in this country at that time. He first saw the filaments made under the Just and Hanaman process at Vienna in January 1906. The patent, he thought, was dated 1904. He found sufficient description in the 1906 document to enable him to carry out the process.

Asked to state the distinction between the 1906 specification and the 1909 document, witness said the latter gave a number of alternative ways of preparing the sintered stick. The 1906 specification did not include the case of pressing and sintering which was given in the 1909 specification. On the other hand, the 1909 ocument included the same process, that was to say, the glucose rocess of producing a sintered stick as was given in the 1906 ecification. Both specifications prescribed the rolling process but e 1909 specification also gave an alternative swaging method. Leaving the reference to repeated mechanical working aside, in his opinion there was no new disclosure as to the working of tungsten.

On November 28th his Lordship gave his decision regarding the admissibility of evidence in the Duram case. He said that some years ago the present plaintiffs brought an action against some people called Duram for an infringement of their 1906 patent, and in that case one issue of fact was whether the process disclosed by that patent was a workable process. In the present case Sir Arthur Colefax had made a clear admission that in the Duram action the plaintiffs (the British Thomson-Houston Co.) contended that by following the directions contained in the 1906 patent they could obtain a filament of drawn tungsten wire. In support of that contention the plaintiffs called three expert witnesses. The Duram action failed, but upon a ground which made it unnecessary to decide that question of fact. In the present action the same plaintiffs sued different defendants for infringement of the 1909 patent. The 1906 patent was pleaded in defence, and the same issue of fact become material, but in the present action the plaintiffs' contention was different. They contended that following the 1906 patent directions it was possible to obtain a tungsten drawn wire filament, but they had called other experts before him as witnesses and not the three experts who gave evidence in the Duram action, one of whom, he was told, was dead. The defendants in the present action claimed to be entitled to read the evidence of the three experts in the Duram case on the ground that the putting forward by the plaintiffs of that evidence was an admission by conduct that the evidence so given was true. It was not suggested that such an admission operated in any way by way of estoppel, but that it constituted *prima-facie* evidence which was now admissible. There was no direct decision on the point in question, and there were conflicting views by various judgments as to the admissibility of written evidence, but oral evidence seemed to be on a different footing. There being no decision forcing him to admit the evidence he was at liberty to act on his own view. He was not disposed to extend a rule which might result in inconveniences and difficulties, and he accordingly refused to allow the evidence of those three experts to be read in the present case.

Cross-examined by Sir Arthur Colefax, on November 30th, Mr. Ballantyne agreed that the details necessary for the production of a tungsten drawn wire filament were all set out in the 1909 specification, which was the only document that set them out in words.

The case is still proceeding.

OVERSEAS NOTES.

Improving Electrical Trade in China.

According to the latest report on the Industrial and Economic Situation of China by the Commercial Secretary to H.M. Legation, Shanghai [H.M. Stationery Office, 1s. 6d.], the electrical trade in China has steadily advanced during the past twelve months, not only in the number of new plants, and extensions to existing ones, that have been installed, but also in the type of machinery which Chinese buyers now insist upon. The education of the Chinese merchant in the matter of purchasing machinery has made considerable progress, and economy and reliability are factors entering into machinery transactions as well as the matter of price, which, a few years ago, was the only generally desideratum.

Among the more important extensions to power plants made in the period under review, the following may be mentioned: Hangchow, 2-2 000 kW turbo sets; Chinkiang, 1-750 kW turbo set; Canton, 1-5 000 kW turbo set; Hankow, 2-3 000 kW turbo sets; Changsha, 2-1 000 kW turbo sets; Yangchow, 1-1 000 kW turbo set; Mukden, 1-3 000 kW turbo set; Pootung, 1-500 kW turbo set; Pengpu, 1-300 kW turbo set; Peking, tramway system, comprising power plant, sub-station, equipment, rolling stock, etc. The foregoing are purely Chinese concerns. Among "foreign" electricity enterprises, important plant extensions have been made to the power stations at Shanghai, Kowloon, and Hongkong. It is stated in conclusion that in spite of political troubles and trade depression, steady progress has been made in the use of electricity, justifying the optimistic hopes that have always existed.

Electric Railways for Calcutta?

Consideration for traffic congestion in Calcutta demands the provision of early measures for its relief, Mr. T. A. F. Stone, of the North Western Railway, offered, in a paper recently presented to the Indian Institution of Engineers, a detailed analysis of the traffic problem, and suggested measures for its solution. He suggests the construction of a north and south shallow tube or overhead line, the building of a circular or elliptical railway round the outskirts, and the acceleration of the suburban railway services. He considers that the existing steam services will be unable to provide the necessary additional transit facilities, that electric railways would be the cheapest and quickest means of providing for the daily movement of this population, and that to give adequate service four new double-track electric lines, radiating out about 16 miles from the present termini, would be required in addition to the existing steam services which should be electrified at the same time. To relieve some of the street congestion, a tube railway connecting Howrah and Sealdah stations and the heart of the city is, Mr. Stone states, an immediate necessity. New broad arterial streets should be constructed as well as a circular railway round the outskirts.

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PERSONAL GOSSIP.

Mr. William Auld, of William Auld and Sons, electrical contractors, 70, Sandgate Street, Ayr, and Mrs. Auld have celebrated their golden wedding.

Councillor E. Gough has been re-elected chairman of the Cardiff Electricity Committee. Councillor C. H. McCale is vice-chairman in the place of Councillor E. Curran, resigned.

According to a daily contemporary Sir William Bull claims to be the most accessible member (of Parliament) in London, as anyone can see him at any time without an appointment.

Mr. J. S. Ramsden, the British Thomson-Houston Company's district manager at Birmingham, has been appointed manager of the Supply Department at Rugby, in sucession to the late Mr. J. A. Phillips, whose death we recorded in our issue of September 28th. Mr. F. Hughes-Caley, of Rugby, succeeds Mr. Ramsden as district manager at Birmingham.

Mr. J. O. Roberts, the late Mayor of Gloucester, and Chairman of the Electricity Committee from 1910 to 1923, has been presented by the technical and administrative staffs of the municipal electricity and tramways undertakings with an electric standard lamp, to mark their appreciation of his services on the Committee. The presentation was made by Mr. F. C. H. Corson, the city electrical engineer.

Sir James Kemnal has accepted an invitation from the British organisers of the World Power Conference, to be held at Wembley next July, to read a paper on "Steam Generation," a subject about which he probably knows as much as any living specialist, and a good deal more than most. Apart from his association with Babcock and Wilcox, Sir James is also chairman of Worthington, Simpson, Ltd., and President of the British and Latin-American Chamber of Commerce in London.

We understand that Mr. Raymond J. Mitchell, until recently chief engineer of Electricars, Ltd., and Edison Accumulators, Ltd., has joined the staff of the Ransome and Marles Bearing Co., ball-bearing manufacturers, Newark-on-Trent. Mr. Mitchell has been identified since 1912 with the development of accumulator electric road vehicles, on which subject he has during this period read a number of papers before engineering societies, in addition to having contributed numerous articles to "The Electrician."

Mr. R. R. Maccall, secretary and treasurer of the Glasgow Corporation Electricity Department, was last week entertained by the municipal employees at a smoking concert at the Grand Hotel, Glasgow, to mark his services as chairman of the Employees' Advisory Committee on Superannuation in the work of establishing a superannuation fund for all the servants of the municipality. After lengthy negotiations, a scheme mutually agreeable to the Corporation and the employees was put into operation last June. During the evening Mr. Maccall was presented with a canteen of cutlery.

Mr. H. P. Brown, an assistant staff engineer at the General Post Office, London, who was lent to the Australian Post Office a year ago to act in an advisory capacity, has, it is reported, been appointed permanent head of the Australian Postal Department at a salary of £2 500 a year—double the customary amount. During the war Mr. Brown was in charge of the emergency telephone arrangements for anti-aircraft defence purposes in this country. He reorganised the Calcutta telephone services after the war. Mr. Brown, who is 45 years old, started his postal career as a sorting clerk at Newcastle-on-Tyne in 1897, and became in succession telegraphist, junior clerk in the engineering department, senior clerk and assistant staff-engineer.

Obituary.

We regret to record the death which took place at Chapel-Allerton, Leeds, on November 28th, of Mr. Rowland E. Dixon, chairman of S. Dixon and Son, electrical engineers and brass founders, Swinegate, Leeds. Although he took no part in public affairs Mr. Dixon, who was 51 years old, was very popular in trade and social circles. He is survived by his widow, a son, and a daughter.

Leeds Electrical Exhibition.

At the Leeds Health and Municipal Services Exhibition, which closed last Saturday, the Corporation Electricity Department's stand occupied a space of 30 ft. by 30 ft., and was divided into five compartments, as follows:—One 15 ft. by 15 ft. illustrating an electrically equipped dining room. One 15 ft. by 15 ft. showing "Tricity" cookers and other domestic appliances, and from which cooking demonstrations were given daily. One 15 ft. by 12 ft. illustrating "Falco" (Hotpoint) domestic appliances, from which cooking demonstrations were given daily. An electrically equipped bathroom 15 ft. by 6 ft., and a portion 15 ft. by 12 ft. devoted to matters of technical interest, and which also provided a listening-in station in connection with the wireless installation.

The Leeds electrical contractors also put up an excellent combined show, and other interesting and popular electrical exhibits were furnished by the Hurley Manufacturing Co., the Hoover Manufacturing Co., and the proprietors of the "Eureka" vacuum cleaner. Notwithstanding the bad weather which prevailed throughout the run of the Exhibition, and the interference with entertainments of this character owing to the General Election, considerably over 20,000 people visited the Exhibition.

NOVEL FLOODLIGHTING.

Illuminating Buildings from Below the Pavement.

The architect and the illuminating engineer have combined forces to produce the wonderful effect now to be seen on the Army and Navy Stores in Victoria Street, London. Sir Aston Webb, who designed the new front, did not wish any fittings to be visible, and suggested that all illumination should be carried out from below the pavement.

Pavement lights were therefore put in by the General Electric Co., and under these Osram gasfilled electric lamps of the projector

FLOODLIGHTING AT THE ARMY AND NAVY STORES.

type were fitted, equipped with specially designed reflectors, with the result that the whole front is now suffused with soft white light, and the absence of glare and visible fittings makes the installation specially attractive. Another feature of this artistic frontage is the introduction of the Strozzi lantern, made in cast bronze by the G.E.C. The lanterns are fitted with a concealed floodlight in the top to illuminate that part of the building which would otherwise be in shadow cast from the lantern itself.

Long-Distance Wireless Tests.

Information regarding important tests on a new system of long distance wireless communication, carried out in association with Mr. C. S. Franklin and Mr. G. A. Mathieu, was given by Mr. G. Marconi at the annual meeting of Marconi's Wireless Telegraph Co. on Monday.

Stating that the system upon which they had been working was destined to bring about somewhat of a revolution in the methods hitherto employed for communication by wireless with distant countries, Mr. Marconi said that according to this system the electric waves which carry the messages are projected and propagated in a beam in any desired direction only, instead of being allowed to spread around in all directions.

Owing to the better utilisation and concentration of power under the new arrangement, a much smaller amount of electrical energy need be employed for a given distance, resulting in a substantial economy in capital and in working expenses. Only stations inside a certain restricted angle or sector were enabled to receive, and this increased the privacy and secrecy of communication, besides greatly reducing the possibility of mutual interference with other stations Owing to the employment of comparatively short waves, the speed of transmission and reception could be several times greater than what was attainable with existing long-distance systems. The disturbances caused by the effect of atmospheric electricity were greatly minimised.

During the tests referred to, he continued, communication was successfully carried out on this system between England and many places abroad, including St. Vincent (Cape Verde Islands) up to a distance of 2 250 nautical miles, by the employment of only a fraction of the electrical energy hitherto found necessary to cover such distances. He was now completing arrangements which would enable him to give this system a thorough test between England and the United States of America.

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THE BIRMINGHAM DINNER.

Mr. Amery Emphasises the Need for Empire Development.

The annual dinner of the South Midland Centre of the Institution of Electrical Engineers was held in Birmingham on Friday, November 30th, Mr. J. D. Morgan being in the chair. The attendance was a record, and in spite of the absence of certain distinguished guests on political duties, the standard of the speeches was very high.

Proposing the toast of the "Institution of Electrical Engineers," Mr. L. S. Amery said the dense population of this country offered an ideal opportunity for the development of the use of electrical power, especially in the Midlands where small factories were common. If the United States could develop its electrical industries, so could the British Empire. Half the water power of the world was in Canada, and Alberta possessed the greatest coal-field in the world. But if this development were to be made possible, they must adopt a policy which aimed at national and Imperial greatness, and, above all, at the creation of men worthy of a great Empire.

Dr. A. Russell, in reply, drew attention to Mr. Amery's sympathy with scientific research, and said that the latest ships would reflect the effects of the research which the Admiralty had been carrying on. He was glad to be able to report the continued prosperity of the Institution, whose influence was extending daily. The electrification of our railways was long overdue, and the system to be employed should be standardised, so that the work could be begun in real earnest. This would be an ultimate boon to the country, and an immediate benefit to the unemployed. Next June they would be celebrating the centenary of the birth of Kelvin, and he hoped that all engineering Institutions and scientific societies would join with them on that occasion. Next year also, engineers from all over the world would be assembling in connection with the World Power Conference, and he hoped that Birmingham manufacturers would help in the entertainment of these men by throwing open their works and exhibiting the colossal strides that have been made in engineering in the district.

Mr. G. C. Vyle, chairman of the Birmingham Chamber of Commerce, in proposing the "Electrical Industry," congratulated those present on its excellent vitality and general health. There had been a tendency on the part of municipal bodies in the past to place orders abroad for electrical machinery. In that way a few thousand pounds were saved on a contract, while tens of thousands of pounds were being paid in the relief of unemployment. This was a short-sighted policy. There was no electrical apparatus which could not be made efficiently in this country to a price, and he looked forward to the time when the electrical industry would be able to supply the needs of this country, the needs of the British Empire, and the needs of as many other countries into which it could permeate.

Mr. Hugo Hirst, in reply, said that our builders of Empire saw the great part that the electrical industry was going to play in realising their ideas. Electrical power was a source of wealth which would enable new industries to be established and old industries to be developed in the uninhabited places of the earth, and he hoped that, whatever the result of the election, the electrical industry would be protected to carry out this work, otherwise the conditions of twenty years ago would come back, when there were no profits and no confidence in electrical progress. Electrical engineers did not deserve to be thrown back into that state. The electrical industry required profits not for its own enrichment, but because it was in a state of evolution, and if no money was available for research and development, it could not keep pace with the work of its more sheltered competitors.

TELEGRAPH AND TELEPHONE.

Last Saturday a new telephone exchange was opened in Formby, replacing with up-to-date apparatus the existing Formby exchange.

The Telegraph Construction Co.'s c.s. "Colonia" last week made the final connection at le Havre of the new cable between France and the U.S.A.

At the opening of a telephone exchange at New Luce (Wigtonshire) Mr. Gauntlett, district manager of the Post Office telephones, said it was one of between 400 and 500 rural exchanges which had been opened under the new policy of the Government, to encourage the development of telephone services in rural districts on terms which were not likely to be remunerative in themselves.

According to the Milan Correspondent of "The Times," a decree has been approved authorising the Italian Telegraph and Submarine Cable Co. to modify the route of the cable which is to link Italy with the United States. The company has learned that, although its capital of 200 000 000 lire has been subscribed, it cannot proceed with the laying of the cable between Italy and the Azores (which was to be the link in the direct communication between Italy and United States), because the Portuguese Government has not conceded the landing point at the Azores. A new route is now being considered—either Malaga-Cadiz, or Fiumicino-Malaga-Canaries. The Western Union Co. is to lay the section between the United States and Cadiz or the Canaries.

WIRELESS CHAT.

The B.B.C. and Transatlantic Broadcasting Experiments.

The widespread interest aroused in the experiments in picking up on this side of the Atlantic programmes broadcast from the United States has led the British Broadcasting Co. to contemplate carrying the experiments a stage further by relaying these transmissions through their various stations to listeners in this country.

The exact date for the test has not yet been fixed, but due notice will be given of the attempt. The general plan is to take a powerful receiving set out into the open country, pick up the American broadcast, and relay it through to the B.B.C. stations. It is proposed that a 17-valve set shall be used to pick up the American transmission. If the relaying is successful, owners of crystal sets, through their local B.B.C. station, will be able to hear music played on the other side of the Atlantic.

On Sunday unsuccessful attempts were made by the American broadcasting stations and the stations of the B.B.C. to establish conversation between the two countries. The reception in the United States was generally good, the British stations being heard in New York, Boston, and other places. The reception in this country, however, owing to atmospherics, was far from good, and the American messages were only heard intermittently. The failure to establish conversation was largely due to the bad conditions.

During last Wednesday's transmission test to the U.S.A. Mr. G. Marconi mentioned that he had lately been making experiments with short wave lengths, which seemed to prove that the disadvantage of broadcasting private messages would be partially overcome, because it might be possible to send out between England and America beams of radiation which could not be tapped except at points lying between the two stations.

Synthetic Crystals.

In forwarding a sample of synthetic crystal of the sulphide type made in their own laboratories, J. J. Eastick & Sons, of St. Dunstans Hill, London, E.C.3, make the interesting observation that the majority of alleged synthetic crystals at present in use are not synthetic at all, and state that in many cases it is possible definitely to identify the substance as natural crystal. As they know of no crystal that can definitely be stated to be of British manufacture, "the point arises, do sets fitted with foreign crystals come under the B.B.C. arrangements?"

Irish Licensing Delays.

It looks as if an almost exact repetition of the wireless licensing muddle in this country will take place in the Irish Free State unless the Government takes action at once. At present, although quite a number of receiving sets have found their way into the country, listeners-in are compulsorily "pirates" because the Government has not yet issued a licence of any kind. Many cheap and nasty "sets" are being sold to the public by unlicensed vendors, some of whom appear to have taken some trouble to fix up special apparatus for demonstration, but not for sale. According to the "Freeman's Journal" one of these vendors invited people to hear a concert from Manchester on a single valve set with a frame aerial. A wireless expert who attended one of these demonstrations discovered that nothing was being received from Manchester, but that, by the aid of a microphone and a gramophone in another room this smart dealer was giving a miniature broadcast concert of his own. In the room containing the receiving set was a box with a lid on it, which looked like a battery box, but actually contained two other valves.

Building with Radiobrix.

The way of the listener-in is being made easier and easier. If he disdains complete sets, there are plenty of accessories from which he can make up his own apparatus and plenty of diagrams to show him how to do it. In a recent issue we described the "Radiobrix," which have been moulded (if this is the right term) by the Metropolitan-Vickers Electrical Co. to enable sets to be built up by a series of simple connections, and now we have received from the same company a book whose object is to suggest to the beginner simple circuits with which he can lay a firm foundation of radio knowledge. Carefully graduated circuits of greater complexity which are suited to those with a higher degree of skill are also given, together with a number of useful suggestions and notes. There are in all some thirty-six circuits, all of which are given diagrammatically and in "Radiobrix" form, and are accompanied by usefully explanatory notes. Each page of diagrams and notes is faced by a page of squared paper for the amateur's use, and arrangements are made for taking in the extra circuits which are to be issued from time to time. The book, which was on sale at the All-British Wireless Exhibition and will also shortly be available at all booksellers and newsagents, is one of which everyone interested in wireless should secure a copy. It is published at 1s.

South Africa's wireless station is to be erected at Milnerton, a suburb of Cape Town. There will be 16 masts of an average height of 830 ft.

The first important Australian wireless broadcasting station was completed last week at Northbridge, Sydney. The service is being conducted by a drapery firm.

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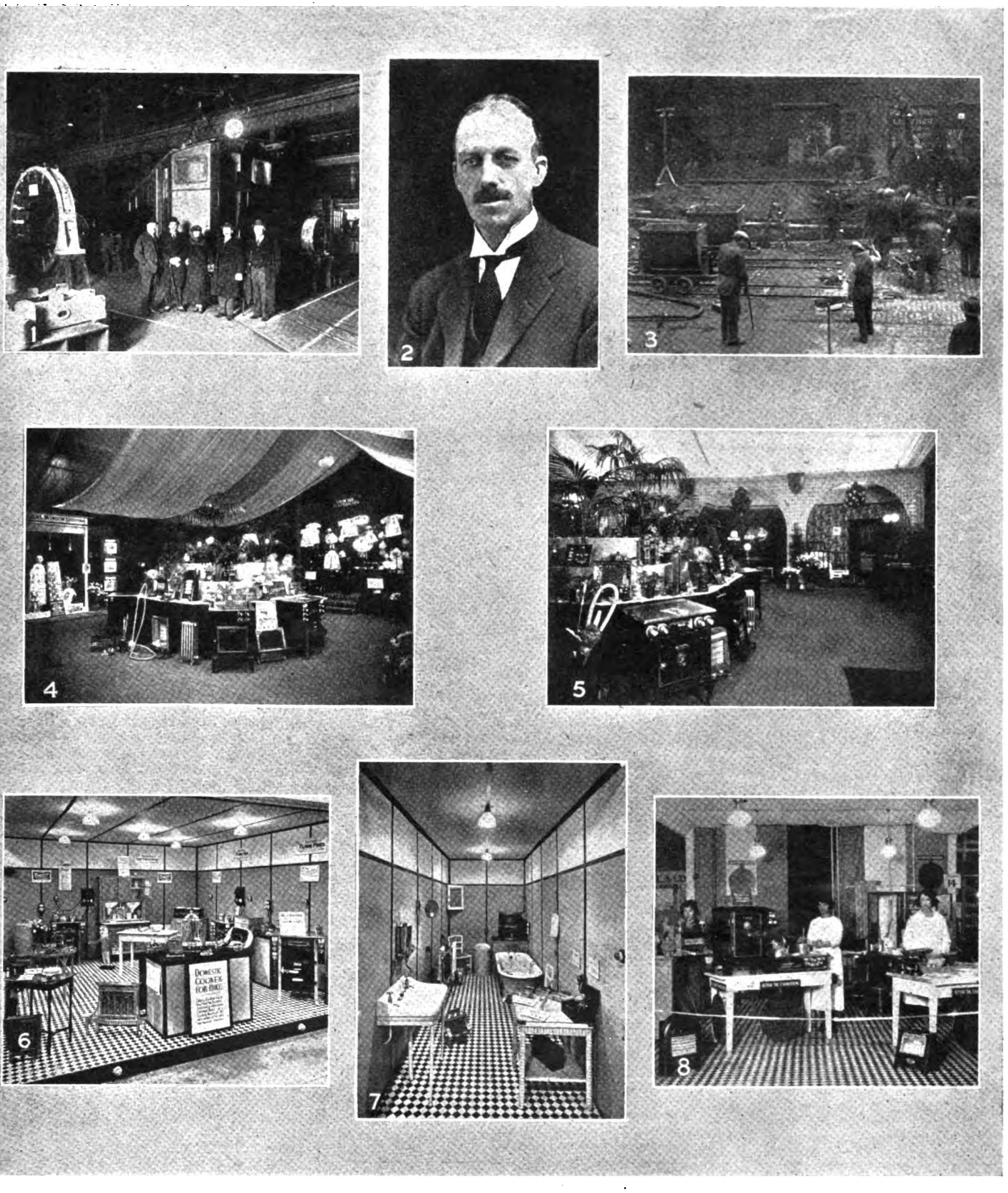

ELECTRICAL NEWS IN PICTURES.

1.—The Australian Premier at the Metropolitan-Vickers Works at Trafford Park. Reading from left to right the group shows Capt. R. S. Hilton of the Metropolitan-Vickers Co., Mr. and Mrs. Bruce, Mr. Clare Lees, of the Manchester Chamber of Commerce, and Mr. Marshall Stevens, chairman of Trafford Park Estates, Ltd. Behind the group is a 3 000V d.c. locomotive built for the South African Railways, while on the extreme left is part of a turbo-alternator for Melbourne.

2.—Mr. C. G. Morley New, the Cardiff City electrical engineer, whose work on the Committee of the Mining Engineering Exhibition at Cardiff has contributed materially to its success. A number of electrical manufacturing firms had stands, p. 649.

3.—At work this week filling in the chasm at Newington Causeway, London, caused by the subsidence on the City and South London Tube Railway, p. 649 ("Electrician" photo).

4 and 5.—Views at the Paisley Electrical Exhibition, organised by Mr. W. Blair Smith, engineer and manager of the Paisley Corporation Electricity Department, p. 644.

6 and 7.—Arranged by the manager (Mr. C. Nelson Hefford), the display of the Leeds Corporation Electricity Department, at the Leeds Health and Municipal Services Exhibition, drew large crowds of people, p. 643.

8.—The stand of the Newcastle-upon-Tyne Electric Supply Co. and associated companies at the Newcastle Ideal Home Exhibition.

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ELECTRIC TRAIN EXPLOSION

Ministry of Transport Inspector's Interesting Conclusions.

A long report by Major G. L. Hall on an explosion which occurred on an electrically-operated train at London Bridge Station, on the Brighton section of the Southern Railway, on July 11th, 1923, has been issued by the Ministry of Transport.

The train consisted of six coaches, alternately trailer and motor. The explosion occurred in the motorman's compartment of the second motor coach from the front of the train, and broke the windows in that compartment and one of the windows in a passenger train standing at an adjoining platform. Six of the passengers in the latter train were injured, but practically no other damage was done to the stock beyond a slight bulging in the door of the high-tension chamber in the motor coach in which the explosion took place.

Train's Electrical Equipment.

The report gives a detailed description of the electrical equipment of the train. Single phase energy is supplied at 6 700 V through duplicate bow collector gear—one set for forward and the other for backward running. There are four motors on each motor coach, and these are supplied through two transformers. In the high-tension circuit current passes from the trolley wire through the bow collector, choking coils and the primary of the current transformers to the main high-tension switch, and then through the main fuses to the transformers. The main oil switch has four fixed and four moving contacts. Two of the fixed contacts are bridged by a non-inductive resistance, whose value is 1 500 O. The switch is opened by gravity, and closed by the action of a coil, whose energisation depends on the bridging of two contacts on an overload relay. This relay is normally short-circuited by a fuse, which in case of heavy overload on the high-tension side will blow and cause the oil switch to open. Under normal conditions the oil switch is not called upon to interrupt any current except that required to magnetise the main transformers. The switch insulators are of white glazed porcelain with litharge and glycerine packing inside, and the oil-containing box is lined with three-ply wood and provided with two vents each 1¼ in. diameter, which are covered by spring flaps. The oil used is Vacuum A.F., and the working quantity is 16½ pints.

After the accident the oil switch was found in the open circuit position, considerable burning being evident on both the fixed and moving sides of the shorter contacts. The quantity of oil present was found to be only 9½ pints, and the porcelain insulator surrounding one of the fixed contacts was cracked in three places, about equally spaced round its circumference. There were unmistakable signs of arcing from the bare portion of the fixed contacts protruding from this insulator to the left-hand corner of the switch oil container in which a crater about ⅛ in. deep had been burnt. The lining showed signs of surface burning, and the container was slightly bulged outwards. The overload relay fuse had blown, but the other fuses, including those protecting the main transformer primaries, were intact. The steel door of the high-tension chamber was slightly bulged outwards, and all the gear inside was covered with grease and soot.

The Driver's Evidence.

It appears from the evidence that the train had been in use for some two hours at the time of the accident, and that upon arrival at London Bridge the driver had reversed the bows to the correct position for leaving the station. As he was walking down the platform to the front of the train he saw a puff of smoke come from the overhead conductor near the middle motor coach, and shortly afterwards heard an explosion. On reaching the motor coach he noticed a good deal of smoke, and went to the front of the train to lower the bows. On returning he noticed that the bow on the coach on which the explosion had occurred had not dropped, and gave instructions for the current to be switched off for the time. The station staff generally confirmed the evidence of the driver, while members of the electrical staff gave evidence as to the blowing of fuses at Peckham Junction Central Switch Cabin and at the London Bridge Switch Cabin, and that after the line had been reported in order a switch was closed, only to open again immediately.

Major Hall deduces from the evidence that three distinct short-circuits occurred, and that the trouble originated in and was confined to the main high-tension oil switch. The conditions of the contacts showed that these short-circuits occurred when the main switch was closed, that it opened when it was carrying a considerable short-circuit current, and that the overload relay fuse did not blow until the final short-circuit.

He also comes to the conclusion that the fault originated in the cracked insulator of the main high-tension switch, and that a more or less limited discharge had been taking place through these cracks from the surface of the insulator to the casing of the switch for some time, at first in the form of a high-resistance leak which carbonised and vaporised the oil, the result being a lowering of the oil level and the production of a heavily carbonised vapour and sooty deposit which increased the conductivity of the discharge path.

The first short-circuit probably occurred when the bows were changed over, causing a serious vaporisation of the oil and the charging of the high-tension chamber with an explosive mixture. When the circuit was closed 20 secs. later a discharge of such intensity occurred as to fire the explosive mixture already generated and to lower the oil level so as to expose the bare ends of the fixed contacts. The third short-circuit probably caused the burning of the switch contacts which would now be above the oil level, and the formation of the crack in the container. This short-circuit was the only one that operated the three cut-outs which had varying time constants.

A careful analysis of the oil at Faraday House showed that it could not be held responsible for the accident, though it was pointed out that it burns when ignited in the atmosphere, and when mixed with air it formed an explosive mixture.

The damaged insulator was subjected to careful tests at the makers' works, which failed to reveal any defect, and in the opinion of the manufacturers the fractures were caused by internal mechanical pressure, and were not the result of an electrical breakdown.

There are two types of insulators in use on these coaches which differ mainly in the depth of the recess on the underside. A thorough examination of the whole of the oil switches in both types of stock showed that of the insulators with the greater depth of recess none were broken or cracked, while in the case of the others one was somewhat chipped and another cracked all the way up. This is due, Major Hall thinks, to the cement filling, which, owing to expansion, causes strain or, in aggravated cases, cracking. He concludes that the insulator was split by the litharge filling in the recess having absorbed moisture or having been tightly packed in the first instance, so that a strain was set up which was increased to breaking point by the unusually high temperature prevailing for a week or so before the accident.

The record of these electric trains has been a remarkably good one, this being the only explosion reported since their operation started in 1909. It is suggested, however, that insulators with the greater depth or recess should replace the others, particular care being taken that the packing is not brought down into the recess, and that the oil gauge on the switch should be modified so that the level of the oil is more easily read than is now the case, and that, owing to the liability of formation of an inflammable gas under conditions of short-circuit, the company should consider the advisability of providing some ventilation near the top of the high-tension chamber.

"ONE-MAN" CARS.

Ashton-under-Lyne Corporation's Experiment.

The "one man" type of tramcar now installed on the Hurst route of the Ashton-under-Lyne Corporation Tramways, and illustrated in our previous issue, owes its origin to the United States, where this kind of vehicle still maintains its popularity and has been found remarkably economical under suitable conditions.

The car is of the single-deck type, seats 24 passengers and has a smoking compartment in the rear. It is fitted with a single Brill truck with a 6 ft. wheel base, the length over all being 27 ft. with an overall width of 6 ft. 9 in., and a clear height inside of 7 ft. 9 in. Fully enclosed vestibule ends are provided, the top half of the central glass panel opening outwards and overlapping the lower half on the lines of motor car screen practice. A light is fitted in front of the driver to give him notice in case of the trolley leaving the wire. The car is fitted with hand and magnetic brakes, and in addition there is the usual rheostatic brake.

A patent sanding device is provided so that the sanders in the rear may be operated in the case of a run-back. Folding doors are fitted on the near side; these are operated by a short horizontal lever located above and to the left of the controller. The step operates in conjunction with the door. A bolt is shot across the inside of the rear door, and a barrier is dropped across the saloon rear gangway to indicate that passengers are not permitted to have access to this platform, and notices are provided instructing passengers how to obtain access to the rear platform and how to open the door in case of emergency. Besides the ordinary type of lifeguard, folding sideguards have been fitted on each side.

Steel-cored Aluminium Cables.

The Lake Erie and Northern Railway, Canada, which is operated at 1 500 V d.c., has both a heavy passenger and freight traffic, and is further interesting from the fact that a steel cored aluminium cable of the type now common for long distance transmission is used for the main catenary on the overhead construction. This cable consists of 61 strands, each 0·118 in. diameter, the seven innermost wires being of high tensile steel and the rest of aluminium. In this way the first cost is reduced as longer spans can be used and economies thus effected in towers, insulators and erection. The catenary is connected to a galvanised steel contact wire 0·155 sq. in. in section by flexible bonds placed 150 ft. apart. The use of steel for this purpose is, it is claimed, less costly than copper, its rate of wear is smaller and it has a lower coefficient of expansion. No trouble has yet been experienced with corrosion. Full particulars of the installation are given in a pamphlet recently issued by the British Aluminium Co.

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ELECTRICITY SUPPLY.

Extensions and Developments.

Elland Electricity Committee proposes to spend £7 500 on a street lighting scheme.

Burnley Electricity Committee proposes to lay about 1 000 yd. of cable in Barden Lane.

Bury (Lancs) Town Council has been recommended to apply for a loan of £70 000 for electricity purposes.

The Uckfield Board of Guardians are discussing the question of replacing the Institution's present gas supply by electricity.

In order to cope with increasing demand the Oxford Electric Co. have recently installed two new generators at their Osney works.

A sub-committee of Preston Electricity Committee has been appointed to organise an electrical exhibition in the Public Hall next spring.

In reply to a request from Forest Town for a supply of electricity the Mansfield Town Council announces that it cannot take the supply there at present.

Keighley Town Council is to instal a new 5 000 kW set, with boilers and equipment, at an estimated cost of £50 000. Sanction is being sought for a loan of that amount.

Fulham (London) Borough Council is applying to the Commissioners for sanction to an expenditure of £120 000 for two 6 000 kW turbo-alternators and accessories.

Preston Electricity Committee has received an application from the Penwertham Parish Council for a supply for public lighting. A sub-committee is to report on the matter.

Although foreign tenders for two 1 000 kW motor converters for the Bradford Corporation's Sunbridge Road sub-station were lower than the British offers it has been decided to accept a British tender.

Hammersmith Council has received permission to borrow £42 000 further on account of the scheme for extending the plant at the electricity works, approved by the Council, at an estimated cost of £211 590.

The Brodsworth Colliery Co. (which is to give a bulk supply of electricity to Adwick-le-Street Urban Council), and the Bullcroft Colliery Co., have decided to undertake the wiring of all houses erected by them.

To meet increased demand Cardiff Electricity Committee proposes to increase the present boiler house plant at an estimated cost of £11 895. Sanction is being sought to a loan of £60 000 for the extension of mains and services.

Ruskington Urban Council, in view of the fact that plant at the waterworks will soon need renewing, has requested the Water Committee to consider the advisability of combining power for pumping and generating electricity.

Subject to public interests being safeguarded, the Upper Ward District Committee of Lanarkshire County Council has decided to assist a scheme put forward in conjunction with the Clyde Valley Co. to utilise water power in the vicinity of Lanark for the generation of electricity.

Fleetwood District Council has passed a resolution that it is not in favour of the proposal of the Lancashire Electric Power Company to erect a capital station near to Padiham, but is prepared to support an application for the erection of such a station at Burnley by the Corporation of Burnley. The electrical engineer has been authorised to arrange for the fitting of oil-firing apparatus at the electricity works.

The question of further extending the Dundee Corporation's power station at Carolina Port is again receiving consideration. Although the precise nature of the extensions has not been settled it is understood that the Electricity Committee requires a 12 500 kW set, with four water-tube boilers. In order to discover the best and most economical plant Mr. Douglas H. Bishop, the engineer, has been authorised to visit recent installations in other places.

Alterations in Charges.

Llandudno Urban Council has reduced its charges to 6d. per kWh for lighting and 2½d. for power.

Beckenham Urban Council has reduced the charge for electricity for lighting from 8d. to 7d. per kWh.

Worksop Urban Council has decided to reduce its charges for lighting from 7½d. to 7d. per kWh. The slot meter rate of 8d. per kWh will remain unchanged.

Stoke Newington Council has reduced its charges for private lighting from 5½d. to 4½d. per kWh, and for power on the maximum demand system from 4½d. and 1½d. to 4d. and 1d.

Maidstone Town Council has decided to reduce the flat rate for electricity for private lighting from 7d. to 6½d. per kWh as from January 1st and for intermittent power from 4d. to 3d. per kWh.

As the result of representations by the Kensington Council, the Brompton and Kensington Electric Supply Co. has reduced its charge for electrical energy supplied to the Council from 4d. to 3½d. per kWh.

Birmingham Electricity Committee recommends a further reduction in the prices charged to consumers, varying from one-halfpenny to one farthing per kWh off the existing scale, according to the character of the supply.

Representatives of Preston's entertainment catering interests have decided that, unless Preston Corporation is prepared to charge power rates for energy used through motor generators at places of amusement, steps be taken to decide the legality or otherwise of the existing charges.

Twickenham, Teddington, Hampton, East and West Molesey, Esher and Dittons, Hampton Wick, and Ham District Councils have decided to make joint representations to the Ministry of Transport for an alteration in the prices or method of charging in the Special Order of 1920 granted to the Twickenham and Teddington Electric Supply Co.

Inquiries and Orders.

Crompton and Co. have asked the Burnham-on-Crouch Urban Council for support in an application to the Electricity Commissioners for a Special Order to supply electricity to the town. The Council has decided that the matter shall stand over for three months.

The Electricity Commissioners have communicated with the Chailey (Sussex) Rural Council pointing out that, while the Council has withdrawn its objection to the proposals of the Burgess Hill and District Electric Supply Co.'s Order, it had not given formal consent to the scheme. The Commissioners inquired if the Council was prepared to give formal consent in order to obviate the necessity of making a special report to Parliament. The Council, which originally opposed the overhead wire system, has decided not to give the consent referred to.

NEWARK ELECTRICITY SCHEME.

Commissioners Hold Local Inquiry.

The Electricity Commissioners opened at Newark on November 28th an inquiry into an application of the Town Council for power to erect an electricity generating station at Newark, and provide a municipal supply of electricity.

Col. T. C. Ekin presided, and was assisted by Mr. A. N. East. The Town Clerk (Mr. H. Tallents) appeared for the Corporation, and the opponents included the Derby and Notts Electric Power Co. (which has already a provisional order), the Newark Rural Council (whose area is included in the scheme), the Newark Property Owners' Association (objecting on the grounds of expense), and several local engineering firms (who oppose on the grounds that as they have electrical installations in their own works they should not be called upon to pay as ratepayers a deficit on a municipal undertaking). The Nottingham City Council is putting forward an alternative scheme of a bulk supply from its North Wilford station and the Lincoln Corporation has a similar scheme.

Mr. C. H. Wordingham, the Newark Council's adviser, gave a report on his scheme, which the Council has adopted, for two 1 500 kW sets, the scheme including station, mains, etc., at an estimated cost of about £100 000.

The inquiry was resumed on November 29th, when Mr. Wordingham, cross-examined by Mr. Rowland Harker, for the Derby and Notts Power Co., said that at one time he was in favour of a bulk supply for Newark, but was later forced to the conclusion that Newark should have a power station. He had not encouraged the Corporation to believe that the powers of the Derby and Notts Co. were revoked in 1911.

Mr. G. C. Kew, Chairman of the Newark Rural Council, said his Council was never consulted by the Borough when they put the rural area into the scheme. They did not want it, and there was no sign of any load being taken in the rural district.

Evidence was given by Lieut.-Col. Higgs, managing director of the Ransome and Marles Bearing Co., the largest users of power in the town, that they would not take a municipal supply, and he spoke on behalf of other large firms similarly situated.

The inquiry was again adjourned.

AFTER BUSINESS HOURS.

An "Enlightening" Evening.

Members of the Upper Thames Street establishment of the Siemens and English Electric Lamp Co. held an enjoyable staff social and concert last Friday, with "The Boss" in the chair. In addition to a dance and a whist drive there was an excellent concert, not the least amusing item of which was Gertrude Jennings' farce "The Bath Room Door." The "official" programme was a work of art and contained some highly original advertising matter. It is a pity that some of these out of the rut announcements cannot be given a wider circulation, particularly the one describing Siemens lamps as "The grocer's bugbear—Consumers' Currant bills greatly reduced"!

The Henley Dramatic Club.

The Henley Dramatic Club produced "Beauty and the Barge" last Friday evening at the Cripplegate Institute, and a delightful performance it was. Among first time appearances on a stage, the following were exceptionally good: Miss Kathleen H. Dunk, as Mrs. Smedley; Miss Hilda Starbuck, as Mrs. Porter, and Mr. R. D. Benjamin, as Herbert Manners. The producer, Mr. Henry Thornton, is to be highly commended upon the show, and we feel sure that his personal delight at the performance was shared by every member of the large audience, which consisted mainly of the Henley staff and friends. Among others present there were Mr. and Mrs. Percy Rosling, Mr. W. J. Potter, Mr. and Mrs. W. F. Bishop, Mr. and Mrs. Hedgecock, Mr. W. W. Bradfield (of Marconi's) and Mr J. Traxler, manager of Henley's Tyre and Rubber Co. The next performance, for which a play has not yet been selected, has been arranged for March 7th next.

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PRIVATE BILLS.

Proposed Electrical Legislation for the next Parliamentary Session—Fewer Ambitious Projects in Contemplation.

The number of notices of Private Bills dealing with electrical projects in the next Session of Parliament is again below the average, and in most cases power is sought to legalise matters of detail rather than ambitious schemes. We give below abstracts of the notices lodged :—

Electricity Supply Bills.

NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO.—Extension of limits of supply to include Baldock, Bishop Stortford, Hitchin, Royston, Sawbridgeworth, Stevenage, Buckhurst Hill, Epping, Loughton, Wanstead and Woodford urban districts and Ashwell, Buntingford, Hadham, Hitchin and Epping rural districts, enlargement of the company's powers in Tottenham, Edmonton, Enfield, Wood Green and Southgate urban districts, repeal and modification of restrictions on supply of electricity, new prices and methods of charging, generating station at Enfield.

DOVER CORPORATION.—To extend area for electricity supply so as to include the parishes of Altham, Hougham Without, Lydden and Poulton, in Dover rural district ; to repeal existing powers of any company or person under the Kent Electric Power Acts, 1902 and 1906, and the East Kent Electric Power Act, 1911, etc.

COUNTY OF LONDON ELECTRIC SUPPLY CO.—To supply electricity in an area consisting of the county of Essex to authorised electricity supply undertakers, authorities having the right to contract for the lighting of public places, etc., and to persons requiring supply for power, and for lighting, heating, cooking or other domestic purposes ; to utilise in such added area electricity generated by the company at any existing or authorised generating station ; extension to the company and the added area of powers conferred by the Electricity Supply Acts upon power companies.

TYNEMOUTH CORPORATION.—Provisions with respect to the Corporation's electricity undertaking, including better enforcement of terms of contracts by consumers, and with respect to defective meters and sale of fittings previously let on hire.

HALIFAX CORPORATION.—To extend the boundary of the borough by including therein part of the parish and urban district of Southowram, to extend the Corporation's limits of electricity supply to the added area and to exclude that area from the limits of electricity supply of any other company, body or person, to acquire and use for the purposes of the Corporation's electricity undertaking land belonging to Clayton, Metcalfe and Co., etc.

WAKEFIELD CORPORATION.—Further general powers with regard to the Corporation's electricity undertaking, further provisions with regard to borrowing of money, etc.

LONDON ELECTRICITY SUPPLY (NOS. 1 AND 2).—These applications for Bills legalising the heads of agreement with the companies forming the London Electricity Joint Committee, which were approved by the London County Council on July 31st, were abstracted in THE ELECTRICIAN of November 23rd (p. 576).

Joint Supply and Traction Bills.

HASLINGDEN CORPORATION.—To authorise running tramcars and omnibuses reserved for special purposes ; suspension of tramway traffic on special occasions ; laying electric lines in streets not dedicated to public use, etc.

LONDON, MIDLAND AND SCOTTISH RAILWAY CO.—Authority for alterations of certain sections of railway, extension of time for construction of other sections, appointment of a joint committee for the management of railways now managed by various joint committees of the company and the London and North Eastern Railway Co., to supply electricity to Crewe Corporation, etc.

ROTHERHAM CORPORATION.—Provision for trolley vehicle routes in the borough and the rural district of Rotherham ; further provisions as to trolley vehicles, including an extension of powers by order of the Minister of Transport ; further provisions in reference to the gas and electricity undertakings of the Corporation.

MANCHESTER CORPORATION.—Extension of periods for purchase of lands and construction of tramways authorised by the Manchester Corporation Tramways Acts, 1904 and 1907, Withington District Tramways Order, 1897, Withington Urban District Council Act, 1900, Manchester Southern Tramways Act, 1903, Stretford Urban District Council Act, 1904, and Manchester Corporation Acts, 1909 and 1920 ; provision and running of trolley vehicles on roads within and without the city, including roads on which tramways have been authorised but not constructed, further provisions in reference to the Corporation's electricity and tramway undertakings, etc.

ASHTON-UNDER-LYNE CORPORATION.—To provide and run trolley vehicles on any roads in the borough on which the Corporation is authorised to construct or use tramways and also on the road from the boundary of the borough to the boundary of Oldham ; to authorise Oldham Corporation to provide and run trolley vehicles in Oldham ; to empower the Corporation of Ashton and the Corporation of Oldham and any other corporation body or person to enter into agreements with reference to construction and inter-running of trolley vehicles, motor omnibuses and tramways ; to extend electricity supply area so as to include Hurst urban and Limehurst rural districts, etc.

Electric Traction Bills.

CHATHAM AND DISTRICT LIGHT RAILWAYS CO.—Provision for repayment of preference capital, and purchase, cancellation and extinction of such capital.

POST OFFICE (LONDON) RAILWAY (EXTENSION OF TIME).—To extend the time now limited by an Order of the Ministry of Transport for the completion of the railways and works authorised by the Post Office (London) Railway Act, 1913

SOUTHERN RAILWAY CO.—To construct railways in Wimbledon, Sutton, Leatherhead and Dorking, and a subway at Oxted Station ; to extend platforms, to widen viaducts at Elephant and Castle and Brixton stations ; to widen bridges in Lewisham and Camberwell, and to construct a subway for electric cables at and near Greenwich Park Station, etc.

LONDON COUNTY COUNCIL (TRAMWAYS AND IMPROVEMENTS).—To construct and work electric tramways from Bromley Road to Well Hall Road ; from High Street, West Norwood, to Crystal Palace Parade ; from Auckland Hill to Gipsy Road ; from Southwark Bridge Road to Queen Street Place ; from Waterloo Station to Waterloo Bridge ; to extend time limited by Orders of the Ministry of Transport for completion of tramways in Farringdon Road, etc.

LONDON UNITED TRAMWAYS, LTD.—To provide and work electric railless trolley vehicles on routes in Twickenham urban district, etc.

CENTRAL LONDON AND METROPOLITAN AND DISTRICT RAILWAY COMPANIES.—To empower the Central Company to make and maintain subways at Bond Street Station ; to extend time for purchase of lands, etc., by the District Co. and the Metropolitan Railway Co. ; to confirm agreements between the District, the London Electric and the Midland Railway Companies with regard to the Hammersmith Junction fund, and between the District, the Whitechapel and Bow and the Midland Railway Companies relating to additional through railway line at Whitechapel ; to enable the District, London Electric, Central and Southern Railway companies to enter into agreements as to the alteration, electrification, etc., of the Kensington and Richmond branch railway and the Wimbledon and Fulham Railway of the Southern Railway Co., etc.

CROYDON CORPORATION.—To provide and work electric railless trolley vehicles on routes within or without the borough, and to authorise abandonment or discontinuance of tramways in so far as such tramways are rendered unnecessary by the running of trolley vehicles under the provisions of the Bill, etc.

WEST THURROCK WHARF AND RAILWAYS.—To incorporate a company to make and maintain, in Orsett (Essex) rural district, a wharf on the foreshore of the river Thames and certain railways connecting the wharf with the London, Midland and Scottish Railway (London, Tilbury and Southend section) ; to erect and use stations and works for generating and transforming electrical energy ; to authorise the London, Midland and Scottish Railway Co. to enter into agreements with respect to construction of and running over railways, the supply and working of rolling stock, plant, machinery and electrical energy, etc. ; to authorise the proposed new company with respect to the supply of water, gas and electric light and power for ships' use ; to authorise agreements with respect to the provision of electric generating stations or plant, etc.

Traction Provisional Orders.

ST. HELENS CORPORATION.—To equip, work and run railless electric trolley vehicles on certain routes in Whiston rural and Prescot urban districts ; to provide that for certain purposes the trolley vehicles shall form part of the Corporation's tramway undertaking.

KEIGHLEY CORPORATION.—To provide and use electric trolley vehicles in place of tramways.

HULL CORPORATION.—Construction of tramways on seven routes within the city and two outside the city ; acquisition of lands, borrowing of money, etc.

BIRMINGHAM CORPORATION.—Construction of tramway extensions in the city ; extension of periods for compulsory purchase of lands and construction of tramways, etc.

SUNDERLAND CORPORATION.—Further provision with reference to borrowing of money in connection with the tramway undertaking and for other purposes.

Light Railway Orders.

WREXHAM AND DISTRICT TRANSPORT CO.—To authorise construction of a light railway, about 3½ furlongs in length, in the parish of Rhosllanerchrugog in Wrexham rural district.

SOUTHPORT CORPORATION.—Extension of Corporation tramways.

Miscellaneous Bills.

RAWTENSTALL CORPORATION.—Provisions with regard to the supply of electricity by the Corporation, including power to increase the maximum prices for the supply of electricity, new methods of charging, stand-by supplies, etc. ; and power to make and enforce by-laws for prevention of damage or obstruction to the public from aerials, wires, etc., in connection with wireless telephone or telegraph installations.

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HASTINGS CORPORATION.—Application to the Corporation's electricity undertaking of provisions of Electric Lighting (Clauses) Act, 1899, and further powers in regard to the conduct of that undertaking and the supply of electricity by the Corporation; further provisions with regard to the attachment of brackets to buildings, by-laws as to the regulation control, etc., of wireless aerials, etc.

Scottish Provisional Orders.

CLYDE VALLEY ELECTRICAL POWER CO.—Application for an Order authorising the raising of additional capital, conferring further powers in regard to acquisition of lands, extension of area of supply to the parishes of Avondale, Lesmahagow, Douglas, Carmichael, Covington, Culter, Biggar, Pettinain, Libberton and Symington, in the county of Lanark, the parish of Inverkip, in the county of Renfrew, and the parish of Row, in the county of Dumbarton, etc.

ROTHESAY TRAMWAYS CO.—To authorise the company to convey passengers, luggage, etc., on the tramways on Sundays as well as on other days, to increase or alter fares, etc.

GRAMPIAN ELECTRICITY SUPPLY CO.—Particulars were given on p. 589 of THE ELECTRICIAN of November 23rd.

HYDRO-ELECTRIC WORKS ON THE RIVER CLYDE.—On p. 589 of THE ELECTRICIAN of November 23rd particulars were given of an application for an Order to incorporate a company to construct works on the Clyde, with authority to supply electricity to the Clyde Valley Electrical Power Co. and others.

EDINBURGH CORPORATION TRAMWAY PROVISIONAL ORDER.—See THE ELECTRICIAN, p. 590, November 23rd.

Irish Bills.

The following Bills are being introduced in the Parliament of Northern Ireland:—

NORTH ULSTER ELECTRICITY SUPPLY.—To incorporate a company to develop and use water or other power for the generation of electricity to supply electricity in (*a*) the whole of the county of Antrim except the city of Belfast and the island of Rathlin, and (*b*) urban districts of Coleraine and Portstewart and the rural district of Coleraine in the county of Londonderry. The proposed works include the construction of dams and weirs across the river Bann, impounding and regulating the waters of Lough Neagh and Lough Beg and canals and navigations.

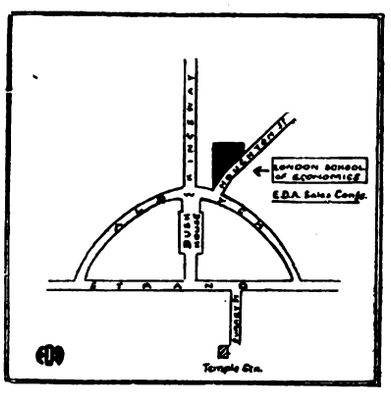
BELFAST CORPORATION.—To construct work by electric or other power tramway about 1¼ furlongs in length in the City of Belfast, to attach compulsorily to any building such brackets, wires and apparatus as may be necessary for the working of the said tramway; to provide and run motor omnibuses or charabancs, etc.

SELLING ELECTRICITY.

Success of the E.D.A. Salesmanship Conferences.

Owing to the large numbers attending the E.D.A. Sales Conferences this year, the Association has found it necessary to obtain a larger meeting place.

The next meeting—the date of which is December 14th, at 7.30 p.m.—and all subsequent conferences will be held at the London School of Economics, Houghton Street, Aldwych, on the ground floor. The main entrance to the London School of Economics is almost immediately opposite Bush House, as shown in the street plan herewith.



The new hall will permit of still larger attendances, and the Association desires to emphasise the fact that the conferences are open to anyone engaged in any branch of the electrical industry, supply, contracting or manufacturing, and particularly to the younger men at the selling end of the business. There is no entrance or other fee.

Cardiff Engineering Exhibition.

There are many exhibits of electrical interest at the Mining Engineering Exhibition, which opened at the Drill Hall, Dumfries Place, Cardiff, last Thursday, and which closes to-morrow (Saturday). The exhibitors include: British Arca Regulators, Ltd.; Thos. Broadbent and Sons; Brookhirst Switchgear, Ltd.; Cambridge and Paul Instrument Co.; Campbell and Isherwood, Ltd.; the "Ceag" Miners' Supply Co.; George Ellison; English Electric Co.; the Federation Lamp Co.; the General Electric Co.; Gent and Co.; Igranic Electric Co.; McWhirter and Sons; Mavor and Coulson; Meldrums, Ltd.; the Metropolitan-Vickers Electrical Co.; the New Switchgear Construction Co.; the Kartret Switchgear Co.; Frank Pearn and Co.; the Pulsometer Engineering Co.; Robins Electrical and Wireless Depot and Institute; Rene Volet; Sterling Telephone and Electric Co.; E. Thomas and Williams; Thor Electric Safety Lamp Co.; Underfeed Stoker Co.; J. Samuel White and Co.; Witty and Wyatt (Cardiff) Ltd.; and the Wolf Safety Lamp Co.

ELECTRIC TRACTION.

We learn that Croydon Corporation, assuming that its Bill authorising the adoption of the railless trolley system of traction is passed in the ensuing session of Parliament, hopes to use double-deck, top-covered trolley omnibuses similar to those which have been so successful in Birmingham. The precise type of vehicle has not yet been decided upon.

Metropolitan Electric Tramways, Ltd., is experimenting with a new reversible staircase for tram cars. The staircase is so constructed that the conductor can turn it round at each terminus, so that both front and rear staircases face the near side of the car. An interchange of passengers can be made in half the time occupied in the case of an ordinary car with entrance and exit both at the rear.

J. A. Mactaggart and Co. suggest that Glasgow Tramways Department should construct extensions of the tramways on roads in Kelvinside and King's Park. On such of these roads as are owned by them Mactaggart and Co. are prepared to give the necessary rights, and in the case of a new road from King's Park to Rutherglen they offer to contribute £1 per lineal foot towards the cost. The matter has been referred to the Sub-Committee on Extensions.

At an inquest at Bradford into the cause of the death of a lady 71 years of age, it transpired that the deceased was stepping off a Corporation tramcar when the car jerked forward a few inches, causing her to fall and sustain injuries from which she died. The jury found a verdict of accidental death, and the Coroner agreed with a recommendation for the reinstatement of the driver who started the car without a starting signal while the conductor was on the top deck.

The Highways Committee has submitted a report to London County Council on trailer tramcars. Tests on the Clapham and Merton route have shown an increase in passengers carried, and a saving of both time and expense in favour of tractor cars only as compared with tractors and trailers combined. Similar results were obtained on the Streatham and Norbury route. The Committee has therefore recommended that the use of trailer cars be definitely abandoned, and the Council adopted the recommendation on Tuesday.

Electric Railway Items.

The opening of the electric railway between Mexico City and Vera Cruz will take place in January.

The boring of one of the two tunnels under the Burroughs, Hendon, which form part of the extension of the Underground Railways of London (Hampstead Line) to Edgware, was completed last week, when the miners broke through at a point near Hendon Station. This boring work, which was started at Colindeep, has been performed by rotary borers at a speed of 60 feet per day. The construction of the line from Colindeep to Edgware is making good progress, and a service of trains between Golders Green and Edgware will be inaugurated in the near future.

The Underground-Electric Railways Co. of London state that the mishap which occurred on the City and South London tube railway on Tuesday of last week was caused by the excavation works for the enlargement of the tunnel coming in contact with what is probably an old storage well. This caused an inrush of sand and water into the tunnel, leaving a crater-like empty space beneath the surface of the road. Being thus robbed of their support, the various mains and cables for gas, water, post office, etc., collapsed into the opening. The gas main did not explode. It broke by reason of its unsupported weight, and the escaping gas, forming an explosive mixture with the air, became ignited. The decision entirely to close down the railway is partly dictated by the necessity of using every possible lift shaft to clear away the debris in the northbound tunnel speedily. The Minister of Transport appointed Lt.-Col. A. H. L. Mount to inquire into the circumstances surrounding the accident. At the inquiry on Tuesday, evidence was given by the Resident Engineer of the City and South London Railway, the driver of the train which passed the point in the tube where the accident occurred at the time when the debris began to fall, and other employees of the company. Col. Mount agreed with the statement made by the company that the cavity was the cause of the explosion and not the result of it. The joints between the old and the new lining of the tunnel, were temporarily secured by timber, and at the point where the trouble occurred the timber failed to retain the surrounding soil. There was no reason for the public to suppose that the linings of tube railways were liable to collapse. Under modern conditions travelling by tube was as safe as any other form of travelling.

BUSINESS MEMS.

L. McMichael, Ltd., radio engineers, of London, have opened a branch business at 5, Yelverton Road, Bournemouth.

Mr. Haydn T. Harrison, consulting electrical engineer, has transferred his office to 14, Victoria Street, Westminster (Tel.: Victoria 3719), to which address all communications should be sent in future. He will be pleased to receive all new issues of catalogues, etc., especially those relating to lighting, which may not have been sent to him previously.

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BUSINESS OPPORTUNITIES AT HOME AND ABROAD.

Contracts Open.

HORBURY PRIMITIVE METHODIST CHURCH.—Electric light installation in church and school. Particulars from Mr. G. W. Outhwaite, Horbury.

GREENOCK CORPORATION, December 8th.—Three 3 000 kVA transformers, 22 000 V. three-phase switchgear, transformers with boosters, etc. Specifications from the Borough Electrical Engineer; deposit £2 2s.

ECCLES CORPORATION, December 10th.—580 tons B.S.Sec. No. 4 7 by 7 in. or new B.S.Sec. No. 7, 7 by 6¾ in. tramrails, 600 copper bonds, 14 in. centres, 80 ditto 64 in. centres, 832 ditto 36 in. centres, with steel pins, and 1,000 tie bars. Specifications from the Borough Engineer and Surveyor; deposit £1 1s.

EDINBURGH CORPORATION, December 10th.—Pavement box frames and covers, house service fuse boxes, underground conduits for electric cables. Specifications from the Engineer and Manager, Electricity Department, Dewar Place, Edinburgh.

GLAMORGAN COUNTY COUNCIL, December 10th.—Electric light wiring and fitting of Penarth Police Station and Court. Specifications from the Police Station or the County Hall, Cardiff.

GLASGOW CORPORATION, December 10th.—Electric wiring and fitting in connection with the Kelvinside housing scheme. Specifications from the City Electrical Engineer, 75, Waterloo Street, Glasgow.

HAYES URBAN DISTRICT COUNCIL, December 10th.—Electric light installation at Barra Hall.

HULL ELECTRICITY COMMITTEE, December 10th.—Six months' stores, including electric lamps, engineers' stores, oils and greases, etc. Specifications, etc., from the City Electrical Engineer.

ILFORD URBAN DISTRICT COUNCIL, December 10th.—E.h.t. and l.t. cables and joint boxes. Specification from the Engineer and Manager, Electricity Works, Ley Street, Ilford.

WALLASEY CORPORATION, December 10th.—30-ton overhead electric travelling crane. Specification from the Engineer, Electricity Department, Sea View Road, Wallasey.

BRAMLEY GUARDIANS, December 12th.—Electric light wiring and fitting at the Institution. Specifications from the Clerk, 1, Green Hill Road, Armley, Leeds.

DUBLIN PORT AND DOCKS BOARD, December 11th.—Electrical supplies, ironmongery, paints, oils, etc. Forms from the Secretary, Westmoreland Street, Dublin.

EAST GRINSTEAD GUARDIANS, December 12th.—Electric lighting installation at the Institution. Specification from the Guardians' Offices, 36, High Street, East Grinstead; deposit £1 1s.

WALTHAMSTOW URBAN DISTRICT COUNCIL, December 14th.—E.H.T. and l.t. feeder cables and l.t. distributor cables. Specifications from the Engineer, Electricity Works, Exeter Road, Walthamstow; deposit £1.

PORTHCAWL (GLAMORGAN) URBAN COUNCIL, December 15th.—Provision of electricity supply undertaking. Particulars from the Clerk to the Council.

ST. HELENS CORPORATION, December 15th.—Supply and installation at Cropper's Hill Power Station of (1) one 6 500 kW continuous maximum rated turbo-alternator with condensing plant and auxiliaries; and (2) two water-tube boilers, with superheaters, economisers, induced draught fan, and boiler accessories, steel chimney, structural steel boiler-house building, etc. Specifications from the Borough Electrical Engineer for £2 2s. deposit in each case.

KEIGHLEY CORPORATION, December 17th.—5 000 kW turbo-generator, condensing plant and auxiliaries. Specification from the Borough Electrical Engineer, Coney Lane, Keighley; deposit £1 1s.

NEWPORT (MON.) GUARDIANS, December 17th.—Electric light fittings, ironmongery, etc. Forms of tender, etc., from the Clerk, Queen's Hill, Newport.

WARRINGTON CORPORATION, December 17th.—Motors. Specification from the Borough Electrical and Tramways Engineer, Howley, Warrington; deposit £1 1s.

BELFAST GUARDIANS, December 18th.—Schemes for centralised heating and lighting plant in Institution buildings. Further information from the Clerk, Workhouse, Belfast, on £5 5s. deposit.

LONDON COUNTY COUNCIL, December 31st.—One 3-ton three-motor overhead travelling crane, and one 30 cwt. motor-driven portable workshop crane for the tramway central repair depot, with six months' maintenance in both cases. Specifications from the General Manager, L.C.C. Tramways, Victoria Embankment, W.C., on £2 deposit.

PLYMOUTH CORPORATION, December 20th.—Five e.h.t. main switchboard panels. Specifications from the Engineer, Electricity Works, Prince Rock, Plymouth; deposit £1 1s.

Overseas.

COMMONWEALTH OF AUSTRALIA, December 12th (in London), or December 15th (in Australia).—Cable terminal boxes (S.A. 676). December 17th (London).—Cable terminal boxes (S.A. 674) January 3rd (London).—Telephone and telegraph apparatus (T. 415). Tender forms, etc., from the Supply Officer, Australia House, Strand, London, W.C.2.

VICTORIAN ELECTRICITY COMMISSION, December 15th.—Four 1 000 kVA single phase transformers and spares. January 19th.—Transformers, switchgear and accessories for sub-station B. Specification (Nos. 23/145 and 24/2) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS DEPARTMENT, December 19th.*—Transformers for Meek's Road sub-station. February 6th.*—Equipment of two sub-stations. February 27th.*—Motor generator sets. February 27th.*—Motor-driven air compressors, and batteries for switch operating.

VICTORIAN ELECTRICITY COMMISSION, December 19th.*—Fibre for insulators. January 3rd.*—Aluminium steel cored cable and accessories.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO, December 27th.* Electrical supplies, including cable, wrenches, insulating compound, lamp shades, also rubber belting, ironmongery, etc.

NEDERLANDSCHE HANDELMAATSCHAPPIJ, AMSTERDAM, January 3rd.—High and low voltage plant for new building. Specification from the company's offices, Heerengracht, Amsterdam, on payment of 35f.

SYDNEY CITY COUNCIL, January 7th (in Australia).*—Electrically driven coal unloading and conveying plant at Darling Island power houses. February 25th (extended from November 19th.)—Stepdown transformers (Contract 758).

VICTORIAN RAILWAYS COMMISSION, January 9th (in Australia).*—Spring coiling machine with electric motor, and taper rolling machine with electric motor (Contract 36 659); also two small induction motors with starting apparatus.

MELBOURNE CITY COUNCIL, January 14th.—Totally enclosed armoured type 6 600 V three-phase switchgear. Specifications from the City Electrical Engineer.

CITY OF TORONTO, January 15th.*—Centrifugal sludge pump, direct connected to 2 200 V 3-phase 25 cycle variable speed induction motor, running at about 730 revs. per min. at full load (Contract No. 58).

POST AND TELEGRAPH DEPARTMENT, WELLINGTON, N.Z., January 30th*.—30 000 galvanised iron earthrods.

TARANAKI (N.Z.) POWER BOARD, January 30th.*—Electric generators and switchgear.

SYDNEY HARBOUR TRUST COMMISSIONERS, February 11th.*—Supply and installation on runway tracks in wharf shed, No. 6 Berth, Darling Harbour, Sydney, of one 5-ton electrically-operated overhead travelling bridge crane. (Contract No. 23/36.)

SYDNEY HARBOUR TRUST COMMISSIONERS, February 11th.*—Two double-drum horizontal electric capstans or warping winches. (Contract 23/34.)

ARGENTINE STATE OILFIELDS ADMINISTRATION, February 14th.*—Erection and equipment of 11 250 kW electric power station.

SYDNEY CITY COUNCIL, February 18th.*—Armour-clad switch-gear.

Tenders Accepted.

ADMIRALTY.—General Electric Co., Osram traction lamps.

LONDON MIDLAND AND SCOTTISH RAILWAY CO.—Siemens and English Electric Lamp Co., Siemens metal filament train lighting lamps.

AIR MINISTRY.—General Electric Co., three months' supply of Osram metal filament vacuum lamps and Robertson carbon filament lamps.

WELLS (SOMERSET).—Daniel Adamson and Co., automatic sewage ejectors, air and rising mains, with steam driven air compressing plant, etc.

CLEATOR BRIDGE, CUMBERLAND.—Daniel Adamson and Co., automatic sewage ejector plant driven by automatic hydraulic air compressing plant.

SCUNTHORPE AND FRODINGHAM URBAN COUNCIL.—Western Electric Co., electric generating plant, cables, transformers and switchgear, £4 300.

DOUGLAS CORPORATION.—Siemens Bros. and Co. (accepted) for additional cables, £11 913 16s. 6d. Other tenderers: W. T. Henley's Telegraph Works Co., £12 283 1s. 6d.; Callenders Cable and Construction Co., £12 254 13s. 11d.; W. T. Glover and Co., £12 039 0s. 2d.; and British Insulated and Helsby Cables, £12 035 14s. 6d. The specifications were prepared by Messrs. Handcock and Dykes.

LONDON COUNTY COUNCIL.—Richardsons, Westgarth and Co., (alternative tender), 15 000 kW steam turbo-alternator (with Parsons alternator) and condensing plant, for Greenwich power station, £77 466 15s. (recommended). Richardsons, Westgarth and Co., in common with other firms, submitted a number of alternative quotations varying according to the make of turbine, alternator or condensing plant. The following is a list of the original tenders: Steam turbo alternator and condensing plant: Oerlikon, Ltd., £55 769 6s.; Brown, Boveri and Co., £56 623; Escher, Wyss and Co., £65 229; Richardsons, Westgarth and Co., £70 104 15s.; James Howden and Co., £72,991 5s.; Metropolitan-Vickers Electrical Co., £72 626; English Electric Co., £74 182; C. A. Parsons and Co., £73 768. Steam turbo-alternator only, British Thomson-Houston Co., £60 690; Fraser and Chalmers Engineering Works, £62 562. Condensing plant only: Hick, Hargreaves and Co., £10 455 12s. 6d.; G. and J. Weir, £12 592 10s.; John Musgrave and Sons, £12 594 5s.; Worthington-Simpson, £12 902; Mirrlees Watson Co., £12 904 11s.; Cole, Marchant and Morley, £13 063 12s.; Vickers, Ltd., £13 190.

* Particulars from the Department of Overseas Trade.

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COMPANY MEETING.

Western Telegraph Co. and the Italy-New York Cable Project.

The ninetieth ordinary General Meeting of the shareholders of the Western Telegraph Company, Ltd., was held on November 29th, at Electra House, Moorgate, London, E.C.

Sir John Denison-Pender (the chairman) who presided, said the net result of the year's working was a balance of £327 241, against £547 000 for the previous twelve months, the reduction being due to the depression and unrest that had prevailed in almost every part of the world. The revenue account had been credited with £200 000 transferred from the "Provision on account of investment fluctuations," still leaving a very large surplus provision as values stood at the present moment, to meet depreciation on their investments in respect of the reserve fund. After deducting the dividends amounting to 10 per cent. free of income tax paid during the year, there remained the handsome balance of £329 739 to carry forward, for he was afraid they must still look for reduced traffics, compared with the last few years.

During the last few weeks, however, there were signs of improvement in their traffic returns.

Dealing with a matter which had received a great deal of publicity Sir John said that the President of the Western Union Co., before leaving America for London three weeks ago, was reported to have said, according to certain newspaper reports :—"The manufacture of the proposed cable between New York and Italy via Azores has not begun because British Government has through influence in Portugal prevented American Company from landing in Azores, which was designated as neutral territory in the last cable conference abroad. I cannot imagine anything more outrageous than the American Company being prevented through English pull from completing this most important cable undertaking. The trouble with Great Britain is that she wants to levy a tribute upon every American cable at the Azores. They talk of hands across the sea. It sounds nice at the dinner table, but no cables across the sea without tribute. But we will eventually win."

Agreement with the Western Union.

Taking the report as published, the remarks seemed rather unfair both to this country, and certainly to their company. The Italians were constructing a line to the Azores, and later intended laying further cables on to South America. The latter undertaking was to be subsidised by their Government. The Western Union Co., said Sir John, will lay a cable from the Azores to New York, and desires to be also financially interested in the European portion, thus forming a competitive route to South America. It will be apparent, as a glance at the map will show, that the door is open for subsidised competition as regards our South American traffic. When we co-operated with the Western Union Co. in the new cable communication between North and South America via Brazil—Barbados—Miami, thus connecting your system with that of the Western Union Co., you will remember how the Americans held us up for two years after the cable was laid owing to our having preferential cable rights on the coast of Brazil, rights which the American Government by their action ultimately forced us to relinquish before they permitted the cable to be used. Our Barbados —Miami agreement with the Western Union Co. provides that neither of the two companies without the previous consent of the other shall make any traffic, or working agreement, or interest itself directly or indirectly with anyone else competing with our joint route. This protected your interests, and I see no reason why that agreement should be set aside.

If the Western Union Co. is to be interested, and that is admitted, as to 25 per cent. in the Italian section of this cable-communication South American traffic may be tapped, and diverted to the detriment of our direct route, moreover, the Italian Government have given a subsidised preferential concession. In your interests we have the right to object, and to take our stand on the clauses in the Barbados —Miami agreement. The utterance that a tribute is required has been interpreted in terms of money, and it has gone forth that we require payment for landing rights. That is not the case ; such a matter has never even been discussed. Regarding the reference as to the Azores being neutral territory, we can safely leave this to Portugal to answer. So long as these proposed cables are used solely for Italian and North American traffic we have no grievance. We rely upon the goodwill of Portugal, the valued and oldest ally of this country, and with whom our associated companies have worked most amicably for half a century to the financial benefit of the Portuguese Government as well as the company. The sentiment of hands across the sea is one I personally reciprocate, but we as your directors would be wanting in our duty if we interpreted that sentiment in such a way that agreements are to be circumvented. I am very glad to say, however, that last week Mr. Newcomb Carlton, who is the President of the Western Union Co., and I met, and we came to an arrangement which meets our views and is also acceptable to the Western Union Co. This satisfactory result having materialised, I should much prefer to have avoided making any reference to the matter to-day, but the publicity given to the United States Press interview leaves me no alternative.

In reply to questions, the Chairman said that as regarded wireless they had not for a long time thought it desirable to go in for any sort of propaganda on that matter. They had tried to show by facts, by dividends, and reserves what their position was. They had to be very careful with regard to wireless as they did not wish it to be understood that the cable companies were in any way disparaging the wireless. Sooner or later the two would have to come together in the interests of everyone concerned, both the sender of messages as well as the companies themselves.

The report and accounts were adopted and the retiring directors, Sir John Denison-Pender and Sir Albert E. Bowen, unanimously re-elected.

COMPANY NEWS.

MARCONI'S WIRELESS TELEGRAPH CO.—Mr. G. Marconi, presiding at the annual meeting on Monday, said that the company's expenditure upon research and experiment ran into tens of thousands of pounds each year, which reduced the credit balance of their profit and loss account, and they felt that a substantial part of that expenditure at least should be received by them for the benefit which the nation enjoyed through Government use of their work. and expenditure. The British Broadcasting Co. had just completed its first year's work. Its work had been admirably done. British broadcasting was second to none; it had come to stay and would grow day by day in importance. Acting upon the agreement with the Postmaster-General, a very considerable manufacturing business was opened up, and tens of thousands of workers found occupation, but during the time the Committee of Inquiry set up by the Postmaster-General was sitting the business was brought to a standstill, and foreign material, enabling cheap and poor receiving sets to be put together, was imported, filling much of the demand for the time being. He thought it was only a question of time before the bulk of those sets gave place to something better.—Mr. Godfrey C. Isaacs, deputy chairman and managing director, said in regard to the company's claims against the Government that, having failed to get the necessary information to allow of their proceeding to a settlement, he had appealed to the Prime Minister, and Sir Wm. Joynson-Hicks, then Financial Secretary to the Treasury, informed him that the Government was now ready to press forward with arbitration, and would accept Lord Buckmaster as arbitrator. The company agreed, and there was a reasonable prospect that before the new year was very far advanced all the matters which had remained so long in abeyance would be satisfactorily disposed of. The report and accounts (abstracted in our previous issue) were adopted and the dividends approved.

INDIA RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO.—At the meeting last week the chairman and managing director, Mr. C. H. Gray, stated that, as regards profit, the foreign branches were 100·82 per cent. better for the year ended August last than for the previous year, and the Persan works showed an improvement of 73·01 per cent. The Palmer tyre section of the business, however, was 32·65 per cent. worse. Notwithstanding the purchase and equipment of the cable steamship, "Silvergray," the item of freehold and leasehold premises, machinery and steamship stood at £752 188, an increase of only £10 042. The expenditure on additions to buildings, etc., was only 30 per cent. of the previous year's amount. There was a small net loss on the trading of the Persan works, which was distinctly better than in the previous year. One of the main causes of the loss was the variation in the exchange value of the franc. The total sales of the Silvertown works products decreased 5·7 per cent. The sale of ebonite goods, telegraph wire, electrical instruments, waterproof goods, and sundries, however, increased. Since the Armistice the management had been working in the direction of getting the branches back to the obvious policy of selling Silvertown manufactured goods. This appeared to be the correct line to adopt, judging by the result of last year's trading, which was satisfactory in the aggregate, but required further alteration in detail. With reference to the manufacture of submarine cable, they had been moderately busy during the past year. The directors' report and accounts (abstracted in our issue of November 23rd) were adopted, and the dividend recommended was approved.

PENNSYLVANIA WATER AND POWER CO.—The regular quarterly dividend of 1¾ per cent. is announced.

GLOBE TELEGRAPH AND TRUST CO.—A quarterly interim dividend of 5s. per share on the ordinary shares is announced.

ALABAMA TRACTION, LIGHT AND POWER CO.—A dividend of $3 per share on the preferred stock has been declared.

BRAZILIAN TRACTION, LIGHT AND POWER CO.—A quarterly dividend of 1½ per cent. has been declared on the cumulative preference shares.

NATIONAL TELEWRITER CO.—After paying interest on debentures, the profit made by the National Telewriter Co. for the year ended June last was £1 213.

POWER GAS CORPORATION.—A dividend of 4 per cent., less tax, for the past year, has been declared. £2,000 is placed to reserve and £11,070 carried forward.

BRITISH ELECTRIC TRANSFORMER CO.—The half-year's trading up to June 30th last shows a loss of £19 959, compared with a profit of £9 266 for the first half of 1922.

WESTERN TELEGRAPH CO.—The first quarterly interim dividend of 5s. per share (at the rate of 10 per cent. per annum), tax free, for the year ending June 30th next has been declared.

BULLERS, LTD.—The directors announce that the final dividend on the 5 per cent. preference shares for the year ended July 31st will now be paid. Payment was postponed pending the recovery of excess profits duty.

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CONSOLIDATED GAS, ELECTRIC LIGHT AND POWER CO. OF BALTIMORE.—Quarterly dividends of $2 per share on the common and series "A" preferred, and $1·75 per share on the series "B" preferred stock have been declared.

VENEZUELA TELEPHONE AND ELECTRICAL APPLIANCES CO.—For the year ended June 30th last, revenue was £744 000, an increase of £6 500 over that of the preceding year, and after providing for administration expenses, paying debenture interest and £5 per cent. dividend on the ordinary shares, and placing £6 000 to reserve, there remains a surplus of £4 500, which has been carried to undivided profits account.

At the meeting on Tuesday the report and accounts were adopted. The chairman, Mr. J. S. Austin, said the dividend now being paid was the first for a very long time. Revolutions and political troubles had continued in Venezuela for about 15 years, and during that time the company had remained stationary. They had emerged from their difficulties, and he would be disappointed if they were not in a position next year to make a material improvement on the present dividend.

MARCONI'S WIRELESS TELEGRAPH CO. OF CANADA.—The report for 1922 states that an agreement has been concluded with Canadian General Electric Co., Canadian Westinghouse Co., Northern Electric Co., Bell Telephone Co. of Canada, and International Western Electric Co., under which the company has effected an exchange of patent licences with those companies. Provision is also made for the establishment of certain wireless telephone services jointly by the company and the Bell Telephone Co. of Canada. Reserves amount to $316 461; $22 251 has been added to surplus account, representing balance of profit for year, making a total surplus of $279 264. As the result of a complete revaluation of stocks it was decided to appropriate $254 287 from surplus and reduce inventories by that amount.

New Companies.

G. PROCTOR-PORTEOUS TRADING CO., LTD.—Cap., £1 000 Manufacturers of electrical machinery, etc. Reg. office: 34, Bloomsbury Square, London, W.C.1.

MULTIPLEX SIGN CO., LTD.—Cap., £1 000. To acquire the licence from the patentees to use inventions in patents Nos. 188 197 and 195 192 for the U.K., the Irish Free State and the Isle of Man. Reg. office: 10, Kirby Street, Hatton Garden, London, E.C.1.

W. A. SAXBY AND CO., LTD.—Cap., £1 000. Manufacturers and assemblers of and dealers in plant, machinery, etc., for the generation transmission, reception, and storage of electricity or electric power. Reg. office: 3–5, Gayford Road, Shepherd's Bush, London, W.

MARCONI (IRELAND), LTD.—Cap., £5 000. Agents in Ireland for Marconi's Wireless Telegraph Co., Ltd., the Marconi International Communication Co., Ltd., and the Relay Automatic Telephone Co., etc. Reg. office: Trinity Chambers, 41, Dame Street, Dublin.

WEST RIDING AUTOMOBILE CO., LTD.—Cap., £100 000. To adopt two agreements with Yorkshire (West Riding) Electric Tramways Co., and to carry on business of manufacturers of and dealers in vehicles, generators and suppliers of electricity, etc. Solicitors: Ashurst, Morris, Crisp and Co., 17, Throgmorton Avenue, London, E.C.2.

CHUBB AND COLMER, LTD.—Cap., £2 000. To acquire the business carried on by Miriam E. Ward, as the Anglo-American Metal Co., dealers in materials and parts used in connection with the electrical, scientific, optical and other trades, selling agent for engineering and other manufacturers. Reg. office: 69–70, Aldersgate Street, London, E.C.

METAL & CHEMICAL PRICES.

TUESDAY, December 4th.

		Price.	Inc.	Dec.
***Copper*—**				
Best Selected ..	per ton	£66 0 0	£1 15 0	—
Electro Wirebars ..	„	£68 5 0	£1 5 0	—
H.C. Wire, basis ..	per lb.	9 1/8 d.	1/16 d.	
Sheet	„	10 3/16 d.	—	—
***Phosphor Bronze Wire (Telephone)*—**				
Phosphor Bronze Wire, basis	per lb.	1s. 1 1/8 d.	1/16 d.	—
***Brass* 60/40—**				
Rod, basis	„	7 1/2 d.	—	—
Sheet, basis	„	10 1/2 d.	—	—
Wire, basis	„	10 1/2 d.	—	—
***Pig Iron*—**				
Cleveland Warrants	per ton	£5 5 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
***Lead Pig*—**				
English	„	£32 15 0	15s.	—
Foreign or Colonial	„	£31 10 0	£1 0 0	—
***Tin*—**				
Ingot	„	£238 10 0	£7 5 0	—
Wire, basis	per lb.	3s. 1d.	1d.	—
Aluminium Ingots ..	per ton	£120 0 0	—	—
Spelter	„	£33 0 0	—	2s. 6d.
Mercury	per bottle	£9 17 6	—	—

Sulphur (Flowers)—Ton £8 *Sodium Chlorate*—Per lb. 3d.
„ (Roll-Brimstone)—„ £8 *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. „ £25 per ton, £7 10s.
Boric Acid (Crystals). „ £48 *Sodium Bichromate*.—Per lb. 4 1/2 d.
Rubber.—Para fine, 1s. 0 1/2 d.; plantation 1st latex, 1s. 2 1/8 d.—1s. 2 1/4 d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

COMMERCIAL INFORMATION

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

BARNETT (B.) (ELEC. ENGINEERS), LTD., 117, Whitechapel Road. £10 5s. 5d. October 18th.

D. A. S. H. WIRELESS SERVICE, 241, Park Road, Aston, Birmingham. £22 6s. 11d. October 16th.

DEWHURST, W. B., 52, Malefant Street, Cathays, Cardiff, dealer in electrical accessories. £18 19s. 9d. November 1st.

FER (CHARLES) AND CO., LTD., Rexine House, 42, Newgate Street, E.C., electric heating and cooking apparatus makers. £21 16s. 6d. October 18th.

GAUNT AND CO., 52, Boundaries Road, Balham, electrical engineers. £35 0s. 9d. October 23rd.

LANDAU, D., AND CO., 115, De Beauvoir Road, Kingsland, electrical engineers. £13 15s. 4d. October 4th.

WICKER RADIO, 40, Bloomsbury Street, W., wireless factors, £15 17s. 7d. October 20th.

Receivership.

HOLMES AND JAMES, LTD. G. T. W. Coleman, F.C.A., of 13, Temple Street, Birmingham, was appointed receiver on November 22nd, 1923, under powers contained in charges dated November 29th, 1922, and June 4th, 1923.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

ASTRO ELECTRIC, LTD., London, S.W.—Registered November 27th. £2,000 debentures and a premium of 25 per cent. (filed under section 93 (3) of the Companies (Consolidation) Act, 1908), present issue £1 000; general charge. *Nil. September 24th, 1923.

BARFORD ELECTRIC SUPPLY CO., LTD.—Registered November 24th. £10,000 debentures; general charge. *£700. May 29th, 1923.

BURKE ELECTRICAL MANUFACTURING CO., LTD., London, S.W.—Registered November 17th, £450 debentures, to H. W. Penney, 192, Meadvale Road, Ealing; general charge. *Nil. October 27th, 1923.

ELECTRICAL IMPORTERS (HULL), LTD.—Registered November 26th. £1 000 debentures to A. Shaw, 25, Albany Street, Hull, electrical engineer; general charge.

MAGUIRE (H.), LTD., Hull, electrical engineers.—Registered November 16th, £500 debenture; general charge.

RADIO STOCKS, LTD., London, W.—Registered November 20th. £3 500 debentures, to E. H. Hawkins, 4, Charterhouse Square, E.C., I.A., and another; general charge.

SKEGNESS ELECTRICITY SUPPLY CO., LTD.—Registered November 26th. £750 debentures; present issue £300; general charge.

TAYLORS RADIO ELECTRIC, LTD., Cardiff.—Registered November 12th, debenture securing £1 850 and other moneys due or to become due to the company's bankers, to E. Horley, 67, Queen Street, Cardiff, solicitor and another; general charge.

UPTON AND GARRETT, LTD., Edgware, electrical engineers.—Registered November 12th, £160 debentures; general charge.

YOUNG (C. F.), LTD., Leicester, manufacturers of electrical apparatus.—Registered November 15th, £1 000 debentures; general charge.

Satisfactions.

AIREDALE ELECTRICAL AND MANUFACTURING CO., LTD. Bradford.—Satisfaction registered November 23rd. £350. registered May 2nd, 1922.

BURKE ELECTRICAL MANUFACTURING CO., LTD., London, S.W.—Satisfaction registered November 17th, all moneys, etc. registered June 10th, 1922.

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COUNTY OF DORSET ELECTRIC SUPPLY CO., LTD., Dorchester.—Satisfactions registered November 17th, £2 500, registered March 1st, 1917, and March 23rd, 1922.

RADIO STOCKS, LTD., London, W.—Satisfaction registered November 26th. £1,000, registered March 12th and October 2nd, 1923.

SUN ELECTRICAL CO., LTD., London, W.C.—Satisfaction registered November 27th. £4 125, balance of amount registered April 19th, 1911.

Private Meetings.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

CARDIFF ELECTRIC AND WIRELESS SUPPLY CO., LTD., 43, Bute Street, Cardiff. Creditors at their statutory meeting have confirmed the voluntary winding-up of this company with Mr. T. H. Coath as liquidator. The statement of affairs showed ranking liabilities of £2 590, all due to unsecured creditors, and net assets of £219, a deficiency of £2 371. The liquidator reported that at the date of his appointment the landlord had distrained for rent, while two executions had been levied. The sheriff had advertised the sale, and the liquidator decided to instruct him to sell the whole of the stock, etc., which had realised £225, out of which the three distraints amounting to £100 had been paid. The only remaining assets to be realised were the book-debts, expected to produce £27. The business was originally commenced some years ago and was taken over by the limited company, shares being issued to the vendors. For the period ended November of the present year there was a loss on the trading for the previous twelve months of £2 027. The total sales during the year were only £4 084 whilst the purchases were £4 001 and there was a gross trading loss of £457. The company also stated that at the recent wireless exhibition they had goods to the value of £150 stolen. The company had an agreement with a well-known London firm to represent them in South Wales. The firm, however, claimed that the company had broken the agreement and had opened a depot of their own in Cardiff. An advisory committee of the principal creditors was appointed.

ROSENBLOOM, David, trading as D. ROSE AND CO., wireless electrical engineer, 25, Osborn Street, London, E., late 17, Osborn Street, London, E. Creditors met last week and confirmed a deed of assignment already executed in favour of Mr. H. Rainsbury (H. Rainsbury and Co., 1A, Gray's Inn Chambers, 20, High Holborn, E.C.), who submitted a statement of affairs showing liabilities of £2 926 (unsecured trade creditors £1 298), and net assets estimated to realise £2 049, a deficiency of £877. Debtor, in reply to questions, said that he had been selling wireless goods wholesale during the last five or six months. He had bought about £1 000 or £1 500 worth, and it had been sold at a profit. The representative of Alfred Graham and Co., who had supplied wireless goods, etc., said that on October 30th goods were ordered to the extent of £35. On the definite understanding that cash would be paid within seven days of the receipt of the goods they had been supplied, but no payment had been made. Before the expiration of the seven days the debtor had been asking for further supplies to almost an equal extent. The matter was discussed at great length, and a committee was appointed, consisting of the representative of Condor Lamps, Ltd., who occupied the chair, Alfred Graham and Co., Kelly and Tarshis, and Mr. Silver. The following are creditors: Condor Lamps, Ltd., £314; Marconi's Wireless Telegraph Co., £96; Owen Shirley, £61; Nussle, J. C., and Co., £60; General Electric Co., Ltd., £48; Sterling Telephone and Electric Co., Ltd., £48; Radio Communication Co., Ltd., £43; Alfred Graham and Co., £39; Kelly and Tarshis, £61; Vandervell, C. A., Ltd., £54.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Companies Winding-up Voluntarily.

ELECTRICAL SERVICES, LTD., Bradford. P. Hodgkinson, 48, Sunbridge Road, Bradford, chartered accountant, appointed liquidator. Meeting of creditors at the offices of Messrs. Ratcliffe and Co., solicitors, 12, Piccadilly, Bradford, on Tuesday, December 11th, at 11.30 a.m.

FLACTON WIRELESS, LTD., Pearl Chambers, East Parade, Leeds. Norman D. Vine appointed liquidator.

NORTH MELBOURNE ELECTRIC TRAMWAYS AND LIGHTING CO., LTD.—H. W. Stacey, 9, Cloak Lane, London, E.C.4, appointed liquidator.

Bankruptcy Information.

BILLINGTON, Raymond, 163, Walker Street, Kingston-upon-Hull, electrical contractor. First meeting, December 11th, 12 noon, Official Receiver's Office, 36, Scale Lane, Hull. Public examination, December 17th, 2 p.m., Guildhall, Alfred Gelder Street, Hull.

HORSFALL, William Miles, 7, Redcross Street, Liverpool, electrical engineer. Receiving order, November 24th. Debtor's petition.

JOHNSON, David, 177, Woodhorn Road, Ashington, Northumberland, electrical contractor. Receiving order, November 28th. Debtor's petition.

Notices of Dividends.

EMBURY, Henry John William and EMBURY, Kenneth Stuart, trading as H. AND K. EMBURY, 29 and 110, Queen Street, Newton Abbot, Devonshire, electrical and mechanical engineers. First and final dividend of 1s. 5d. per £, payable December 17th, 23, Catherine Street, Exeter.

MEARNS, Edward Enoch, 14, St. Bede's Road, East Boldon, county of Durham, electrical contractor. First and final dividend of 1s. 6d. per £, payable December 8th, Official Receiver's Office, Pearl Buildings, 4, Northumberland Street, Newcastle-upon-Tyne.

SLATER, Thomas Gascoigne, trading as SLATER BROTHERS, 25, Dickinson Street, Mount Street, Manchester, electrical engineer. First and final dividend of 3¾d. per £, payable December 10th, Official Receiver's Offices, Byrom Street, Manchester.

Notice of Intended Dividend.

DUFFIN, Albert Harold, and KERSHAW, Gorge, trading as A. H. DUFFIN AND CO., Provincial Buildings, Conway Road, Colwyn Bay, in the country of Denbigh, electricians. Last day for receiving proofs, December 14th. Trustee, P. W. Aston, Mostyn Chambers, Colwyn Bay, chartered accountant.

Bankruptcy Proceedings.

COLEMAN, Horace, 66, Victoria Street, Westminster, S.W. Debtor, who formerly carried on business as a wholesale electrical engineer, attended at the London Bankruptcy Court last week for his public examination on a statement of affairs showing liabilities £1 212 and assets nil. It appeared that for several years before 1913 the debtor was employed as a traveller. Early in that year in partnership with two other persons he began business at Queen Anne's Chambers, S.W., as wholesale electrical engineers. Later on in the year the business was transferred to a limited company which they formed and his share of the sale consideration was 33 shares issued as fully paid in the company. He was appointed as a director of the company and he also acted as a traveller for it. In November, 1914, he joined the Army, in which he served until June, 1919, when he was demobilised with a gratuity of £110. He then returned to his directorship, etc., acting for the company until March last. In August he obtained an appointment as traveller and manager to a firm of electrical engineers at a weekly salary plus a share in the profits.

WIRELESS INSTALLATIONS, LTD., 81, Turnmill Street, E.C. At the statutory meeting recently of creditors in this compulsory winding up, the Official Receiver said the company had enjoyed but a very short innings, having been formed in October of last year with a nominal capital of £100 to carry on business as manufacturers' assemblers and sellers of wireless sets. The promoters of the company were Herbert Charles Phillips and his wife; neither of them had any practical experience of the industry, but it was said that they only intended to conduct the administrative side and leave the other to their son, who possessed very good practical knowledge which they hoped to turn to good account and to give him a start in life. A room at 15, Aldersgate Street, E.C., was taken and there the business was begun. The son had designed a special wireless set which the company exploited, although other designs were manufactured and as the business increased additional rooms were taken at 15, Aldersgate Street, while arrangements were made for warehouse accommodation at 81, Turnmill Street, E.C. Phillips said that up and during April and May the business of the company proceeded satisfactorily. A trading account extracted for the purpose of the statement of affairs showed net sales amounting to £15 646 and a gross profit of £1 096 without taking into account overhead charges, and in view of the small rate of profit it was clear that the company must have failed sooner or later. The directors had started agencies on the Continent for the sale of the company's manufactures. On May 2 six debentures for £100 each were issued to Mrs. Phillips against £600 cash advanced and on August 10, when certain creditors were executing judgments, Mrs. Phillips in order to protect her assets appointed a receiver and for a short time he carried on the business with a view to realisation as a going concern, but he had since closed it and disposed of the stock, etc., for £300. According to the statement of the company's affairs, there were 73 unsecured creditors whose claims amounted to £3 076; in addition there were other liabilities, £88 not expected to rank and loan on debentures £619. The assets which were estimated to realise £611 were all required to meet the claim of the debenture holder. With regard to the shareholders there was a total deficiency of £3 184. There was consequently no prospect of any dividend for the unsecured creditors or of any return to the shareholders who were the promoters.

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PATENT RECORD.

Specifications Accepted.

204 123 G. McAlpine and A. K. Toulmin-Smith. Dynamo-electric machines. (21/6/22.)
204 127 W. A. Coates and Metropolitan-Vickers Electrical Co. Oil-immersed electric switches, circuit-breakers and the like. (23/6/22.)
204 130 British Thomson-Houston Co. (General Electric Co., N.Y.). Wires for sealing into glass and the like. (23/6/22.)
204 136 W. A. McKillop and W. A. Brookem. Electrical inductances. (26/6/22.)
204 146 I. Calvete. Electric switches. (29/6/22.) (Addition to 153 787.)
204 148 C. Lawson. Electrically-operated indicators for theatres, picture palaces and the like. (1/7/22.)
204 158 R. Amberton. Electrical controllers. (12/7/22.)
183 142 E. Zipperle. Electrophorus gas lighter. (15/7/21.)
204 167 A. M. Taylor. Electric power transmission systems. (20/7/22.) (Patent of Addition not granted.)
204 169 W. M. Harrison. Electrical heating means for fuel for internal-combustion engines. (20/7/22.)
204 176 Western Electric Co. and G. Deakin. Telephone exchange systems. (Cognate Application, 30 113/22.) (27/7/22.)
204 185 Western Electric Co. (Western Electric Co., Inc.) Transformer arrangements particularly adapted for high-frequency telephony systems. (12/8/22.)
192 358 C. Dachary and L. Viguier. Method and apparatus for establishing high-voltage electric circuits, comprising removable hand contact-making devices. (28/1/22.)
204 193 Magnum-Ges. and H. Endres. Electric cooking utensils. (30/8/22.)
204 198 Oldham and Son and J. Oldham. Galvanic batteries. (7/9/22.)
204 206 Hague and McKenzie and A. Hague. Electrically-heated kettles and similar vessels. (16/9/22.)
187 595 H. Ateliers Cuenod, Soc. Anon. Induction motors. (18/10/21.)
187 602 E. W. Hutchings. Electric light globe attachments. (18/10/21.)
187 990 L. S. Vello. Method of manufacture of glass caps moulded under pressure for incandescent electric lamps and similar apparatus. (29/10/21.)
204 237 L. G. Preston, H. G. Hughes and A. L. Kirkham. Means for supporting filaments or filament leads in thermionic tubes or valves. (10/11/22.)
190 154 E. Pfiffner. Earthing choking coils or voltage transformers for high voltages. (6/12/21.) (Addition to 173 759.)
204 270 B. E. D.-Kilburn (Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij). Long-distance telephony over submarine cables and other long conductors. (7/3/23.)
204 276 Lodge-Cottrell, Ltd. (Metallbank und Metallurgische Ges. Akt.-Ges.). Device for mechanically rectifying high-tension polyphase current. (27/3/23.) (Addition to 185 891.)

Applications for Patents.

November 19th.

29 104 L. W. Wild. Reception of wireless telephony.
29 123 G. Jaons. Anodes for electro-plating.
29 125 C. Kratt. Component parts for wireless apparatus.
29 136 W. Speth. Testing magnetisable material.
29 154 Coventry Automatic Telephones, Ltd., and J. E. Collyer. Automatic telephone systems.
29 155 A. H. Chapman. Variable resistance devices.
29 164 L. J. Price. Wireless telegraphy, etc.
29 175 Metropolitan-Vickers Electrical Co. Electric furnaces. (2/12/22, U.S.)
29 176 H. F. L. Diedericks. Electrically-heated apparatus.
29 193 Rose Street Foundry and Engineering Co. and C. A. Hadley. Electric welding machines.
29 194 W. H. Higgs. Rotating dynamo.
29 199 H. J. Round. Loud speakers.
29 204 Oldham and Son and W. D. Wilde. Gas exits for galvanic batteries.

November 20th.

29 221 and 29 222 H. E. O'Brien. Protective guarding of conductor rails for platelayers, etc.
29 233 J. A. Parker. Electro-deposition of metals on wire and strip.
29 239 J. P. Gumbley Thermionic valves.
29 242 Electric Construction Co. and W. Tonkinson. Apparatus for generating high-voltage direct current.
29 249 B. A. Pilkington. Electromagnetic sound apparatus.
29 255 Radio Communication Co. and C. E. Vagg. Binding parts or terminals for electrical apparatus.
29 257 Lodge-Cottrell, Ltd. (Metallbank u. Metallurgische Ges.). Rectifying h.t. alternating current.
29267 G. Warder and H. S. Hydes. Loud-speaking device for radio-receiving apparatus.
29270 Etablissements Sein, Morges. Electro-mechanical manufacture of machine parts. (15/3/23, France.)
29 284 R. Woods. Rheostats.
29 287 A. M. Cox. Electrically-operated speedometers.
29 288 General Electric Co., Ltd. Feed control apparatus for conveyors, etc.
29 295 General Electric Co., Ltd. Spiral filaments of refractory metals for electric lamps. (17/5/23, Germany.)
29 296 Metropolitan-Vickers Electrical Co. Dynamo-electric machines. (2/12/22, U.S.)
29 301 A. Nielsen. Electric ovens. (21/11/22, Norway.)
29 302 British Thomson-Houston Co. Radio receiving systems. (21/11/22, U.S.)
29 303 British Thomson-Houston Co (General Electric Co., N.Y.). Motor control systems.
29 304 British Thomson-Houston Co., A. G. Salisbury and A. P. Young. Magneto-electric machines.
29 309 A. F. Berry. Electric heating elements.
29 310 A. F. Berry. Incandescent lamps.
29 320 H. Jenkinson. Crystal holders for wireless detectors, etc.

November 21st.

29 335 E. Long. Contact for starting switches, controllers, etc.
29 339 J. Stevenson and A. G. Gregory. Telephone receivers.
29 350 F. H. Blaxley and E. E. Peace. Grid leaks for wireless telephony, etc.
29 361 A. Reyrolle and Co., B. H. Leeson and R. C. Minton. Control of sub-stations.
29 368 A. C. Gunstone. Induction coil systems.
29 369 A. C. Gunstone. Mercury interrupters.
29 374 W. J. Spicer. Electromagnetic horns.
29 379 Westinghouse Lamp Co. Electron devices for high potential. (28/11/22, U.S.)
29 380 Westinghouse Lamp Co. High-voltage electron device. (29/11/22, U.S.)
29 394 W. J. Ricketts. Radio receiving sets.
29 395 R. Desmons and H. Sabartheg. Electric lighting device. (23/11/22, France.)
29 403 B. Scherer. Holders for incandescent lamps (22/11/22, France)
29 411 J. Scott. Electric towel cleaning and drying devices
29 414 and 29 415 British Thomson-Houston Co. Radio-receiving systems. (21/11/22, U.S.)
29 416 British Thomson-Houston Co. Electron discharge devices. (21/11/22, U.S.)
29 427 F. E. Wilson. Device for designating terminals of electrical instruments.

November 22nd.

29 459 M. S. Dick. Lift-motor control systems.
29 466 M. R. Cahill. Wireless receiving apparatus.
29 467 Relay Automatic Telephone Co. and B. B. Johnson. Automatic telephone systems, etc.
29 474 A. I. B. G. Lyssaert. Audion lamps.
29 478 J. H. Bradley. Resistances and inductances, etc.
29 482 J. E. Dawson. Coil-holder stands for wireless.
29 490 Ateliers de Constructions Electriques de Charleroi. Starting cascade groups of electric machines. (13/10/23, Belgium.)
29 497 Sachsenwerk Licht u. Kraft Akt.-Ges. and F. Hakerle. Oil tanks for transformers.
29 498 W. C. Sharplin. Variable inductance holders.
29 507 H. P. P. Rees. Receiving apparatus for wireless telegraphy, etc.
29 520 Sterling Telephone and Electric Co. Collapsible frame aerial.
29 524 British Thomson-Houston Co. and R. D. Parry. Electric regulating systems.
29 527 British Thomson-Houston Co. and H. Trencham. Supporting means for h.t. conductors.
29 537 Soc. Anon. pour l'Equipment Electrique des Vehicles. Electric signalling apparatus. (5/1/23, France.)

November 23rd.

29 538 H. F. Loveland. Wiring systems for electrical instruments, etc.
29 546 E. A. Foulillefett, C. E. J. Brandt and R. M. Fichter. Adjustment of electric meters, etc. (4/1/23, France.)
29 547 G. G. Mander. Telephone receivers.
29 550 and 29 551 J. B. Tucker. Electric switches.
29 552 W. McGeoch and I. H. Macqueen. Electric switches.
29 555 T. Miyaguchi. Incandescent lamps.
29 579 Western Electric Co. Vibration responsive devices.
29 564 E. G. Craven. Variable condenser for wireless telegraphy, etc.
29 567 C. Foerster. Electro-plating. (23/11/22, Germany.)
29 587 L. H. Soundy and J. M. Turner. Receiving sets for wireless signalling.
29 592 E. E. Rooke. Electromagnetic wave-receiving apparatus.
29 608 Etablissements Davey, Bickford, Smith et Cie. Closures for electric primers for detonators, etc. (17/1/23, France.)
29 611 G. E. A. Pohu. Loud-sounding telephone receivers.
29 613 British Thomson-Houston Co. Automatic re-closing circuit breaker systems. (23/11/22, U.S.)

November 24th.

29 623 A. M. Taylor. Electric transmission systems.
29 644 F. S. de Barro. Telegraphy, telephony, etc.
29 660 L. H. Reid. Earthing clips for conductors.
29 672 A. H. Railing and M. L. Kahn. Balancer for unsymmetrically loaded a.c. systems.
29 677 Lissen, Ltd., and R. P. Richardson. Rheostats.
29 678 Metropolitan-Vickers Electrical Co. Rotary machines, etc. (6/12/22, U.S.)
29 679 Metropolitan-Vickers Electrical Co. Electric switch mechanisms. (13/12/22, U.S.)
29 681 V. C. Malden. Telephone call recording meter.
29 683 W. L. Shaw. Apparatus for use in oscillatory electric circuits.
29 685 Eastern Telegraph Co. and H. V. Higgitt. Electric speed-controlling devices.
29 686 Eastern Telegraph Co. and H. V. Higgitt. Alternating current generators.
29 696 A. R. Angus. Telegraphy and telephony.
29 699 F. M. van Gelderen. Insulating cap for cable joints or ends. (8/10/23, Holland.)
29 702 Siemens und Halske Akt.-Ges. Selective receiving circuits. (25/11/22, Germany.)

Arrangements for the Week.

Friday, December 7th (To-day).

Electrical Power Engineers' Association. (Southern Division).
7 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, W.C.2. Lecture by Mr. J. R. Hutchings on "The Brush-Ljungstrom Turbine."
The Junior Institution of Engineers.
7.30 *p.m.* Visit to the Lighting Service Department of the British Thomson-Houston Co., at 15, Savoy Street, Victoria Embankment, London.

Saturday, December 8th.

Paisley Association of Electrical Engineers.
3 *p.m.* Visit to Pinkston Power Station (Glasgow Corporation Tramways Department).

Monday, December 10th.

The Institution of Electrical Engineers. (Mersey and North Wales—Liverpool—Centre.)
7 *p.m.* At Liverpool University. Paper by Mr. D. Brownlie on "Pulverised Fuel and Efficient Steam Generation."
The Institution of Electrical Engineers. (North-Eastern Centre.)
7.30 *p.m.* At Armstrong College, Newcastle-on-Tyne. Informal Discussion on "Some Elements in Design," opened by Mr. C. Turnbull.

Tuesday, December 11th.

The Institution of Electrical Engineers. (East Midland Sub-Centre.)
6.45 *p.m.* At Loughborough College. Address by Mr. J. D. Morgan.
The Institution of Electrical Engineers. (Scottish Centre.)
7.30 *p.m.* At 207, Bath Street, Glasgow. Paper by Mr. D. Brownlie on "Pulverised Fuel and Efficient Steam Generation."
The Illuminating Engineering Society.
8 *p.m.* At the House of the Royal Society of Arts, John Street, Adelphi, London. Discussion on "Some Applications of Illuminating Engineering in Practice," opened by Mr. Geo. Herbert and Mr. R. A. Ives.

Wednesday, December 12th.

The Institution of Civil Engineers.
7 *p.m.* At the Institution, Great George Street, Westminster, S.W.1. Informal Meeting. Discussion on "The Lighting of Factories," introduced by Mr. W. P. F. Fanghaenel and Mr. Wm. Newton Booth.

Thursday, December 13th.

The Institution of Electrical Engineers.
6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.2. Paper by Mr. D. Brownlie on "Pulverised Fuel and Efficient Steam Generation."
Belfast Association of Engineers.
7.30 *p.m.* At the Municipal College of Technology. Paper on "The Electrification of Flax Spinning Mills on Heat Economy Lines."
The Institution of Electrical Engineers. (Dundee Sub-Centre.)
7.30 *p.m.* At University College. Mr. D. Brownlie on "Pulverised Fuel and Efficient Steam Generation."

Friday, December 14th.

Manchester Wireless Society.
7.30 *p.m.* At the Houldsworth Hall, 90, Deansgate, Manchester. Lecture on "My Wireless Life," by Dr. Stanley Hodgson.

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THE ELECTRICIAN

VOL. XCI.—No. 2378. FRIDAY, DECEMBER 14, 1923. SIXPENCE

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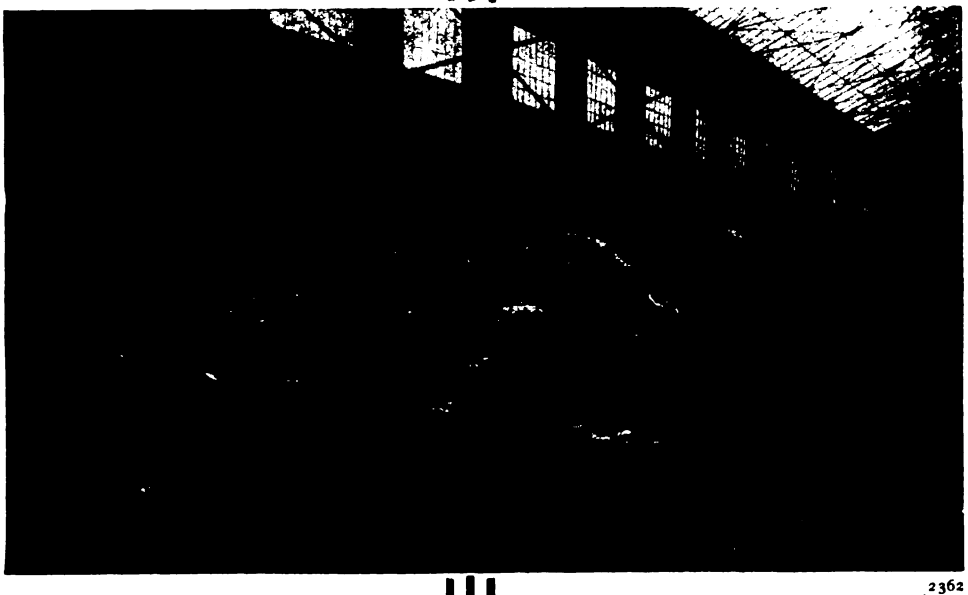

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THE ELECTRICIAN

ESTABLISHED 1861.

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MERCURY TURBINES.

THE attention which has recently been given to improving operating conditions in the boiler-house has led to the conclusion that if present methods continue to be used the efficiency cannot be expected to increase much beyond the existing figure. The results obtained at Dalmarnock over a period of a year show a boiler-house efficiency of 76·6 per cent., and though it is possible this might be raised while still using mechanical stokers to 81·5 per cent., and by the employment of pulverised fuel to 86 per cent., even such an enthusiast as Mr. DAVID BROWNLIE cannot see much hope of further improvement. It therefore follows that if present methods are to continue in use the best that can be looked for in the way of economy is that the efficiency of many of the plants now in operation in this country will be raised by one means or another to something approaching the figures we have just mentioned. While there is no reason why this should not be done, it is not surprising to find that engineers are turning their attention to other methods, thinking, with some justice, that finality has so nearly been reached that the problem must be tackled from a fresh standpoint.

One of the methods suggested is to use steam at a pressure of 3 200 lb. per sq. in., when its temperature is 705 deg. F., and its density is indistinguishable from that of water. For both practical and thermodynamic reasons this is not an ideal arrangement, and it has often been proposed that the thermal working range should be split into a high and low part, and a different fluid best suited to the special conditions used in each. In this way the disadvantages associated with the employment of steam over the whole range, that high temperature is accompanied by excessive pressure, and at low temperatures the specific volume is large, would be overcome. The choice of working fluids other than steam is restricted by the conditions that they must not be injurious to the plant or unstable at high temperatures. Mercury is presumed to fulfil these conditions, and as long ago as 1914 Mr. W. R. L. EMMETT stated that he had an engine of this kind in the working state, though neither then nor later have many practical details been given about it. He claimed that the adoption of the system would increase the capacity of a station by 66 per cent. with only 15 per cent. increase in the fuel used. At a recent meeting of the Institution of Mechanical Engineers, Mr. W. J. KEARTON read an interesting paper on the theoretical aspects of the question and some useful practical details of a second turbine plant, which has been put into operation in America, were given by Mr. W. H. PATCHELL in the course of the discussion. A complete analysis of the thermodynamical factors raised by the author was given in a leading article in "Engineering" of November 23rd, but the practical implications are also of importance.

The plant described by Mr. KEARTON consists of an oil fired mercury boiler, the vapour generated in which passes, after superheating, into a special turbine, and thence through a condenser and economiser back to the boiler. The mercury turbine is coupled to a steam turbine, the exhaust steam from which is delivered to a condenser, whence it passes through a mercury heated economiser and condenser, and is once again transformed into steam which after superheating is delivered to the steam turbine. In a hypothetical machine described by Mr. KEARTON, mercury vapour is generated at 100 lb. pressure absolute, corresponding to a temperature of 907 deg. F., and is expanded adiabatically in the mercury turbine to a pressure of 0·29 lb. absolute, corresponding to a temperature of 382 deg. F. The mercury is condensed at this temperature, and in the condenser is used to generate steam at 200 lb. pressure absolute from water at a hot well temperature of 80 deg. F. The steam generated is expanded adiabatically to 0·5 lb. The thermal efficiency of the set works out at 51·99 per cent. If, however, the temperature of the mercury is decreased to a more practical figure, the efficiency will decrease correspondingly until, while it is still higher than that of a steam turbine, it is less than those of the Diesel and Still engines. Nevertheless, Mr. KEARTON thinks that its mechanical advantages coupled with its relatively high efficiency will probably make it the foremost prime mover for the generation of electric power on a large scale.

It is perhaps not surprising to find that this optimistic outlook was not altogether shared by the speakers in the discussion. Mr. PATCHELL, who has had the advantage of inspecting the plant installed by Mr. EMMETT at the Hartford station, pointed out that the difficulty of obtaining materials which would withstand the high temperatures and the impregnating and amalgamating properties of mercury were very great, while Mr. SELVEY remarked that the experience of manufacturers of steam pipes and fittings with temperatures exceeding 750 deg. F. was not likely to encourage them to go any higher. Mr. I. V. ROBINSON attacked the proposals on the financial side, and showed that in a modern 10 000 kW station the net saving that would accrue through substituting mercury for steam turbines would be 0·05d. per kWh generated; a figure that

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would only rise to 0·25d. if the present cost of coal was doubled. These conclusions were controverted by Mr. KEARTON, who said that the cost of a 100 000 kW would be £29 per kW if mercury turbines were used, as against £28·1 for steam plant. This figure does not, we imagine, take into consideration the certain rise in the price of mercury which now stands at £300 per ton, and 7 lb. of which would be required for every kilowatt installed.

It is, we think, evident that the idea has hardly reached that practical stage when anyone could seriously suggest the replacement of our present plant by mercury turbines. But that is no reason why the question should not be further examined, especially in the way of investigating the effect on the constructional materials and the pitfalls of actual operation. That could be done by a relatively small plant and might be undertaken at once.

Current Topics.

The Newark Impasse.

NEWARK is a town of some 17 000 inhabitants, but it has no public electricity supply. Manufacturers and other private concerns in the district have therefore been forced to instal their own plant and are now not unnaturally opposing the Corporation's proposal to erect a station containing 3 000 kW at a cost of £100 000. They point out that they have all the electricity they want, cannot be expected to take a supply from the public mains or, in equity, be required to bear their share as ratepayers of the loss in working which they regard as inevitable. We can sympathise with them. The Town Council are entirely to blame for this dilatoriness, and now that the time has come when electricity is being demanded it is faced with the necessity of finding a way out of an *impasse* which should never have arisen. The best road out of the difficulty, as Mr. WORDINGHAM, the consulting engineer of the district, half admits, is bulk supply. Newark is part of the East Midlands area, and during the enquiry in the early part of the year it was suggested as a site for a capital station. Nottingham, which is in the area, is putting forward a scheme for bulk supply and Lincoln, which is not, is doing the same. The Derbyshire and Nottinghamshire Power are also willing to help. The problem, it must be insisted, is one not so much for the present as for the future. It may not immediately be possible to give a bulk supply to Newark as cheaply as it could be generated by a local station. But that will not always be the case. We therefore hope that the Commissioners will pronounce against a local station and insist that a bulk supply from one or other existing source shall be taken.

Train Dispatching Developments.

THE circular issued by the American Railway Association on "Recent Developments in Telephone Equipment for Train Dispatching Circuits," should prove of such interest to railway men in this country that we publish an abstract of it on another page of this issue. The need for making a better use of our railways has brought the load dispatcher into being in this country, and fortunately his work has been made easier and more efficient by the increasing substitution of the telegraph by the telephone, by our greater knowledge of circuit conditions, and by the invention of the valve. In America the greater distances impose problems of their own, but the general conclusions reached in the report should also be applicable in this country. A grade of transmission with an equivalent of not more than 20 miles is considered satisfactory using No. 9 A.W.G. copper and loading. This would allow 40 stations, stretching over 250 miles, to be communicated with. With open wires not more than 12 stations could be used. The current conditions on loaded wires are discussed, and it is shown that maxima and minima occur, giving rise to the so-called standing wave. The loading recommended is 0·175 henry on a 1¾ mile spacing. Questions of design at the intermediate stations and at the dispatcher's end are also dealt with, and these should be carefully studied as the factors involved have obviously been thoroughly examined. The matter is the more important as train dispatching is likely to come into greater and greater use on our railways and in designing the system these American experiences will doubtless be useful.

Insulation Resistance Questions.

IN a recent number of "The Electrical World" Mr. J. B. WHITEHEAD draws attention to the methods of measurement of insulation resistance usually employed and illustrates the well-known phenomenon of the masking of the true leakage current by the so-called absorption current, a subject which has just been dealt with in our correspondence columns. Mr. WHITEHEAD has encountered an apparently new difficulty caused by small fluctuations of high tension d.c. voltages, and to overcome this he finally employed 2 000 small dry cells such as are used for the plate batteries in radio work. The alternating voltage, rectified by a cathode vacuum tube, which he found unsatisfactory, appears on the other hand to have been successfully used by Messrs. HAYDEN and STEINMETZ, as reported in their paper on insulation failure in "The Electrical World." We cannot help thinking that much of the large amount of energy that has been expended on dielectric research might be more usefully applied to the building up of a theory of dielectric properties. There are, as Mr. WHITEHEAD points out, "many [of these theories] and none of them completely satisfactory." If some of the terms used were more strictly defined, and in some cases altered, it would be an advantage. Take, for example, the term "absorption current"; this seems to imply a current that flows into a dielectric, but not out of it, but does anyone who uses the term mean this exactly? We understand the British Electric Research Association are engaged in sundry researches into dieletric properties, and we think they might make a very useful contribution to our knowledge of the subject by publishing a preliminary series of explanatory definitions of the terms commonly employed.

Wagner's Theory Not Universal.

MR. WHITEHEAD states in his paper, "The Standardisation Rules of the American Institute of Electrical Engineers carefully avoids both the exact definition of insulation resistance and the fixing of conditions for its measurement." This further emphasises the importance of a clear definition of such terms especially in view of, as our contributor, Mr. FERNIE, pointed out a week or two ago, the additional importance which "insulation resistance" assumes, in the light of WAGNER'S theory. We believe the current view, in this country, regarding this theory is that whilst it undoubtedly explains many cases of insulation failure, yet it does not cover all cases. The theory is probably familiar to our readers, but may briefly be stated thus: All dielectrics increase in conductivity with temperature. A small initial leakage current heats its path; this heating increases the current, which again raises the temperature, and so on until breakdown occurs. Messrs. HAYDEN and STEINMETZ conclude that while it would be premature to claim that all breakdowns of solid insulations are temperature effects, it has been found that this conception has been corroborated over a wide range of insulating materials.

Obstacles to Development.

WE regard it as essential that every means should be taken to increase the use of electricity for all purposes, and that no obstacles should be placed in the way of its development. That obstacles do exist is evident and that

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many of these are not the fault of those in the electrical industry is equally clear. On the other hand, occasions do arise when those who should be most concerned in clearing the way of progress cannot be held altogether innocent. An example is to be found at Ilford. Three years ago those responsible for the electricity undertaking in that town were informed by the Commissioners that no further extensions of the generating plant would be allowed, and that a supply must be taken from West Ham. Negotiations were at once opened, but so far, no definite result has been reached, though it is hoped that they will be brought to a successful conclusion within the next few months. In the meantime Ilford has gone ahead with their side of the work, and a special sub-station has been built and mains laid. Unfortunately for the electrical cause, however, the demand for electricity has been unexpectedly large. During September 192 and during October 334 applications for connection were received, while in two months the radiator load has increased by 310 kW. The result is that the feeders have become dangerously overloaded, and that not only have further applications for heater load had to be refused, but consumers are being asked to reduce their load between dusk and 8 p.m. We do not propose to apportion blame for this state of things. But it will be agreed that it is a bad advertisement for electricity, and steps should be taken by all concerned to alter it as soon as possible. In the meantime we express our sympathy with Mr. SHAW and his consumers.

The Delivery Question.

ANOTHER obstacle, which exists more often than it should, to the development of electricity supply is caused by manufacturers neglecting to deliver plant to contract time. An engineer connected with one of the largest supply undertakings in the country recently expressed his grave anxiety for the safety of the plant and the continuity of supply in his district. He informed us that plant had been ordered in the early part of the year for erection in running order in September, so as to be ready to deal with the winter load. That plant has not yet been delivered. Without knowing the full facts of the case and hearing both sides, it is impossible to comment adequately upon the matter. But we know full well that this disregard of delivery dates is common enough. It is a matter which the British Electrical and Allied Manufacturers' Association would do well to examine, as it is doing no good to the electrical industry. The question may seem domestic only, but it is really of much wider importance. "Can anybody account for the irritating number of breakdowns in electric lighting plant which occur in November," asks "Municipal Engineering"? The answer is, we fear, easy, but stepsshould be taken to ensure that the question does not have to be asked.

Electrical Legislation and Centralisation.

A USEFUL summary of the law as it affects electricity supply, was given in a Paper by Mr. E. W. PIERCE, which was read before the Liverpool Engineering Society last week. He dealt first with the Electric Lighting Act of 1882, and with subsequent measures which were passed into law before the outbreak of war. A considerable amount of space is devoted to the findings of the Coal Conservation Committee and the Electric Power Supply Committee, and to the effect these reports had on the moulding of the original Electricity Supply Bill. The provisions of this Bill and of the enactments which spring from it are dealt with at length and the work of the Commissioners under them is ably summarised. The lesson to be learnt from all this is emphasised by reference to what occurred in the Mersey and West Lancashire District, and it is remarked that the extension of electricity supply contemplated therein will be to cheapen electricity and improve its development. Mr. PIERCE, we are glad to see, is a wholehearted supporter of centralisation. The consumption of electricity per head of population in London is 155 kWh, in Chicago, with a lower population, it is 1728 kWh, while in California and Ontario the results following the abandonment of the parish pump have been equally striking. Mr. PIERCE rightly remarks that the insistence by the public that the work of reorganising electricity supply should be undertaken as speedily as possible is a matter of importance. It might also receive the attention of electrical engineers in order that development may be accelerated.

The Election—and After.

One is almost tempted to revive the once popular query: "Are we downhearted?" Certainly a reply in the negative might be given at this juncture with very decided emphasis—not by politicians, perhaps, who, with the exception of the Labour Party, are presumed to be sitting in sackcloth and ashes; but by industrialists and commercial men anxious for an opportunity of getting on with the business of the country. All that these really want at the moment is a little freedom from the turmoil of Party conflicts; a settled condition of affairs; an atmosphere of tranquillity. The precise degree of such felicity that the immediate future holds for them may be regarded by many as highly problematical; but at least it can be said with confidence that two of the most contentious subjects have been relegated to very back seats. We allude, of course, to the fiscal question and particularly to the Capital Levy proposal. With the rights and wrongs of Protection and Free Trade we are not just now concerning ourselves; neither policy is at all likely to die from want of an argument. What, however, appears to have been the opinion of the country is that the present time, when new life is being fanned into its industrial system, is not exactly opportune for the threshing out of problems of that kind. An examination of the polling figures shows that nearly nine million votes were cast against any drastic change in our fiscal system; and as to the Capital Levy idea——well, almost ten million electors vetoed it. Whilst the General Election, therefore, has left politicians disconcerted and embarrassed, business men may find comfort in the thought that the almost equal sides of this triangular Parliament should be a guarantee against the possibility of extreme policies being made effective for a long time to come.

Workmen's New Compensation.

MOST employers of labour are presumably fully aware of the changes—some of them very drastic—which have been made in the matter of workmen's compensation by the Act which comes into force on New Year's Day. For example, in future the term "workman" is not only to include all persons engaged in manual labour, quite irrespective of the amount of their annual earnings, but also those engaged on other than manual work, providing their remuneration does not exceed £350. Then, again, the liability of employers is extended to accidents resulting in the death or serious and permanent disablement of workmen, even where such accidents are due to the workman acting contrary to regulations or without the employer's instructions—if it can be proved that the act was committed in the interests of the employer. In cases of total dependency the maximum and minimum amounts of compensation payable are raised respectively from £300 and £150 to £600 and £200, medical and funeral expenses from £10 to £15 and the maximum weekly payment from 20s. to 30s., whilst, though the basis of compensation remains at one-half of the average weekly earnings, in the case of a man whose wages are less than 50s. a week his rate of compensation may be as high as 75 per cent. of his earnings. There are many other changes, but sufficient has been written to emphasise the importance of all employers of labour assuring themselves that, as from January 1st, their liability under the new Act is fully covered in the usual way. It is foolish to take needless risks. A point which this New Year's gift to the workers raises in one's mind is the wisdom of both employers and employees widening their interest in the "Safety First" movement —the sort of prevention that is so much better than cure.

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NOTES ON WIRELESS MATTERS.

By PROF. G. W. O. HOWE.

The Fading of Radio Signals.

The Radio Research Board has recently enlisted the assistance of the Radio Society of Great Britain—an amateur organisation—in an attempt to collect reliable data with reference to the fading of signals. Before the advent of broadcasting little was heard of this phenomenon. It has been known for twenty years, however, that the strength of signals received from distant stations varies from time to time during the twenty-four hours, especially at sunrise and sunset and that, while, generally speaking, the night range is considerably greater than the day range, it is more erratic. Nothing can better exemplify the erratic character of transmission across the Atlantic than the fact that whilst amateurs in this country, with modest aerials and two-valve receiving sets report the perfect reception of concerts and other entertainments broadcast from America with a power of 1 kW, the transmitting station at Bordeaux, erected especially for communication with America is fitted with two 1 000 kW arcs. The ratio of the power required to establish occasional communication during the night to that required for guaranteed twenty-four hour reception over distances of two or three thousand miles appears to be about 1/1 000. It has only recently been discovered, however, that rapid and large fluctuations of signal intensity occur over very moderate distances if the frequency employed is high. The higher the frequency, the more rapidly does the earth's surface dissipate the energy of the wave and consequently the shorter is the distance at which the received signal must depend on waves which have been reflected from the Heaviside layer, and the position and nature of this is certainly far more variable with respect to time than any characteristics of the earth's surface or of the lower atmosphere. At the broadcasting frequencies of about 800 000 the variations of strength of the received signals are very noticeable at distances of two or three hundred miles. Some amateur observers have reported that on some occasions the signals fade at regular intervals of about two minutes, while others have failed to find any such regularity. An amateur near Glasgow with a two-valve set at 11 p.m. recently listened with ease to every word of an American broadcast performance from New York with the exception of one interval of about 30 seconds when it faded away and came in again without any adjustment of the apparatus. To make the observation of much value it would be necessary to find out whether the transmitting station was in any way responsible for the apparent fading.

It would obviously be of great interest if such observations of American broadcasting could be made simultaneously by a number of competent observers scattered about the country, who would then notify some central authority of the exact portions of the performance which appeared to fade and which portions were loudly received.

It is obviously a subject on which a large amount of thoroughly reliable data is desirable, and it is with the object of collecting such information that the Radio Research Board has enlisted the help of a number of selected amateur observers.

American Fading Tests.

A series of tests with the same object has been made in the States by the Bureau of Standards with the co-operation of the American Radio Relay League, and an account of these tests has now been issued as a scientific paper of the Bureau of Standards by Messrs. Dellinger, Whittemore, and Kruse. The experiments were made in 1920 and 1921, and differed from those being made in this country in that special signals were transmitted by ten radio stations and these signals observed at about 100 receiving stations, the operators at which were provided with forms for recording the intensity of the signals as received, as well as the intensity and frequency of atmospheric disturbances and general meteorological conditions. The experiments were made with telegraphy, not telephony, and the transmitting stations were generally spark stations with a power of 1 kW, although some of the transmissions were from valve stations. The wavelengths employed varied between 200 and 375 metres. The stations were widely distributed over the Eastern and Middle States, and each transmitted in turn a given schedule of letters for ten minutes. The average transmission distance was about 400 miles.

The reports from the large number of receiving stations were carefully analysed, but it has to be confessed that the analysis led to no very definite result. *It was found that observers within a mile or two of each other got entirely different curves of signal intensity when observing a distant transmitting station.* The authors conclude that " these observations lead to the conclusion that the cause of fading is of such a nature as to effect individually only small receiving areas." Although, from the nature of the tests, the results are necessarily largely dependent upon the personal element, it must be confessed that, in view of the careful organisation, the large number of observers, and the resources in the way of well distributed transmitting stations, the results are very disappointing.

It is interesting to note that the best radio operators were not generally good recorders. An expert operator apparently follows the variations in signal strength without being aware that any variation is taking place.

No connection was clearly established between fading and any of the observed meteorological conditions, but there was evidence that it was more pronounced at the shorter than at the longer wavelengths.

What agreement was found between the different reports is believed to have been accidental. In some cases for no apparent reason, two stations obtained diametrically different results, one getting loud signals when the other was getting weak signals and *vice versa*.

In conclusion, it cannot be said that the results of the tests throw much light on the cause of distribution of the phenomena, but they certainly indicate the extreme care that will have to be taken to obtain reliable data on the subject.

ELECTRICAL WEMBLEY.

Details of the power supply and decorative lighting arrangements at the British Empire Exhibition at Wembley were fully described in our last issue. It may, however, be of interest to supplement this with a brief description of the larger applications of electric power which will be of special interest to the general public. Under this heading will come electrical machinery for driving trains and tramways, and for use in factories, all of which will be well represented at the Exhibition. There will be exhibits of railway motors and control gear and of electrically equipped railway coaches.

Numerous examples of the application of electric power in factories will be found, not only in the engineering section, but also in the mechanical and shipbuilding sections on the south side of the Palace of Engineering.

The section organised by the Electrical Development Association to demonstrate what electricity can do to simplify and lighten the labour of domestic work will of course be of particular public interest. This section, which will be in the north-west corner of the Palace of Engineering will show the best and most economical ways in which electricity can be applied to lighting and heating for domestic purposes. There will be examples of electric cooking and cleaning which will interest every householder. The exhibits in this section will enable the visitor to see the wide choice of designs available for each purpose.

Demonstrations of broadcasting and exhibits of wireless appliances will also be a popular feature. The leading makers of wireless appliances are exhibiting, and facilities will be afforded for visitors to inspect the latest products of the manufacturing firms and to listen to demonstrations during broadcasting hours.

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ELECTRONIC EMISSION.

Hull's Phenomenon Investigated by Goetz.

A recent paper by A. Goetz* describes an investigation into the phenomenon of the secondary emission of electrons, discovered by Hull in high vacuum triode tubes. Hull found that, when the cathode wire, the grid and the anode were connected to the battery by the " dynatron " connection, the grid being given a high, constant, positive voltage with respect to the cathode, and the voltage of the anode being gradually raised, the anode current increased rapidly at first, but sooner or later reached a maximum, further increase of the anode potential producing a diminution of the anode current, which in some cases was reversed in sign. Finally a minimum current was observed, after which the (positive) anode current increased with a further rise in voltage, until it reached the same value as before.

Hull concluded that the primary electrons, being accelerated by the high potential of the grid, strike with great violence on the anode, and cause a secondary emission of electrons, which pass out to the grid when its potential is higher than that of the anode. When the anode potential nears that of the grid the secondary electrons will no longer flow from anode to grid, and the anode current will increase again.

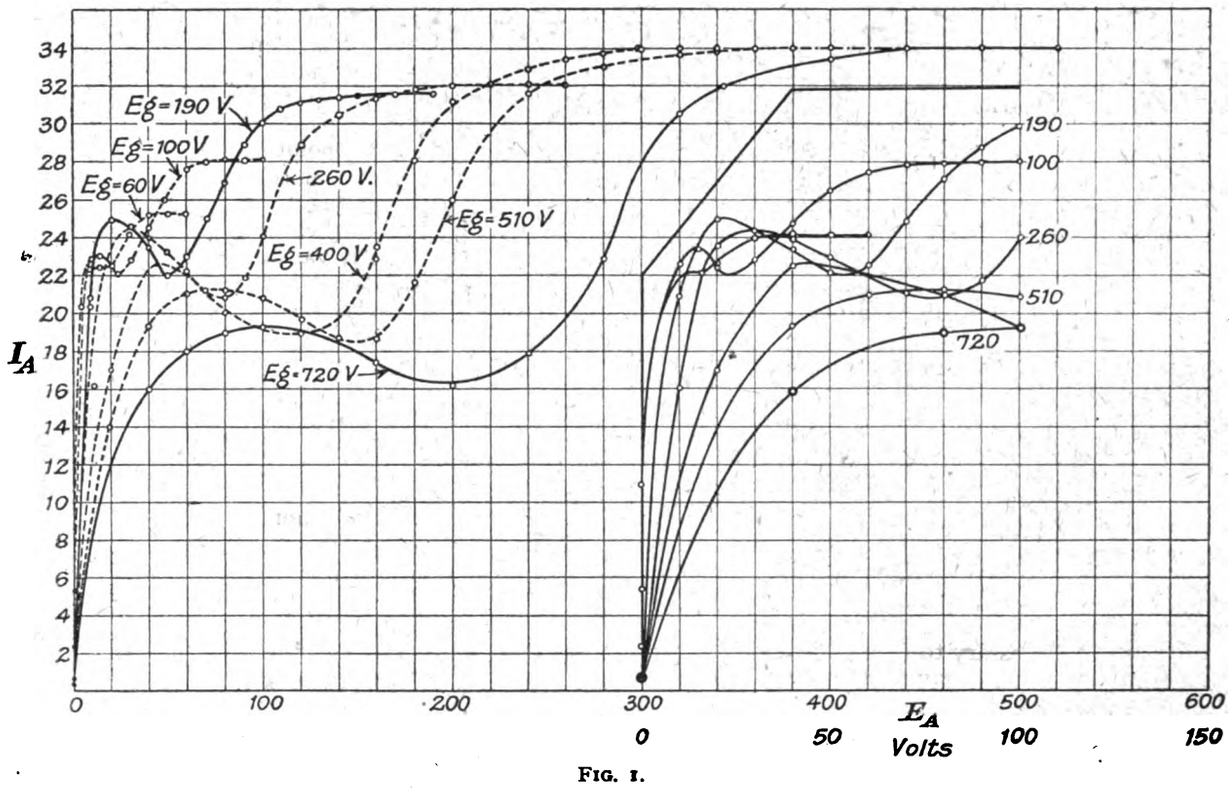

FIG. 1.

Hull came to the conclusion that there were considerable advantages in making use of the negative portion of this characteristic curve for technical purposes, and von Goetz has continued the investigation with this object in view; though he did not at once attempt to construct a tube suitable for technical work, but rather one by means of which an investigation of the phenomena concerned could be carried out satisfactorily.

The conditions to be fulfilled were: A grid with fine wire, having free passage for the primary electrons; large grid surface, so that considerable current density could be employed; screening of the glass wall from the electron stream; very high vacuum to prevent disturbing influences, and to allow the employment of high voltages.

A Coolidge cathode was used, consisting of an iron cylinder, inside which was an electrically heated tungsten spiral; this gave a stream of electrons in the direction of the axis of the cylinder, which passed through the grid towards the anode; electrons were prevented from passing out to the glass walls by the screening action of the iron cylinder. The same object was kept in view in the construction of the grid, which had a very fine meshed network of very thin tungsten wire 2 mm. from the upper edge of the cathode; the anode was at first 14·5 mm. above the grid, but after a series of measurements had been taken at this distance the top of the tube was cut off and it was fused on again, so that the distance was reduced to 3 mm., without altering the relative position of the cathode and grid. A secondary anode was also provided, consisting of a ring of sheet tantalum, which lay concentrically outside the cathode. Since it was necessary to seal off the tube, special precautions had to be taken to produce a perfect vacuum; and a sensitive test is described depending on the fact that if in an ideal vacuum, with constant anode potential, the emission current is measured first with increasing and then with diminishing cathode temperature, the values for given temperatures are almost identical; while with an imperfect vacuum the descending values are larger than the ascending.

In a preliminary experiment with the completed tube, in which, as in all other experiments, careful measurements were made of the current through the heated glass and allowance made for the same, it was found that, with constant heating current in the cathode wire, the emission current of electrons from the cathode towards the grid was practically independent of the anode voltage, and varied only with the grid potential. It also varied, of course, with the temperature of the cathode heating wire. Both the cathode current and the anode current reached a saturation value when grid and anode voltage were the same and sufficiently high. The grid current varied from about $\frac{1}{12}$ to $\frac{1}{9}$ of the cathode current.

Fig. 1 shows the results of a series of experiments with the tube in its first condition. Similar observations were made when the distance between grid and anode had been reduced to 3 mm., and also with other tubes, the general shape of the curves being the same for all cases. The grid voltage was kept constant for each of the curves, and the relation between the anode current and the anode voltage was observed with constant cathode temperature. The inset on the right of Fig. 1 shows the first portions of the curves with an increased voltage scale. In each curve the first rise of *Ia*, the anode current, to a maximum is visible, this being followed by a minimum value as the anode voltage *Ea* increases. Finally there is a rise to a saturation value, when *Eg*, the grid voltage,

* Based on an article in the " Physikalische Zeitschrift."

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is high enough. The first maximum and the minimum shift to the right as the grid potential is increased, the shifts being nearly proportional to the grid voltage. It will be noticed that, contrary to Hull's account of the phenomenon, the first maximum lies considerably below the saturation value. It may be assumed that secondary emission is already taking place at this point of the curve, secondary electrons passing from the anode to the grid, which is at a higher potential. An important point theoretically is that, with low grid voltages, the anode current, with zero anode voltage, has a considerable value, while this is not the case when the grid voltage is raised sufficiently, the curves then starting from zero.

It is, of course, difficult to disentangle the effects of the primary current of electrons, which strikes on the anode from the cathode, and the secondary electron current, which passes from the anode to the grid, since all that can be directly observed is the difference between them, which is measured with the galvanometer as the anode current.

The author, therefore, develops the theory along the following lines: When a metallic cathode is heated electrons are given out, the velocities of which are distributed according to Maxwell's law. Simple mechanical considerations as to their motions in the electric fields due to the grid and anode show that s, the distance from the grid to the dead point of an electron, where its velocity becomes zero, is :—

$$s = \frac{(\delta^2 + 2Eg\, e/m)A}{(Eg - Ea)\ 2e/m},$$

where δ is the velocity with which it leaves the cathode (thermal velocity), Eg the grid voltage, e the charge and m

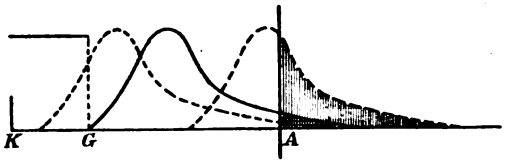

FIG. 2.

the mass of an electron, A the distance from grid to anode and Ea the anode voltage. This would imply that the dead points fall on the far side of the anode, even when Ea is zero, except for those electrons the initial velocity of which $\delta = 0$; or the anode current is always saturated whatever is the value of Eg. Things are, however, by no means as simple as this, owing to the "space charge" at the surface of the cathode, which prevents the slower electrons from moving towards the grid until its potential is sufficiently raised. A further complication is that, when the potential of the grid is small, the electron dead points pile up in the canal like spaces between the wire meshes. They exert a repulsive force on one another, and a low grid potential produces a braking action on those electrons which pass through. Another cause of disturbance is the electrostatic action of the grid itself on the electrons which pass through it. This bends the straight paths of the electrons into parabolas; after leaving the grid they again move in straight lines, but these are not parallel to the axis of the tube, and if the anode is at some distance many of the electrons may miss it altogether.

Fig. 2 shows how the dead points of the electrons may fall in different cases. The full "cocked hat" or probability curve shows how the dead points of electrons, starting from the cathode with Maxwell's velocity distribution, will lie, when the grid is just saturated; i.e., when all the electrons sent out by the cathode K strike the grid G, or pass through it. The number of "spent" electrons at each point along the axis will be given by the ordinate of the curve, which also gives the original velocities of the electrons. For the full curve only a very few electrons have their dead points beyond the anode A, and these strike the anode, which may be supposed to be at zero potential, with a certain velocity, giving a small anode current. An increase in the anode voltage from O to Ea will move the dead points to the right, as indicated in the broken curve. This shows that a large number of the faster electrons have their dead points behind the anode A. These strike the anode and produce a larger anode current. Raising the grid and anode potentials still further will bring the whole of the probability curve behind the anode, which will then be saturated as far as the primary electron current is concerned. Reducing the grid voltage will bring the probability curve into the position indicated by the dotted line, when the grid will not be saturated. It is possible by a suitable process of integration to obtain the primary characteristic, giving the primary portion of the anode current as a function of Ea, for constant Eg and cathode temperature.

Turning next to the question of the secondary emission of electrons by the anode, it may be expected that this will vanish when the velocity of the primary electrons striking on the anode is small, so that they are unable to ionise the atoms of the metal on which they strike, and also when the voltage of the anode is nearly equal to that of the grids. As far as the passage of secondary electrons from the anode to the grid is concerned, the anode is to be regarded as a secondary cathode, with the grid as its anode. There will be a space charge on this secondary cathode, and the grid potential must be in sufficient excess to overcome the effects of this, or there will be no flow of secondary electrons. The intensity of the secondary emission is found to be directly proportional to the number of primary electrons, provided that the secondary current is saturated.

Two Causes of Irregularities.

Two causes of irregularities in the curves are mentioned—reflexion of the primary electrons, and their diffusion backwards. These phenomena, as defined by Lenard, differ in that the reflexion of the electrons takes place at the outer surface of the metal, and so the charge of the anode is not raised, while in backward diffusion they penetrate deep into the structure of the metal, and may be deflected through 180 deg. A very high initial velocity is necessary for this, while reflexion can only take place with a small velocity. Experiments were made with cathodes heated to different temperatures, and these confirmed the author's views.

Experiments made with the ring-shaped secondary anode did not give very distinct results when the distance between the grid and main anode was 14·5 mm., as this distance was so large that matters were very complicated. When, however, the distance was shortened to 3 mm. it was found that the effect due to secondary electron emission was increased by charging the secondary anode to a suitably high potential, thus providing an additional path for the secondary electrons. If, however, this potential was made too high, primary electrons were diverted into the secondary anode; and this complicated matters.

The paper concludes with some remarks on the conditions for the construction of tubes for practical purposes. Such tubes must have high secondary emission, which must follow the straight line law; and the characteristic must be steep. Hull has already obtained twenty-fold secondary emission. The secondary anode enables the second condition to be fulfilled. The incandescent wire should, as far as possible, be surrounded by the grid, and should have a small section. The grid should be of thin wire, with small surface and large passage for the electrons; the surfaces parallel to the direction of the electrons should be as small as possible. There should be a secondary anode, as near as possible to the primary, and screened from the grid. The vacuum should be very perfect as otherwise the primary electrons lose their velocity, and the emission of secondary electrons is checked.

ELECTRICAL APPARATUS FOR THE DEAF.

An apparatus which is to do for the deaf what the optophone does for the blind was described by Mr. C. M. R. BALBI at the last informal meeting of the Institution of Electrical Engineers. It was now possible, said the speaker, to analyse the hearing of all persons by means of an instrument termed the "Audiometer," and its characteristics could be plotted in the form of a chart known as the Weigel audition area.

It was shown that the sense of location formed a most important adjunct to hearing, and that this sense was lost when a patient used a "microphone and receiver" type of instrument, unless special precautions were taken. A simple rearrangement of the instrument was described by which it was possible to restore the sense of location. It was pointed out, however, that it was first necessary for the patient to become accustomed to the instrument before the faculty could be acquired; this was attained by memorising the location of sounds emanating from known positions, such as the ticking of a clock. After a time this process became a habit. Lastly, a new form of instrument was described which had been invented as long ago as 1882 for the purpose of hearing, but the special application of which to the extreme deaf had been recently discovered and developed. The instrument consisted of a small vibrator which, when applied to the head, communicated sound through the bones direct to the nervous system of the ear, and there produced the sensation of hearing.

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TELEPHONE TRAIN DISPATCHING.*

Some Recent Developments in Circuit Arrangements Analysed.

By W. H. CAPEN.

Prior to 1907 the telegraph was the chief means of communication on railways. Changing conditions then made it necessary to employ the telephone. More recently the desire for satisfactory loud-speaking equipment has led to the use of efficient circuits and vacuum tube amplifiers for this purpose.

The ordinary train-dispatching system must allow transmission in both directions and must convey the vibrations necessary for the transmission of the human voice (ranging from 200 to 2 000 cycles per sec.) intelligibly. As the loss of power in the connecting telephone lines may exceed 99 per cent. the problem is complex. On a 300 miles line with 50 to 60 intermediate stations listening simultaneously the stations nearest to the speaker will obviously absorb most of the power. Hence special consideration has to be given to distant stations. There is no inherent reason why intermediate stations cannot be inserted in series in the line, but for various reasons the bridged system is preferable. The impedance of nearby bridged stations must be sufficient to prevent the proportion of power absorbed being unduly great and yet must give a satisfactory volume of sound in each receiver. Theoretically, in order to obtain ideal results impedance must decrease as the more distant stations are approached, and many schemes to effect this have been devised. However this would mean complication and give unsatisfactory transmission from distant stations to the dispatcher. Satisfactory results can now be obtained with sets having uniform characteristics. The satisfactory solution of the problem depends on a proper proportion of resistance for a given impedance. Conditions depend greatly on type and length of line, number of sets in simultaneous use, and grade of transmission required. Most dispatching lines in America are of open wire copper. Iron wire is rapidly being discarded. Sometimes there is a combination of open wire and cable. A complete solution therefore involves consideration of open wires, non-loaded cable and loaded cable, as the characteristics are so different that intermediate stations for each must be of widely different impedances.

Grade of Transmission.

The grade of transmission acceptable for regular telephone service—namely, a 30 mile equivalent—was formerly considered adequate for dispatching service, and some 25 to 30 stations could then simultaneously receive from the dispatcher. But as traffic conditions changed it was found that not more than 10 to 15 stations could be simultaneously used if satisfactory results were to be obtained.

From a consideration of typical dispatching lines in the United States and Canada it appears that No. 9 A.W.G. copper could be considered representative, and that a maximum length of 250 miles with 40 stations would be a reasonable assumption. For loaded cable two typical conditions are considered, 100 miles of No. 13 A.W.G. with 25 stations and 30 miles of No. 16 A.W.G. with 15 stations.

In order to simplify investigation it was assumed that: (1) A typical line could be used; (2) if power at the last station was sufficient, intermediate stations would receive sufficient power; (3) power consumed in intermediate impedance could be satisfactorily converted into sound; (4) stations were spaced equally along the line; (5) transmission from dispatcher to intermediate stations was of primary importance, and that if this was satisfactory reverse transmission would also be adequate; (6) loss introduced by selectors was negligible, and (7) single frequency computations would give satisfactory results.

Satisfactory transmission for other conditions was next considered, and it was found that this could be ensured without modifications in intermediate impedance. Investigation was made of: (1) open wires and (2) loaded cable.

From curves relating transmission equivalent to impedance angle it appears that, for the impedances considered, the best value for the intermediate station is about 5 000 O, having an angle of 86°. This condition is actually impracticable, and a value of 5 000 O with a positive angle of 75° was tentatively adopted. Other curves in the original paper show a variation of the transmission equivalent at the last station on a 250-mile line for different impedances and numbers of stations. With the present desired equivalent of 20 miles it is not possible to use more than 12 stations simultaneously. Moreover, with stations having the proposed value the equivalent is considerably below the limit and changes little with a variation of stations from 1 to 45. The farthest station does not necessarily receive the smallest amount of power owing to the "standing wave" effect which is more pronounced on loaded cable, but the equivalent is still sufficiently low to be satisfactory. Investigation showed that irregular spacing of stations had little effect.

Loaded Cable.

As already mentioned, 100 miles of 13 A.W.G. cable and 30 miles of 16 A.W.G. cable, with 25 intermediate stations and 15 intermediate stations respectively, were considered representative. For the loading 0·175 henry coils on 1⅛ miles spacing and 0·205 henry coils on 1·4 miles spacing were assumed. The best value of intermediate station impedance at a frequency of 800 was found to be 20 000 O or more at a small angle, though, as diagrams accompanying the original paper make clear, the values are not at all critical. Calculations show that both on 800 cycles and 1 500 cycles with respective impedances of 20 000/0° and 34 000/61° efficiencies pass through maxima and minima at approximately regular intervals—i.e., at one-half wave length points, the greatest loss being at one-quarter wave length from the distant end of the line. The sudden changes in efficiency are due to interference phenomena known as "standing waves." With a line of uniform structure changes in phase and magnitude are uniform. But if a sudden change in the character of the line occurs the voltage wave may be reflected from this discontinuity; this reflected wave will also follow the law of uniform change in magnitude and phase until a discontinuity is again encountered. With stations of high impedance the terminal of the line is approximately an open circuit which gives maximum discontinuity and total reflection. The phenomenon gives rise to maxima and minima along the line and causes the so-called "standing wave."

If there happens to be a station near one of the null points the current through it will be correspondingly small. As would be expected the greatest loss occurs at the interference point nearest the end of the line and shows a gradual decrease towards the sending end, since the difference in amplitude of the two waves will be greater as the sending end of the line is reached. These maxima will not be found if stations occur at points on the line which are even multiples of quarter-wave length from the end, since at such points the two waves will be in phase, giving minimum losses. But it will be observed that those stations having the greatest losses at 800 cycles will have minimum losses at 1 500 cycles. Further, with 1 500 cycles, there are twice as many maxima and minima points. All this is borne out by curves representing actual conditions. The effect of standing waves is not so serious on open wires as the reflected wave is not so large. Only one maximum is found, the longest line considered being less than one wave-length. The speed of propagation on open wire is much greater than on loaded cable. Equally important is the effect of standing waves in causing distortion, and hence means must be taken to avoid this effect. The best way of avoiding the trouble is obviously to terminate the line in such a manner that no reflection occurs. This may be effected by terminating the line in its own impedance—*e.g.*, by shunting the last station with a resistance of approximately 1 260 O, since the characteristic impedance of the lines here considered is about this value. The good results of this method are borne out by experience with a typical 100 mile line. The efficiency then varies proportionately to the attenuation of the length of line and the difference between 800 and 1 500 cycles is not great. Having thus eliminated standing waves, the impedance for the intermediate station was considered: 35 000 O/$\overline{20°}$ at 800 cycles, and 20 000 O, with as low a positive angle as possible at 1 500 cycles, were considered the best compromise values. There appears to be practically no advantage in using heavier loading than 0·175 henry on 1⅛ miles spacing, as with heavier loading leakage is materially increased.

For an intermediate station set the following requirements are desirable: (1) The set must have a condenser in series to reduce losses to selector currents; (2) the set should have a key for talking; the transmitter to be open during listening;

*Abstract of a Circular issued by the American Railway Association.

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(3) there should be sufficient " break-in " efficiency during talking to attract the operator's attention ; (4) transmitting efficiency should be a maximum ; (5) the receiver and transmitter should be insulated from the line by an induction coil ; (6) the impedance in the receiving condition must be as close

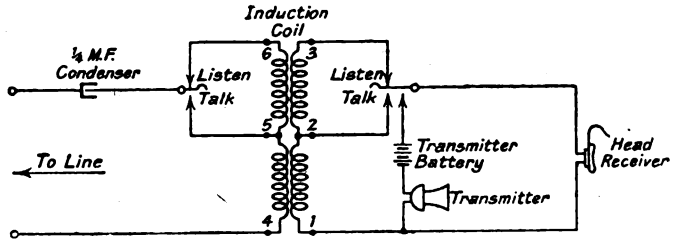

FIG. 1.—WAYSIDE STATION FOR OPEN WIRE LINES.

to the desired theoretical values chosen as practicable. The combined impedances of coil, receiver and condenser give approximately 7 500/70° as required. The ¼ mf. condenser reduces losses at the low frequencies of selector currents. The induction coil, besides providing suitable insulation between line and receiver ensures the desired higher positive impedance angle. In order to obtain high transmission efficiency the ratio of turns on the coil, when used to connect the transmitter in circuit, must be changed. This is done by depressing the key which also closes the transmitter circuit. To give satisfactory " break in " efficiency the receiver is bridged directly across the transmitter winding of the coil. The insulation between primary and secondary windings of the induction coil and between contacts of key is tested at 1 000 V. This ensures adequate protection from induced voltages between line and ground.

In the loaded cable set two additional condensers are needed in order to meet the more difficult impedance conditions. The impedance of the set will vary considerably for different

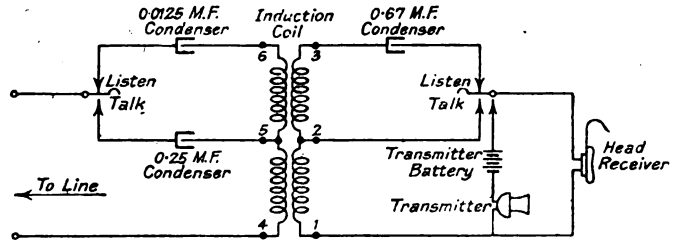

FIG. 2.—WAYSIDE STATION SET FOR LOADED CABLE DISPATCHING CIRCUIT.

frequencies, but investigation has shown that the impedance of this set will be sufficiently satisfactory throughout the range of important frequencies, and calculations for others than 800 and 1 500 cycles are not required.

The operating features are similar to those of the open wire set. In the receiving condition the secondary series condenser is of small value (0·0125 mf.). The 0·68 mf. condenser in series with the low impedance receiver is needed to give the proper impedance and slightly increases the efficiency of the set. The third condenser of ¼ mf. is necessary when the circuit is switched to the transmitting condition. The shunt at the end of the line might, from a transmission standpoint, be a pure resistance of 1 250 to 1 300 O, but in view of losses to selector currents a 1 or 2 mf. condenser in series with this resistance is desirable. Fig. 1 and 2 illustrate suggested arrangements for these conditions.

The requirements of a dispatcher's set are different from those of an intermediate station set. The dispatcher must listen almost continuously for eight-hour periods. " Break in " efficiency should be as high as possible, and in order to save the transmitter batteries a foot-switch is usually provided. Power from the transmitter is divided between line and receiver, sometimes about equally. This means that any noise in the room is apt to lead to a disturbing sound in the receiver. Hence an " anti-side-tone " set seems desirable for this class of service. It also appears best to use the invariable type of set in order to obtain a maximum " break in " efficiency. The impedances of open wire and loaded lines are sufficiently alike to make it advisable to design one dispatcher's set for use with both. The operation of the anti-side-tone sets is based on the Wheatstone bridge principle. It is not practicable to design a single balancing network to equal exactly the impedance of different lines at all frequencies likely to be met with, and a compromise is necessary. In a dispatcher's equipment a simple resistance and condenser are sufficient. A set of the type adopted has a transmitting efficiency about two miles less than that of a transmitting station set, but a receiving efficiency about six miles better. The side tone is about 15 miles less, the break-in efficiency about the same as the receiving efficiency.

The possibility of using intermediate station sets for dispatching has been considered. In some cases this may answer, but in general the requirements are distinctly different, and the anti-side-tone feature alone seems to justify the more complicated set. Fig. 3 shows a diagram of a dispatcher's set.

It is only since the development of the vacuum amplifier that the demand for loud-speaking equipment has become more urgent. This equipment should be used with an anti-side-tone circuit in order to reduce the tendency to local oscillations. It is also necessary to reduce the amplification

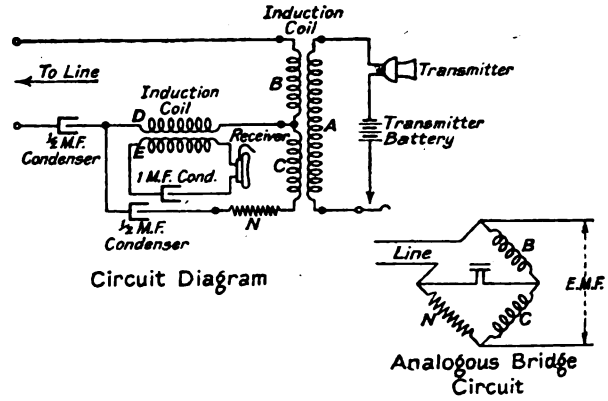

FIG. 3.—DISPATCHER'S SET FOR NON-LOADED OPEN WIRE METALLIC LINES AND LOADED CABLE CIRCUITS.

while transmitting in order to prevent " howling," but the reduction is not sufficient to decrease the " break-in " below a satisfactory volume. The amplifier is a simple one-tube circuit, and is arranged in the customary way with input transformer and suitable current supply connections. Certain dispatchers' circuits are not equipped with selectors, and the use of loud-speaking equipment at each intermediate station enables the operators on the line to hear all of the messages transmitted and to be called directly by voice without the necessity of wearing the head receiver all the time. On lines where the switchman is the only operator it would be practically impossible for him to wear a head receiver, and for such circuits a loud-speaking amplifier has been designed. The circuit is the same as that for the dispatcher's set, except for

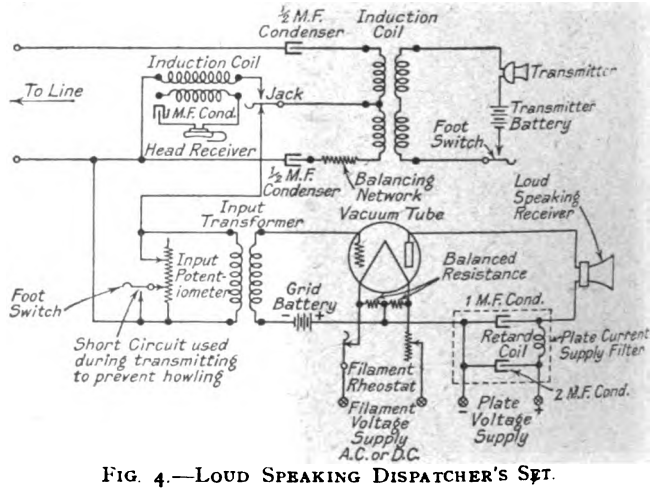

FIG. 4.—LOUD SPEAKING DISPATCHER'S SET.

the characteristics of the input transformer, the elimination of the input potentiometer and the addition of the grid resistance.

On such dispatching circuits as are equipped for selector calling, there is a selector permanently bridged across the line ; any loss caused by the selector can be ignored with the best modern types as the impedance at voice frequencies is very high, 1/2 megohm or more. On loaded cables it is not advisable to have more than 20 to 25 selectors bridged on the line because of the possibility of magnetising the loading coils, which would prejudice their loading effect by decreasing their inductance. Fig. 4 shows a loud speaking dispatcher's set.

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SOME NEW MARCONI APPARATUS.

Details of Multi-Valve Amplifying Detectors and Low Frequency Magnifiers.

To meet a wide range of requirements, the Marconi Wireless Telegraph Co. has designed a series of multi-valve amplifying detectors, which are suitable for the reception of spark, continuous wave and telephone signals. In the design of this apparatus, simplicity in operation has been regarded as the most essential quality. It may be admitted that the ideal amplifier for general utility purposes would be one that was equally effective on all the wavelengths commonly employed for wireless communications—i.e., over a range of, say, from 200 to 25 000 metres. But although this ideal has been very nearly accomplished in the "A" models of the instruments described below, the construction of such an instrument introduces complications which in many cases—for instance where reception is only required on a limited waveband—it would be desirable to avoid. To meet both classes of requirements, the Type A.G. amplifiers are therefore manufactured in several models, and the purchaser has the choice either of an extremely long wave range instrument or of several alternative limited wave range instruments, each of which covers a wide waveband. In a large

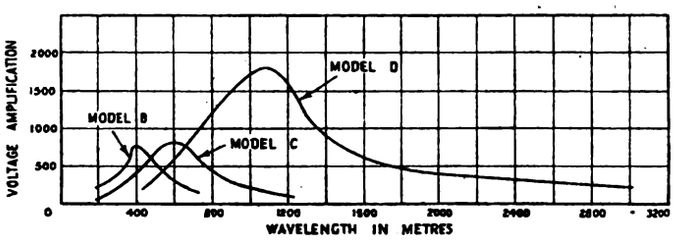

FIG. 1.—MAGNIFICATION CURVES OF NEW MARCONI AMPLIFIERS.

majority of cases, one or other of the limited wave range instruments will fully meet the requirements, on account of the by no means narrow range of sustained amplification which is obtained, while there is the additional advantage that in the neighbourhood of the optimum wavelength a considerably greater amplification can be obtained with the same number of valves than with the long wave range instruments.

There are three standard series of the Type A.G. amplifiers, which are named respectively A.G.1, A.G.2, and A.G.3.

A.G.1 is a combined high frequency and low frequency amplifier. It employs six valves, four for high frequency amplification, one for rectification, and one for low frequency amplification.

A.G.2 is a high frequency amplifier only. It employs seven valves, six for high frequency amplification, and one for rectification.

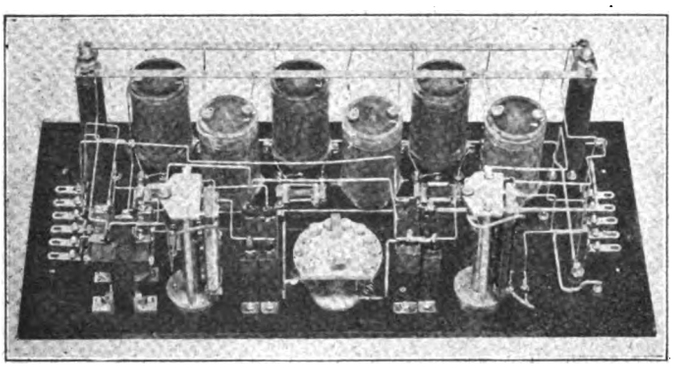

FIG. 2.—MULTI-VALVE AMPLIFYING DETECTOR—BACK OF PANEL SHOWING CYLINDRICAL TRANSFORMERS.

A.G.3 is a combined high frequency and low frequency amplifier. It employs nine valves, six for high frequency amplification, one for rectification and two for low frequency amplification.

Each of these three types of instrument can be supplied in five models according to the wave range required and their relative high frequency magnification on different wavelengths is shown by the curves in Fig. 1. The actual values indicated are approximately those which can be obtained with six high frequency stages only, and allowance must be made for the fact that the type A.G.1 has only four stages of high frequency amplification and that the note magnifier included in both the A.G.1 and A.G.3 instruments will greatly increase the over-all magnification of the audible signals. The valves used in these magnifiers are designed to have the smallest possible capacity though even so the amplification on short wavelengths falls off rapidly. Besides being used as detectors these amplifiers can be employed to reduce interference, for frame aerial reception, for obtaining reaction and for ultra magnification.

Fig. 2 is a view of the back of the panel of one of these detectors showing the cylindrical transformers, while Fig. 3 illustrates

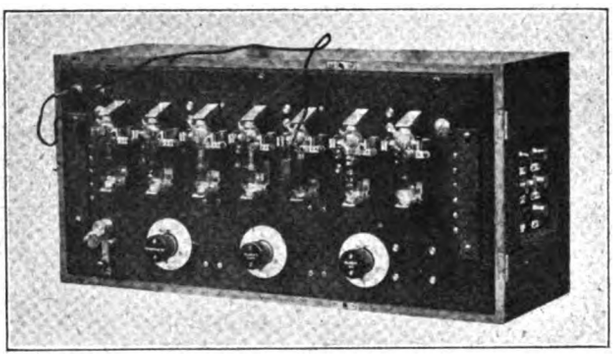

FIG. 3.—VIEW OF MARCONI AMPLIFYING DETECTOR. TYPE A.G.2.

the A.G.2 pattern. This is a seven-valve instrument, six of the valves being used for high frequency amplification, and one for rectification. The high frequency intervalve transformers are wound with a fine gauge of high resistance wire on formers of special materials, and are afterwards treated by a process which protects them from atmospheric conditions. As the h.f. transformer units are interchangeable, the wavelength of a particular instrument can be altered, though this requires a certain amount of skill. A selector clip and wandering lead allows the number of valves in use to be varied as required.

The low frequency signal magnifiers which are known as Types N.G.1 and N.G.2, are designed for use in conjunction

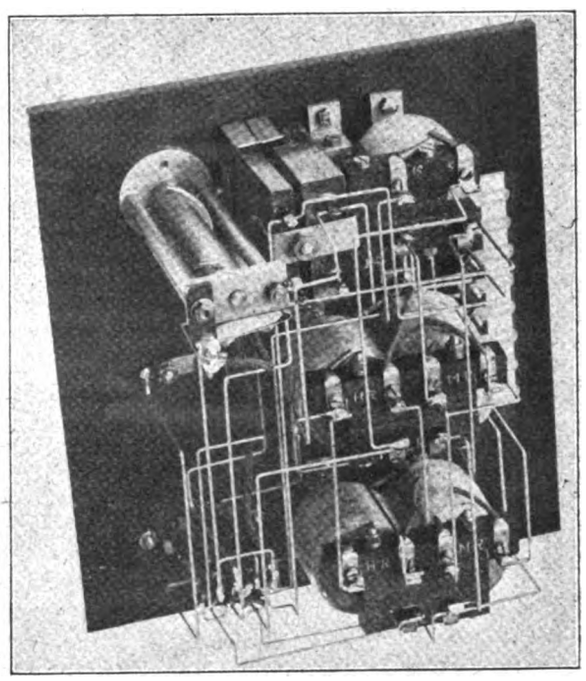

FIG. 4.—LOW FREQUENCY SIGNAL MAGNIFIER. BACK OF PANEL SHOWING POSITION OF "LINK."

with any type of aural wireless telegraph or telephone receiver for the purpose of increasing the strength of signals or speech.

The amplification of electric currents, so far as it concerns

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wireless telegraphy and telephony, can be broadly divided into two classes, namely :—

High frequency amplification, covering radio frequencies of 3 000 000 to 10 000 cycles per second, representing wavelengths of 30 000 metres to 100 metres, and

Low frequency amplification, covering audio-frequencies of 20 to 10 000 cycles per second.

The great value of the valve amplifier as an aid to the solution of radio communication problem lies, not so much in the enormous increase in sensitivity which can be obtained from its use, as in enabling methods of reception to be used in which extraordinary selectivity can be achieved. By the use of an effective multi-stage valve amplifier, the high frequency currents resulting from the weakest signals, whether spark or continuous wave, may be brought up to the necessary strength for receiving highly efficient rectification. For this reason, the reception of weak signals is best effected by amplification before rectification, that is to say, by the use of a high frequency amplifier.

On account of the fact that all rectifiers are disproportionately insensitive to very weak signals, except when heterodyne methods are employed, note amplification does not increase the ultimate sensitiveness of a receiver. It can, nevertheless, be advantageously employed for the purpose of increasing the readability of weak signals by producing a larger volume of sound in the telephones from a given signal. By means of note magnification signals which are only just audible and far too weak to read can be brought up to full strength. A very much greater overall magnification can be obtained without tending to make the valves oscillate by using a combination of high frequency and low frequency magnifiers than could be obtained by high frequency magnification alone.

In the reception of wireless telephone signals—whether music or speech—the question of distortion is of considerable importance, and, although distortion in the amplifier is an undesirable element in all classes of reception, yet in the case of telegraphy where the signal is received on a single note, this objection is nothing like so important as in the case of telephony. For this reason, the two classes of low frequency amplifiers have been developed by the Marconi Co., namely, the signal amplifiers in which the reduction in cost of manufacture and simplicity have been obtained by neglecting to a certain extent the element of distortion, and the speech amplifiers, in which special precautions have been taken to obtain practically distortionless amplification over a very wide range of frequencies.

Fig. 4 illustrates a back view of an N.G. low frequency signal magnifier showing the position of the link. These instruments employ iron core intervalve transformers, so that a very high ratio of magnification per valve, about 7 : 1 can be obtained. The distortion is not sufficiently marked to interfere with the reception of commercial speech. They are constructed on the panel principle, so that the whole unit can easily be withdrawn from the containing case.

TEMPERATURE CONTROL.

An Automatic Electrical Device for Ensuring Accuracy in Industrial Processes.

As has often been pointed out, one of the greatest advantages of electric heating for industrial processes is the ease with which the temperature can be controlled. This makes repetition easier and the quality of the product more certain.

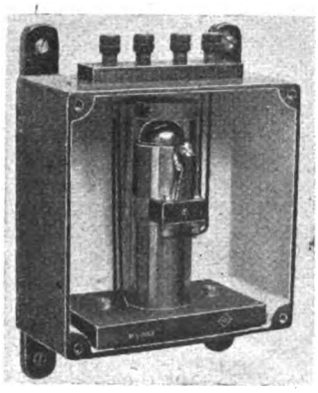

Fig. 1.—View of Ball Relay for Automatic Temperature Control Work.

To ensure this constancy of temperature indicating instruments are, of course, necessary and these are equally required when other methods of heating are used instead of electricity. The simplest form of instrument to employ is either a thermometer or a pyrometer, it being left to an attendant to regulate the heat in accordance with the readings given.

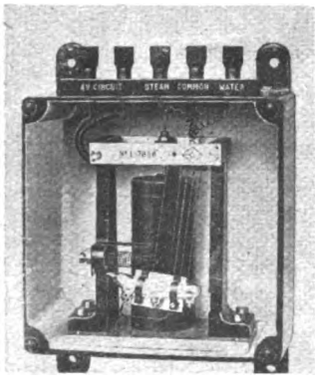

Fig. 2.—Three Contact Relay Used when Rapid Control of Temperature is Required.

For the best results to be obtained, however, it is obvious that this is not enough and a great deal of work has been done in devising systems of automatic control so that attendance is dispensed with and temperature regulation is accurately effected in accordance with the working requirements.

The form of automatic control apparatus manufactured by the Cambridge and Paul Instrument Co. consists of a sensitive element connected to an indicator which is fitted with a device which automatically increases or decreases the furnace temperature when certain pre-determined limits are exceeded. In electric furnaces this device operates a relay

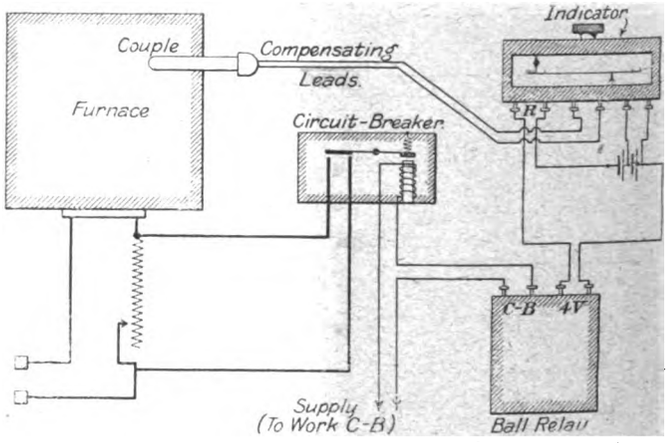

Fig. 3.—Connections of Automatic Control Apparatus Using Ball Relay.

which controls the main circuit. In furnaces fired by other means a valve is operated either directly or through a relay.

In this system the form of element employed depends on the maximum working temperature. For temperatures not exceeding 540 deg. C. an index thermometer fitted with a mercury-in-steel bulb is used. For temperatures up to 1 400 deg. C. thermo-couples are usually employed, while for higher temperatures the total radiation of the hot body is measured by a Féry telescope. In the first class of apparatus the indicator is fitted with an adjustable contact which is set to the temperature at which the furnace is to be controlled through the ball relay described below, the action being reversible. In the second class of apparatus the indicator is a high resistance moving coil galvanometer fitted with a calibrated temperature scale. Near the end of the pointer is attached a light thermo-couple which is electrically connected to a moving coil relay. A small electrically heated

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coil is set to the point on the scale at which it is desired to control the temperature; when this temperature is reached the thermo-couple on the pointer is brought opposite to the coil and becomes suddenly heated. The e.m.f. thus set up energises the relay and so completes the circuit which operates the mechanism controlling the supply of heat. As soon as the temperature falls the thermo-couple leaves the coil and the process is reversed. With a suitable combination of indicator and element an accuracy of 0·5 of 1 per cent. can be guaranteed for temperatures not exceeding 900 deg. C.

The ball relay to which we referred above is illustrated in Fig. 1. It consists of a glass sphere into which two

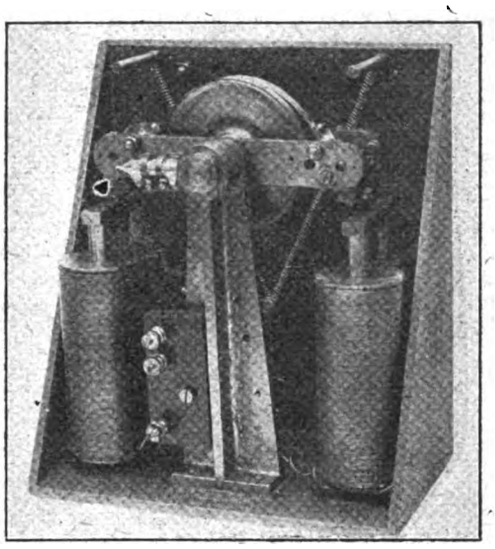

FIG. 4.—A VALVE USED FOR HIGH PRESSURE WORK.

platinum wire electrodes are sealed. This sphere rests upon a bell-shaped magnet which consists of a hollow steel cylinder over which a coil is wound. There are two electrodes, one of which is covered with mercury on which floats a hollow steel sphere. When the magnet is energised this sphere is pulled down and the mercury is squeezed out laterally, thereby closing the circuit between the two electrodes so as to operate a valve or energise a breaker in the main circuit as shown in

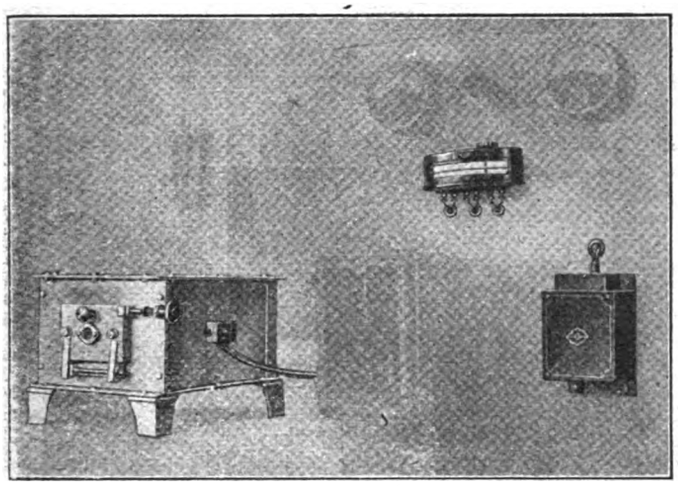

FIG. 5.—AN OUTFIT FOR CONTROLLING THE TEMPERATURE OF AN ELECTRICALLY HEATED FURNACE.

Fig. 3. The relay requires current from a 4 V accumulator or direct current supply for its operation. In certain steam-heated processes it is necessary to obtain very rapid control of temperature by turning on cold water at the same time as steam in shut off. A three-contact relay, shown in Fig. 2, is then used. This consists of three platinum wires sealed into a glass tube containing mercury. Normally, two of the electrodes are covered with mercury, thus completing a circuit which closes a water valve. As soon as the temperature rises to a certain figure a solenoid is energised and the tube is tilted so that the mercury flows to the other end, opens the water valve circuit and closes a steam valve circuit.

For low pressure work a disc valve operated by magnets is used, while for high pressure work the valve shown in Fig. 4 is employed. In this apparatus a shaft is connected to the spindle of the valve and two phosphor bronze band brakes working in conjunction with solenoids are wrapped round a steel disc which is fixed to the shaft. These brakes are attached to the solenoid cores through an arm. When one of the solenoids is energised the arm is drawn downwards, and one of the bands is tightened so that the valve is slightly closed. At the end of the stroke the electrical circuit is broken and the arm is restored to its neutral position by a spring. This operation is continued until the valve is closed sufficiently to maintain the desired temperature. The same operation is performed by the other solenoid when the valve is to be opened.

The system we have described has numerous applications; in Fig. 5 an outfit is shown controlling the temperature of an electrically heated furnace.

POWER STATION AUXILIARIES.

On April 26th, 1923, a Paper on "The Drive of Power Station Auxiliaries" was read before the Institution of Electrical Engineers in London, and an abstract appeared in our issue of May 4th. This Paper was also read before the North-Western Centre on November 20th, and below we give an account of the discussion:—

Mr. W. ECCLES said that stations containing units of about 20 000 to 25 000 kW were still comparatively exceptional in this country, and there was less indecision with regard to their auxiliaries than in the case of smaller stations. He asked for an expression of opinion as to the size of station or unit at which the use of divided auxiliary supply and double auxiliaries would cease to be desirable. He thought that for 10 000 kW units the case would be doubtful. On this point Mr. Midgley replied that experience seemed to show that with sets down to 8 000 to 9 000 kW the auxiliaries should be duplicated. For a 33 000 V station having auxiliary motors of a total of about 1 000 kW per unit of 20 000 to 25 000 kW Mr. Eccles had compiled figures which showed that for drive from the main busbars *via* transformer and motor generator the capital cost would be £10 5s. per kW and the efficiency 70 per cent., while with a geared condensing house set the efficiency would be 69 per cent. and the capital cost only about £5 7s. per kW.

Mr. H. C. LAMB remarked that the suggested arrangement of a special 400 V d.c. generator on the main alternator shaft was new, and possibly economical. There were, however, the disadvantages of additional length and the fact that the auxiliaries thus supplied would not be available during running up. Mr. G. A. JUHLIN later discussed the question of high speed d.c. generators, and stated that while such machines had been constructed for 5 000 kW or more at 3 000 revs. per min. they were not sufficiently reliable to recommend themselves for drive of auxiliaries. Mr. Lamb said that the special feature of d.c. motors—ease of speed control—was requisite on the stoker motors and small boiler fans only, and for these cases control could easily be obtained on a.c. motors with a series resistance. Many troubles would be eliminated if d.c. drive were not used. He advocated the adoption of a house service set and a.c. motors, with alternative supply by transformers from the main busbars. Mr. S. L. PEARCE later stated in this connection that of 7 000 H.P. of auxiliaries at Barton only 170 H.P. were d.c. motors.

Mr. A. STUBBS agreed with the authors' treatment of the subject, but doubted the conclusions they had come to. In the light of recent developments in turbine design for power stations it might prove that the very foundations of the Paper might be cut away. Turbo sets of 20 000 kW or more were being offered and built as two-cylinder units, the high efficiency of the high pressure cylinder raising the efficiency of the complete set to something over 80 per cent. It was clear from this that the back pressure turbine would yield a very high thermo-dynamic efficiency. The main double cylinder turbine could thus operate in parallel on the steam side with a smaller back pressure cylinder developing approximately the same thermo-dynamical efficiency as the main unit. The back pressure cylinder in such a case would be coupled to the house service generator and exhaust to the pipe leading to the l.p. cylinder of the main set.

Mr. S. L. PEARCE said that in the new Barton station the auxiliaries were supplied from either of two sets of bars, one set supplied by the house service set and the other by house service transformers. These bars were normally not coupled but might be in emergency. He thought that the use of steam-driven auxiliaries would decline.

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STORAGE BATTERY LOCOMOTIVES FOR MINES.

By JOHN T. PRINGLE.

(*Concluded from page* 633.)

The essential details of a first-class storage battery locomotive suitable for mines taking first a *main line machine* and then a *pony* or *putting machine* may be summarised as follows :—

A main line machine should be constructed so that it can be run into a cage and sent down the shaft with as little dismantling as possible. Some English makers produce machines about 10 ft. long by 3 ft. 3 in. wide, and not more than 4 ft. 6 in. high with the cab removed. This is an ideal unit for transhipment into most mines—the cab can be easily and quickly detached and replaced without in any way interfering with the controller or brake gear. The locomotive I have in mind is 13 ft. 6 in. long over buffers 4 ft. to 5 ft. high from rail tip to crown of cab, and 3 ft. 3 in. total width. It has a wheel base of 3 ft. 11 in., two pairs of 32 in. diameter wheels, which gives ample ground clearance. It has a total weight of 7 tons and a maximum tractive effort of 4 000 lb. The frame is built of steel plates with braced stretchers and horn guides and keeps. The buffers and couplings are of the spring type to protect the battery from shock. The wheels are on steel axles with outside journals, and have turned steel tyres. Cast iron axle boxes are fitted, and these have brasses for oil lubrication, with dust shields and inspection doors. The springs are of helical type properly housed in the frame. The brakes are of powerful type of screw pattern, with inside hung blocks—in some cases "Ferodo" lined—applied to all wheels and operated from the cab.

Details of Design.

The cab is of sheet steel, and can be fitted or discarded at will. The battery box is also of sheet steel, mounted on rollers and run on to a channel track on the frame, where it is securely locked by a patent locking device. Sand boxes with suitable gear are also fitted, and a hand or pedal operated gong or horn is provided. The whole frame work is coated with Torbay red oxide before the final painting is done. The electrical equipment consists of two totally enclosed traction motors of 22 H.P., each on one hour rating at the tread of the wheel, and drives the axles through totally enclosed machine-cut single reduction spur gearing running in oil; the ratio of gearing being 6·68 to 1 to give a normal speed of 5 to 6 miles per hour. The controller is of the standard traction type, each direction having provision for series parallel operation and rheostatic braking, which is absolutely necessary for mine work. The resistances are of the cast iron grid type, and ironclad Exide I.M.V.$_8$ cells are used. The machine is complete with circuit breakers, ammeter and voltmeter, chronhodograph, electric light fore and aft in the cab, are inspection lamp with plug sockets, and all the necessary switches.

It is built on sound locomotive principles, and is an ideal unit for the work it has to perform. The cost of such a machine to-day would probably be a little over £2 000, and with charging set and equipment about £400 more.

American locomotives of similar type are designed for working in higher seams are usually of longer and wider dimensions with lower drawbar pull for equal weight, they have less ground clearance, and a slightly longer wheel base, this means that they have to be totally dismantled for transference to and from the mine or have to be slung under the cages, which entails considerable cost and is a dangerous operation.

Generally both are good machines, but most suitable for the country in which they are made. There is practically no difference in price, and when the points enumerated have been considered probably many mining engineers will favour the English-made machine. There are, however, several other machines of various design on the market. Some are chain driven and some are without spring frames and buffers and other essential details, while some have cheaper forms of battery and some lack the necessary refinements of good locomotive practice, and are priced at half the amount specified. It is extreme folly for any practical engineer to compare the machine described with a machine of this type for similar duty, as the price alone indicates that the latter machine lacks many essential details which will have to be added later to make it complete and then at a wasteful cost.

Another type of battery locomotive that can be used on existing light section track is one developed on an old principle: that of a rope in tension running the full length of the track by which a light locomotive pulls itself along. A fleeting wheel driven by the locomotive is employed, to take in and pay out the rope. It is possible with this arrangement to get a very good drawbar pull with quite a light machine, but it is apparently not suitable for roads whose sidings have to be negotiated as delay must take place in changing the rope connections. In all probability the principle could be developed to advantage for straight and heavy gradients.

The pony or putting locomotive is such as is asked for in the Markham competition. There are several of these manufactured in this country, the best being similar to that already described, but they are miniature machines of 2¼ tons total weight, having a tractive effort of 650 lb. or 950 lb. at starting with a normal speed of 6 miles per hour and are intended for use in confined spaces. The gauge is generally from 1 ft. 6 in. to 2 ft. 6 in., the wheel base 3 ft.; width 2 ft. 10 in.; height 3 ft. 8 in., and total length 9 ft. 5 in. They are fitted with a 10½ H.P. motor and are gear driven with a 10 to 1 ratio. This machine approaches closely to what is required for this competition providing it will comply with the mine regulations for a gaseous mine.

The leading conditions to be complied with for the Markham offer are briefly as follows :—

1. Competitors must within six months deliver the locomotive to a place near Doncaster.
2. Competitors must bear the whole of the cost of drawings specifications, estimates, transport, delivery, and removal of locomotive from place of testing and cost of locomotive.
3. The donor has the right to purchase any locomotive at a price declared by the competitor on entering the competition.
4. The donor has the option to require all or any of the competitors to enter into a contract with him for the manufacture and delivery to him of any number of locomotives not exceeding ten at a price not exceeding that declared by the competitor upon entering the competition.
5. No design shall include or involve any infringement of patent such as to prevent the free and unrestricted use throughout Great Britain and the Dominions.
6. The judges have the power to withhold or to divide the prize between two or more competitors after trial and to publish the result of their decision.

Technical Requirements.

(1) *Gauge of Rails.*—2 ft.

(2) *Dimensions.*—Not to exceed 3 ft. 2 in. in width, 3 ft. 6 in. in height from top of rail. Maximum length about 12 ft. on wheel base to allow locomotive to turn through an angle of 90 deg. on a circle 13 ft. radius from centre of track. Overhanging not to exceed 12 in. over outer rail.

Drawbar height to be adjustable vertically between 10 in. and 16 in. above height of rails. All parts of locomotive must be 5½ in. clear above rails.

(3) *Weight.*—Complete with battery, 2½ tons.

(4) *Brakes.*—Hand brakes effective in either direction of motion, smooth in action and capable of using the whole of the locomotive adhesion. Adequate braking of locomotive and train when travelling down an incline in all cases where above brakes could not hold.

(5) *Sanding.*—Boxes, valves and connections for sanding in either direction of motion to be provided.

(6) *Enclosure.*—To be drip-proof and splash-proof. Drip-proof means capable of being worked in rain; splash-proof means capable of being worked through water 3 in. deep above rails. Condensation of moisture to be considered.

(7) *Duty and Clearances.*—Drawbar pull, 600 lb. minimum at a speed of 3½ miles per hour on straight track for 1¾ hours for each complete charge of battery. Minimum battery output 12 kWh at the one hour rate and 18 kWh at five hour rate of discharge. Working voltage not to exceed 80 V.

(8) *Test Load.*—Hauling 5 tons.

(9) *Percentage of Full Output of Battery* when discharging at two hour rate required to perform the actual test duty necessary for 36 double trips.

(10) *Acceleration.*—From rest with full load on straight clean track against a gradient of 1 in 24 shall be such that a

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speed of 3½ miles per hour is reached in not less than 15 seconds and not more than 20 seconds.

(11) *Electrical Control.*—To be such that a fully loaded locomotive on straight level track may be regulated to a speed not exceeding 5 miles per hour.

(12) *Battery Changing.*—Provision must be made for the quick and easy replacement of a discharged battery.

(13) *Safety.*—The locomotive must be constructed to meet with the possible dangers of electric shock, fire or ignition of inflammable gas, as set out in Appendix A, or comply with the Coal Mines Act for operation in gaseous mines (Appendix A supplied with terms of competition by donor).

(14) No fixed headlights are to be embodied in the design, provision to be made for a standard British safety lamp to serve as a headlight.

(15) All information asked for in additional schedule obtained from donor must be given by the competitor at the time of entering the competition.

(16) *Drawings* to be submitted at the time of entering the competition are :

(*a*) Outline drawing of locomotive to ½ full size showing plan and elevation.

(*b*) Detail to any convenient scale showing construction of chassis and all essential working parts including battery changing gear.

Appendix A.—General rules connected with :

(*a*) Open sparking in ordinary use, covered by Part 1, General Regulation No. 118 Mines Act.

(*b*) Open sparking arising from defects, Part 2, Section A, General Regulation 132 Mines Act.

(*c*) The shrouding of unavoidable inflammable material or general fire risk.

(*d*) Flame-proof enclosure, as Part 2, Section A, Mines Act General Regulation 127.

(*e*) Damage to electrical parts caused by mechanical defects, and

(*f*) Replacement and cover locks on flame-proof enclosures, as Part 2, Section A, Additional Regulations 132 Mines Act.

Appendix B.—Deals with details in design of flame-proof enclosures, the walls and joints in the structure, holes for bolts and studs, and attachments of parts of the structure as per Mines Act, Part 2, Section A Regulation 127. In this Section it should be noted that the enclosure of electrical parts other than the battery should be total, without ventilated openings, but provision may be made for relief or prevention of gaseous pressure, provided such vents are flame-proof. The battery case may be ventilated, provided the openings constitute a flame-proof enclosure. It is assumed that gas may obtain access to any flame-proof enclosure that is not hermetically sealed, and the enclosure should be flame-proof for any mixture of methane and air within the limits of inflammability of such mixtures.

Appendix C deals with the control of the electrical circuits, such as main switch, controller and charging terminals, which must comply with Appendices A and B, and the Mine Regulations.

Appendix D deals with the insulation of the electrical circuits and battery.

Remarks on the Conditions.

It is clear from the conditions (1) to (5) that only competitors with considerable financial resources can enter the competition because the cost of manufacture and experimental work with delivery of the machine to Doncaster will entail an expenditure in excess of the value of the prize offered, with the possible likelihood of losing all the money spent on the production should the judges refuse to make any award. This narrows down the field to a few manufacturers and cuts out the smaller designer who might be just the person to produce a suitable machine.

From a general survey of the technical requirements it would appear that the competitive locomotive must have one or two outstanding features, and these are due to the required acceleration of 3½ miles per hour in 17½ sec.; this is equal to 0·2 miles per hour per sec. with a force of acceleration of 20·4 lb. per ton. It is a high figure, as also will be the rotational acceleration, taking it as 1-10th of the translational acceleration. A tractive resistance of 22 lb. per ton is what appears to be required taking a 20 lb. per ton journal friction and 0·12 for track friction.

The total force to give the train and locomotive the specified velocity will be slightly over 1 000 lb., taking into account tractive resistance, force to accelerate, force to overcome gravity and rotational acceleration of both trains and locomotive in every case. Allowing for an adhesive coefficient of 450 lb. per ton of dead weight and a maximum tractive effort of 25 to 30 per cent. of total weight—the locomotive will work out at the weight specified, and will need about 14 H.P. to drive it. The figures given are only approximately correct, but they show to some extent what the technical requirements demand.

It should be noted that before a battery locomotive can be installed in a mine it is generally necessary to obtain consent from the Mines Department, and usually when this is given a special list of conditions are stated which are best suited to the mine in which they are to work, in pursuance of Regulation 136 (*b*) of the General Regulation made on July 10th, 1913, under the Coal Mines Act, 1911, the consent is given until further order.

In one case a set of conditions stated that the electrical pressure shall not exceed 100 V, that the locomotive should be constructed of non-inflammable material with no wood except for buffers—that all cables must be protected by metallic coverings or casings—that the controller should be contained in a substantial metal case—that the equipment should include fuses or other safety devices—that all live parts should be enclosed so as to prevent accidental contact or risk of fire from excess of current arcing or sparking and that the brake shoes should be "Ferodo" lined or covered with similar material to prevent sparking; that if the batteries were charged or changed underground, it shall be done at a charging station having direct communication with the return airway, and approved by the Inspector of the Division, and such charging or changing should only be done under the supervision of a competent person. These conditions being in addition to and in substitution for any of the requirements of the Coal Mines Act, 1911, and any regulation in force thereunder as to the use of electricity in mines.

In conclusion, it might be said that opinions on weights and powers of battery locomotives differ widely with reputable manufacturers. This is clearly seen in quotations for machines of equal duty. However, the subject is one that is now of interest and may in the near future produce much in the way of data that can be used as a standard guide for the solution of storage battery locomotive problems.

Industrial Research.

At the last meeting of the North Midland Centre of the Institution of Electrical Engineers, Mr. W. Wilson's paper on "Industrial Research" was discussed. An abstract of this paper appeared in our issue of November 9th, p. 510.

Mr. W. M. SELVEY remarked that in the electrical industry much valuable development was work due to customers. Experience in actual service provided data for manufacturers to work upon. He agreed that there was difficulty in co-operation in research work, which had to be individual.

Mr. R. M. LONGMAN thought that insufficient encouragement was given to suggestions from employees. Research workers should be familiar with the worst conditions to which apparatus might be subjected. Mr. W. H. N. JAMES emphasised the value of definiteness both in working and recording results. Mr. A. F. CARTER thought it was a bad principle for the final design to rest with the drawing office, which was apt to follow stereotyped methods. Mr. DINNERMAN also referred to the need for closer co-operation between drawing office and research worker. He also thought that an organisation such as that outlined by Mr. Wilson would tend to suppress individuality. Mr. S. D. JONES thought that development was mostly a matter of common sense. The final stage of any apparatus was almost always much simpler than the original device.

Mr. WILSON, in reply, said that greater co-operation between manufacturers and supply authorities was now taking place. In one case supply authorities had co-operated in tests involving the short-circuiting of a switch across a 600 kVA generator for a whole day. He agreed that suggested improvements were often regarded with suspicion by the management and there was not enough incentive to experiment. Suggestions from the works should be encouraged, but in his experience they were often poor. It was a mistake to think that because a final product was simple, no scientific man was required. Simplicity was only attained after passing through many preliminary stages involving elimination. Relations between designer and drawing office should be close and informal. He did not agree that research factories killed individual effort. The head must gather a staff animated by keenness and initiative so that work would go on, irrespective of his presence.

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ELECTRIC STRAYS.

The Question of Leakages—An Ideal Remedy—The American Scare.

During the recent Public Works, Roads and Transport Congress, a Paper on "Electric Strays" was read by Mr. F. C. Raphael.

Mr. S. E. BRITTON (President of the I.M.E.A.), who was in the chair, said that twenty years ago a great deal used to be heard of the effect of electricity on roads, but recently that trouble had been eliminated.

In the course of his Paper Mr. RAPHAEL said that omitting leakage from telegraph and telephone circuits electric strays could be divided into three categories: leakage of return current from the rails of tramways and railways; leakages from, and faults on, electric light and power mains; leakages from electric light and power installations in buildings. In the United States of America, and also in Germany, it was found that within a few years of the introduction of electric tramways, gas and water pipes in the neighbourhood of the lines suffered considerable damage owing to electrolytic action. In this country the development of electric tramways had been retarded by Parliamentary restrictions, and when the time came for the construction of lines on a large scale information was already available as to this unexpected electrolytic action, and the Board of Trade wisely imposed regulations to limit the permissible pressure drop on the rails and the potential difference between rails and neighbouring pipes. On the whole, although a number of well-established instances had occurred, they had been wonderfully free from trouble from this source, but it would be fatal to relax the existing precautions on that account.

It was, of course, the duty of tramway and railway engineers to keep the stray current as small as possible, and the methods of doing this were well known. No cases of electrolysis had been recorded from lines with insulated returns such as the existing Underground Railways in London and the conduit or double trolley lines of the L.C.C. Tramways, and, for the present purpose, the ordinary single trolley system and single-conductor rail system, both with rail return, need only be considered. The ideal remedy would be to insulate the whole of the pipes throughout their length. This was, of course, impossible in practice, but a great deal could be done by seeing that all new mains and also all new services and joints were well bituminised outside. At the joints in the mains, however, it was on the whole best to ensure good conductance by not bituminising the interior of the socket or the spigot end of the pipe, but to let them make as perfect as possible metal to metal fit. An insulated joint was liable to promote electrolysis on the wrought iron services on one side of it, where the current flowed back to earth again. Particular points might occur, however, on tramway systems where for a local reason a definite earthing connection or an insulated joint might be desirable, but in general it would be safest to follow the broad rule of keeping the pipes as far away from the tramrails as possible, and to make the pipe system as completely as possible a good and independent conducting network. If, under such conditions, electrolysis did occur, it would be more likely to be localised at one or two definite places, and could then be more adequately dealt with.

Electrolytic damage due to leakages and faults in ordinary electric light and power mains was unlikely to occur. No cases were on record, and it would imply serious negligence on the part of those responsible for the maintenance of such networks if leakages and faults were permitted to persist long enough to cause electrolytic destruction of pipes. Leakages from electrical installations in houses had seldom done any harm to other services. If the wiring work was good, and, in the case of workshops, the Home Office Electricity Regulations were strictly observed, no trouble from electric strays need be apprehended.

Under normal conditions it was extremely doubtful whether there could be any electrolytic deterioration of ferro-concrete at all. Only three cases of electrolytic corrosion of ferro-concrete, two in Southampton and one in America, had come under his notice. In one of the Southampton cases—on the Coal Barge Jetty—corrosion occurred at points above the high water level of neap tides, and it was found that owing to a faulty electric light circuit there were 10 V difference of potential between a plate girder bridge supported on the reinforced concrete and the water below. It seemed quite reasonable to suppose that there was electrolysis here, but the second case, on the Old Extension Quay at Southampton, was doubtful, for the rails were at a potential of only 0·3 V above the steel work. The American case was that of a cold storage building in New York. In such a building a considerable amount of permanent moisture might be assumed in and upon the ferro-concrete, and there was always a liability of trouble on the electric wiring. The steel conduit carrying the wires was suspended on hooks screwed into sockets forming the steel beams, so that the ferro-concrete structure was in the direct path of the leakage current. Apparently the earthing was very bad as well as the condition of the electrical installation, for 5 V were measured between the steel work and earth, the steel work being positive to earth.

The scare as to electrolytic action on ferro-concrete started in 1906 in America, and the Bureau of Standards at Washington ultimately made a very thorough investigation into the whole subject. The main conclusion come to was that if the concrete was wet, conditions for electrolysis existed, but even then a fairly large voltage was necessary to produce it. The presence of sodium chloride or calcium chloride in the concrete even to the extent of a fraction of 1 per cent. greatly increased the initial electrolytic conductivity of the concrete, and had also the effect of destroying the "passive" condition of the iron in it. Assuming absolutely dry material nothing need be feared from electrolysis at all. If ferro-concrete structures were employed to support the rails of electric railways, there was some risk of the voltages being sufficiently high to start corrosion. Knowing this, however, it was a simple electrical problem to arrange that when ferro-concrete supports were used they should not convey any of the stray currents.

Mr. S. C. BARTHOLOMEW disagreed with the statement of the author that there had been no trouble with the Underground Railways in London where the fourth rail was used. As one of the Post Office engineering staff, he knew of three cases where cables had been damaged where they passed under the track and where the ground was moist. They had also had a number of cases where faults on electric light mains had caused breakdowns of telephone cables. It was generally the breakdown of the telephone line from electrolysis which caused the leakage to be located. In one case there was leakage from an electric main which had gone on for over six months without being discovered by the electricity supply authority. Of recent years there had been a disquieting increase in the number of cases of electrolysis which might be attributed largely to the neglect of maintenance of the tramway tracks during the war. Another factor might be the increase in the use of lead-covered cable by the Post Office. Last year they had fifty cases of electrolysis requiring attention, and this year there had been sixty. There was always the possibility with lead-covered cable that the damage might be due to chemical action, apart altogether from stray currents. The voltage tests laid down in the Ministry of Transport regulations, although they indicated where there was likely to be trouble, were not conclusive. They could, however, insulate their cables and take steps to prevent moisture getting near the mains or they could connect the cable to the rails.

Mr. W. C. P. TAPPER (Stepney) said there had been no trouble in his district, and he did not think he would have taken six months to discover a leakage, as the mains were tested twice a day.

Mr. A. WATTS confirmed the author's views as to the absence of trouble from electrolysis due to tramways running under Board of Trade regulations. In 1895, when the National Telephone Co. was laying underground cables all over the country, they measured the current which came from the tramways, and there had been no troubles.

Mr. E. WORRALL (Stratford), as a bridge builder, said that he provided against any contingency of electrolytic action by coating the ground spandrils of a bridge with asphalte.

Mr. A. C. CRAMB (Croydon) considered that if the Board of Trade regulations were carefully applied there was little risk in the case of tramways, but there was possibly a tendency on the part of those responsible for the maintenance of tramway track not to do all they should do, and possibly the Post Office suffered from that neglect. There might be some leakage occasionally from d.c. electric supply mains, but with a.c. current there was a great deal less than the Post Office seemed to fancy was the case

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CORRESPONDENCE.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

INSULATION FAILURE.

[To the Editor.]

Sir,—I would venture to suggest that in the correspondence which has taken place in your columns between Mr. Fernie and Capt. Dunsheath, point No. 3 is not admissible as evidence. The so-called partial breakdowns, in my opinion, are the result of external influences which must be eliminated, otherwise the issue is confused.

This is not the first time I have seen it stated that evidence of a partial breakdown has been discovered. Speaking from a wide experience of all classes of high voltage engineering problems and insulating materials—with the exception of cables—I am confident that so far I have never yet discovered any trace of a partial failure of a dielectric due to the electrical failure of the dielectric itself. I confine my remarks to the behaviour of a given mass of dielectric between two electrodes, and, in the case of a condenser type insulator, the whole should be regarded as made up of a series of separate concentric insulators for the purpose of my argument. I have certainly seen many times the pinhole punctures to which Mr. Fernie refers, not only on the insulation of high tension windings, but also upon the surface of tubes used to insulate conductors, at working pressures above 6 kV, where no precautions have been taken to eliminate the cause of this destructive effect. Similar results may be found on the insulation between the high and low tension windings of a transformer, except that it takes the form of a burn under oil instead of a clearly defined pinhole.

The true explanation of these pinholes or partial punctures is that, in series with the insulation itself, there is a thin film of dielectric (generally air but sometimes oil) which has a lower dielectric constant, and, in the case of air and frequently oil, a lower electric strength than the insulating material.

It can readily be demonstrated by an examination of an average case that the gradient across the thin layer of air or oil is so steep that it may break down under working pressure, and the insulating material is subjected continuously to small arcs which in course of time burn pinholes. Such a condition may lead to a reduction of the electric strength of the insulating material itself, and complete breakdown result, but to describe the pinholes as a partial breakdown of the insulating material is erroneous. The pinholes are really destruction brought about by the arcing across the thin layer of air or oil.

Leaving out the question of cables, upon which I do not feel competent to speak, in all other classes of high voltage engineering this phenomenon can be eliminated by suitable design. Failure to appreciate this point has led to difficulties in various classes of high tension apparatus as soon as the working pressure has exceeded 6 kV, and users of high tension insulating materials would be well advised to submit their problems to specialists who have made a study of such matters.—I am, etc.,

A. Collins.

Walthamstow,
December 11th.

THE FYNN-WEICHSEL MOTOR.

[To the Editor.]

Sir,—My attention has been drawn to a note under the heading "The Fynn-Weichsel Motor" in The Electrician of November 23rd, and I beg to point out that I described a similar motor before the Italian Electrotechnical Association last year (1922) at the time their twenty-seventh Congress was held in Milan in October.

In order to prove this, I take the liberty of enclosing herewith an extract of No. 26 (1922) of the journal "L'Elettrotecnica," containing the complete theory of the motor, its constructive details, the results of the trials carried out on it as a synchronous motor, as well as a rotary converter. The reprint contains sketches which make the constructional peculiarities of the equipment quite clear.

A lengthy review of this publication is to be found in "Science Abstracts, Section B, Electrical Engineers, vol. 26, Part 2, p. 58 (N.126), under the heading, "A new compensated type of autosynchronous motor, G. Sartori." I have obtained a patent (Italian Patent, August 19th, 1922) for Italy, and some Italian firms are now constructing this motor. However, I cannot pass over in silence, as I did in the publication quoted, that I ascribe to Crompton and Co., of Chelmsford, the merit of having first put in evidence (English Patent, No. 3 227, 1913) of the possibility of having a self-excited synchronous motor, by making the reaction field intervene, in order automatically to increase the voltage at the commutator brushes with the output.—I am, etc.,

G. Sartori.

Bologna.
December 7th.

[We give below an extract from the paragraphs in "Science Abstracts" to which Prof. Sartori refers :—

"Part II. describes the author's experimental compensated autosynchronous motor, the rotor of which has three slip-rings at one end and a commutator at the other, the d.c. winding being insulated from the a.c. star, and the brush position being adjustable. When in synchronism, the three phase supply feeds the rotor, the exciter of which magnetises the stator. A mathematical investigation into the functioning, power and stability of the machine is given with vector diagrams. Part III. deals with the construction and working of the machine, and gives full particulars of winding, etc., of the author's model (18 kW, 100 V, 42 periods, 4-pole, 1 260 revs. per min. In starting, the controller effects the following steps : (1) Cuts out starting resistances ; (2) closes the (rotor) exciter circuit through a resistance ; (3) by the opening of appropriate contacts the three windings of the stator are changed from parallel to series, and joined in series with exciter and its resistance ; (4) the exciter resistance is short-circuited. In Part IV. tabulated results are given of test runs, showing ranges of rocker adjustment at which synchronisation could be attained or maintained, power consumption (high at no-load), brush voltage, etc."—Ed. E.]

ROTARY CONVERTER TRANSFORMERS.

[To the Editor.]

Sir,—It is a great pity Mr. G. Berg when employing the cardboard and pilot needle method, first suggested by the present writer in the "Physical Review" for May, 1920, did not investigate the field of force between the h.t. and l.t. windings and the iron core of the transformer. Had he done so he would have found little justification for his Fig. 4 in his article which appeared in The Electrician for November 16th.

It is a strange fact that practically no internal leakage lines of the conductors carrying current are magnetically short-circuited by the iron core. The old fallacy continues to monopolise the attention of the German engineer mathematicians in particular, and is based upon a prior Arnoldian suggestion, later much employed in America and elsewhere to "calculate" skin effects and inductances of conductors in proximity to iron masses.—I am, etc.,

A. Press.

Chevy Chase.
December 6th.

OIL-FIRED BOILERS AT THE BRITISH EMPIRE EXHIBITION.

[To the Editor.]

Sir,—In to-day's issue of The Electrician are given details of the steam-raising plant to be installed at the British Empire Exhibition, and the following statement occurs :—

"In both cases the boilers will be fitted with economisers and induced draught installations, chain grate, stokers, coal meters, etc."

Does it not strike one as strange and unfortunate that no oil-fired boilers are to be installed ? The object of the whole plant is to show the most up-to-date machinery and auxiliaries, and one would have thought that liquid fuel should have had a place among this splendid collection of modern British power-station plant.—I am, etc.,

J. F. Stanley.

London, N.6.
December 7th.

Imperial Cable Extension

At the recent Imperial Conference it was stated that the All-British chain of submarine telegraph cables was to receive an important and much-desired addition in the shape of a new cable from Turks Island to Barbados, whence it would bifurcate to Trinidad on the one hand and to British Guiana on the other. The total length of new cable amounts to 1 700 nautical miles and the order has now been placed with Siemens Brothers and Co., Woolwich, who have contracted to manufacture and lay the cable next summer.

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ELECTRICAL CHRISTMAS PRESENTS.

Further Profitable "Last Minute" Gift Suggestions for Electrical Dealers' Christmas Sales Offensive.

L. G. Hawkins and Co.

"Universal" table and domestic appliances, "Miller" table standards and high-frequency apparatus are the principal items in the list of L.G. Hawkins. A suitable gift is the electric curling iron and comb, and again there is a nickel-plated toaster (Fig. 4), opposite, in which the bread can be turned without being touched by the fingers. We should omit an important item if we neglected to mention the Grecian pattern electric coffee urn set, which we illustrate in Fig. 1.

The Hotpoint Electrical Appliance Co.

The Hotpoint Electrical Appliance Co. have taken considerable trouble to help the retailer to increase his turnover in "Hotpoint" and "Falco" appliances, and they are now supplying window decorations and price tickets with the slogan, "Another Hotpoint Servant." For the gift-seeker the company offer domestic irons, adaptable voltage irons, radiant grills, immersion heaters, kettles, coffee percolators, teapots, toasters, bowl fires, and, to close a very incomplete list, the "Premier" and the "Handyvac" vacuum cleaners. The Hotpoint tea kettle, which we illustrate in Fig. 2, will doubtless attract many Christmas gift buyers, as will the boudoir utility set and the immersion heater. Mother will be delighted with the Hotpoint coffee percolator illustrated in Fig. 8.

The Ashley Wireless Telephone Co.

If there is one favourable opportunity in the year when high priced wireless receiving sets can be sold it is now, and it is for this reason that we commend to the notice of retailers the higher priced sets of the Ashley Wireless Co., the marketing company for the wireless products of the Automatic Telephone Co. Our illustration (Fig. 3) is typical of what we have in mind when we refer to higher priced sets. It is the Ashley W124; admittedly an ambitious item to put in the merchandising programme, but one which should pay handsomely.

Partridge and Cooper.

As a gift for the mere man, the range of "Emeralite" desk lamps marketed by Partridge and Cooper should be in popular demand. In Fig. 7, we illustrate a moderate priced standard, most suitable for a flat top table, and the needs of those who have a roll top desk are served by another design. "Emeralite" standards have all those attributes which go to make up a suitable gift—quality, design, and finish, coupled with a moderate price.

The British Thomson-Houston Co.

Of the host of seasonable goods offered by the British Thomson-Houston Co., the following deserve special consideration: Toy transformers, bell transformers, "all-nite-lite" transformers, "Tungar" battery chargers, "Eye-restolite" floor and table units, "Luxor" fittings, a range of wood fittings, a distinctive range of crystal cut-glass shades, shades in glass with a parchment effect, cut glass table standards and candle sticks. We illustrate (Fig. 5), the toy transformer, which will gladden the heart of the growing boy, and will appeal to father as a change from the average trumpery toy or plaything which he usually wastes his money on. To describe this small transformer as a "toy" transformer is unfortunate, for it is a thoroughly sound piece of electrical apparatus which, the manufacturers say, gives a safe and constant supply of electricity for the operation of any electrical toy. The bell transformer, another item in the range of small speciality transformers, can be suggested as a gift for the older boy perhaps. Nothing delights a boy more than to have the correct workings of the bell circuits under his charge, and he will be a happy lad if he can have one of these small bell transformers to instal. The "Tungar" battery charger manufactured by this company can be suggested to the father who desires to make his son a more expensive gift. Owing to the price reductions announced by the B.T-H. a 2A size can be sold at £7 10s. and the 5–3A size at £10. The "Tungar" will also be of interest to those who plan to make a collective present to the father who owns a car. In the "Eye-Restolite" unit the retailer has a novelty device which must appeal to the man who desires to make a gift that has both artistic merit and home comfort combined, and the "Luxor" fitting will at once strike the imagination of a husband as a perfect gift. It is hard to imagine a more tasteful gift than one of the wood fittings which this company manufacture. The floor standard (Fig. 6) can be supplied in mahogany or walnut.

British Electric Transformer Co.

It is difficult to imagine anything more suitable as a Christmas present for a housewife than a highly finished hot plate for her table. "Tricity" appliances have, to a great extent, set the standard for high finish, which is the note of practically all electric tableware sold in this country. The No. 563 hot plate which we illustrate (Fig. 9) is manufactured by the British Electric Transformer Co. Finished in nickel plate and listed at 47s. 6d., it will appeal on the score of price, finish and utility.

Metropolitan-Vickers Electrical Co.

We understand that the plan of the Metropolitan-Vickers Electrical Co., to secure a large share of Christmas gift business, is to issue an attractive list which the trade can distribute; the publication will almost coincide with the appearance of these notes, and the "Cosmos" radiant fire with which all are so familiar will be included. The list will also include a table kettle of very pleasing design which we illustrate in Fig. 10. This kettle has a capacity of two pints and can be supplied either in polished copper or nickel plate. A further gift suggestion is a cast bronze table standard with a well matched silk shade.

Automatic Telephone Manufacturing Co.

This company has such a wealth of merchandise which a retailer can offer for Christmas, that it would seem rather invidious to make distinctions. There is, for instance, a range of fires, including the popular bowl fire, toasters, kettles, boiling plates and, lastly, the vacuum cleaner, which cannot fail to make an appeal as a gift for a housewife. Although lack of space precludes detailed reference to the many lines available, mention must be made of the "Xcel" vacuum cleaner, one of the few cleaners actually made in this country. Another good "Xcel" line is the No. 1 iron with thumb rest, which sells, complete, at 16s. for the 3 lb. size. The variable voltage tourist iron, previously referred to in these columns, is also worthy of notice. The list which the company has just published can truthfully be described as a *vade mecum* of Christmas merchandising. Particularly useful is the table included on page 2 giving the cost per hour of operating domestic appliances at rates ranging from ½d. to 6d. per kWh at various loadings.

The Ever Ready Co.

"The Ever Ready portable electric lamps are the most seasonable of all gifts and always appreciated. . . ." So states the preface to an attractive booklet issued by the Ever Ready Co. (Gt. Britain), Ltd., describing their range of portable pocket lamps, hand lamps, bicycle lamps, and the like; these booklets can be supplied to retailers overprinted with their name and address. Ever Ready specialities are so well known that it is not necessary to comment on them at any length, but reference may be made to the "Ever Ready" Christmas tree decoration outfit. Two separate sets are offered, one being suitable for voltages between 100 and 130, the other being suitable for voltages from 200 to 250. The figures include apples, pears, monkeys, parrots, dogs, and clowns, and if the set is put on circuit on a Christmas tree in the showroom no father will be able to resist the temptation to buy one. The bulbs are mounted into porcelain miniature screw holders wired for burning in series.

Ingram and Kemp.

Sixteen shillings is the price asked for a useful gift, the "Spersom" adjustable lamp, manufactured by Ingram and Kemp. Each lamp is packed separately in an attractive carton, which is in itself a sales help. The specification of the lamp includes heavy cast brass base, strong knuckle joint, brass reflector enamelled white inside, push bar switch lampholder, twelve feet of flexible and a bayonet adapter. The standard finish is antique brass, and at the price named it should sell well during the Christmas season.

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FIG. 1.—BY L. G. HAWKINS AND CO.

FIG. 2.—BY THE HOTPOINT ELECTRICAL APPLIANCE CO.

FIG. 3.—BY THE ASHLEY WIRELESS TELEPHONE CO.

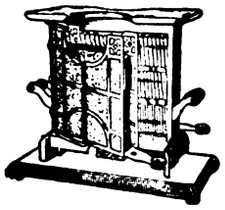

FIG. 4.—BY L. G. HAWKINS AND CO.

FIG. 6.—BY THE BRITISH THOMSON-HOUSTON CO.

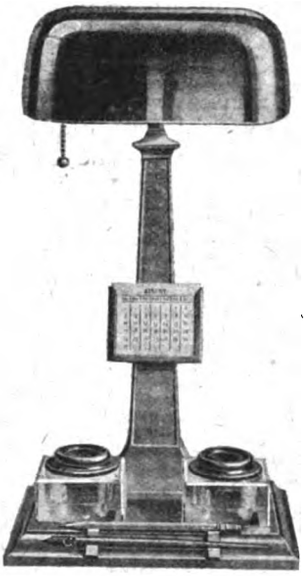

FIG. 7.—BY PARTRIDGE AND COOPER.

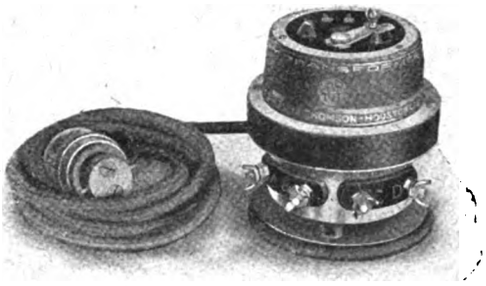

FIG. 5.—BY THE BRITISH THOMSON-HOUSTON CO.

FIG. 8.—BY THE HOTPOINT ELECTRICAL APPLIANCE CO.

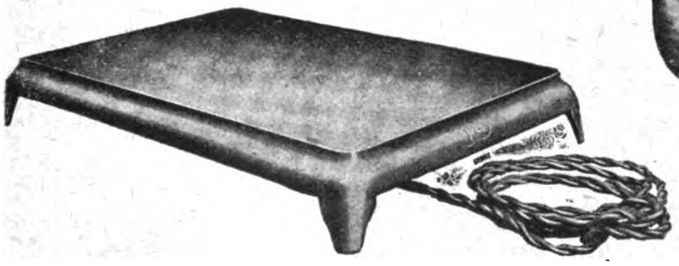

FIG. 9.—BY THE BRITISH ELECTRIC TRANSFORMER CO.

FIG. 10.—BY THE METROPOLITAN-VICKERS ELECTRICAL CO.

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NEWS IN A NUTSHELL.

Electric lighting is to be installed in Lithuanian railway trains by a French firm.

The electric railway linking up Mexico City with Vera Cruz will be opened next month.

On one day last week foreign electrical goods valued at £4 030 were imported into London.

Electric radiators are being hired out by Glasgow Corporation, at from 10s. 6d. to 18s. 6d. per annum.

"Instal a telephone" is the advice printed on inland telegram forms by the Irish postal authorities.

The Saxon textile industry is making increasing use of special electric motors on spinning machines.

"The best 'general'" is the description applied in a newspaper advertisement to an electric cooker.

Three workmen at the West Ham (London) power station were burned last week as the result of a short circuit.

A hydro-electric plant erected by Americans at Sivasamudram, Mysore State, is run by Indians trained by the erectors.

Skidding in Meta (not Meter) Street, a motor lorry belonging to Blackburn Corporation Electricity Department, knocked a gas lamp down.

A canary yellow tinted glass substituted for the ordinary glass in miners' electric safety lamps is likely, the Ebbw Vale Co. thinks, to reduce the incidence of nystagmus.

By using 129 floodlighting projectors, with a total illumination intensity of 20 000 000 candle power, the new 26-storey Wrigley building in Chicago can be seen fifteen miles away.

Further electric vehicle trials will be held in France, probably at the end of September. Details may be obtained from the Union des Syndicats de l'Electricité, 25, Boulevard Malesherbes, Paris.

A torch-like tube which can be held in the hand, and by which X-rays can be focussed locally without exposing the operator to the beams, is said to have been perfected by two Dutch radiologists.

The Board of Trade Returns for November show that exports amounted to £65 768 155, a decrease of £722 629 compared with November, 1922. Imports were £101 584 990 an increase of £6 028 338.

Not only does Lawrenceburg, Tennessee, secure its street lighting and water for protection from fire without charge, but the profits from the municipal hydro-electric plant have paid off the old floating debt of the community.

Burnley Town Council has negatived a proposal to accept a London firm's tender for advertising on local tramcars for a period of ten years at £1 500 per annum, as the appearance of the cars would be spoilt by advertising notices.

The "A. Mackenzie," the new sea-going dredge of the U.S. Engineering Corps, uses electricity for every possible purpose from propelling the ship to blowing the syren. She is said to be the largest vessel to use the Diesel-electric drive.

Two Devonport men are reported to have invented an electrical device which would enable the doors of railway carriages to be controlled from the engine of the train. It is claimed that the device could be applied to house doors.

At the annual dinner of the Electrical Power Engineers' Association (South Wales Section), last Saturday, Mr. W. J. Oswald said the great work before the Association was to make the industry of the greatest possible benefit to the whole of the community.

Electrical energy developed from Niagara Falls on the Canadian side will cost five times as much as the same power developed on the American side, according to the Toronto "Financial Post." The difference is attributed to the greater expense of public ownership.

Battery transport at the British Empire Exhibition is being discussed by the Electric Vehicle Committee of Great Britain with the E.D.A., and the Electric Vehicle Manufacturers' Association. The Committee proposes to appoint a paid official for electric vehicle propaganda work.

At a Ministry of Health inquiry into Warrington Corporation's proposal to purchase electric vehicles for refuse collection and a battery charging plant, the Inspector congratulated the borough electrical engineer (Mr. F. V. L. Mathias) on hearing that the battery charging would only cost 1d. per kWh. It was the first time since the war he had heard of a penny charge.

New three-ton electric cranes are to be installed at King's Dock, Swansea.

Nearly all Venezuelan cities and towns have electric light and power undertakings.

A new telephone exchange has been opened in the Camelford district of North Cornwall.

The September output of American central stations was 12·9 per cent. above normal.

A doll's house with complete electric lighting installation is a feature of a London store's Christmas display.

January 15th has been chosen as the date for the annual dinner of the Electrical Contractors' Association.

Electric locomotives for local and goods traffic on the French railways are being constructed at Budapest and in Switzerland.

Lancashire electrical machinery manufacturers report a quiet and steady demand with a number of small home and overseas orders.

Porcelain insulators and electric cables are among the goods exempted from a new Norwegian tariff increase of 79 per cent on prevailing rates.

"Electricity has done more to brighten Christmas for the mass of people than anything else that has ever happened."—"J. M." in "The Graphic."

The first volume of the General Report on the Inquiry into Production, undertaken by the International Labour Office has now been published in French.

In the face of world competition, a firm of British engineers is said to have secured the contract for the largest electrical excavator ever built in this country.

American exports of electrical goods during October, at $6 035 410, show an increase of $912 120 over October, 1922 and of $109 881 over September, 1923.

The Nobel Prize presentation took place at Stockholm on Monday. Dr. R. A. Millikan, who was awarded the prize for physics, was not present at the ceremony.

The refusal of increased pay to the administrative and clerical staffs in Viennese electrical works is said to have resulted in a lock-out of the manual workers.

Bath's Corporate Property Committee has shown great reluctance to grant the applications of a number of traders for permission to fix electric signs on their premises.

A strike of municipal electrical workers was (it is reported) averted at Aberdeen on Monday this week, the Electricity Committee agreeing to an immediate increase in wages.

Negotiations are being conducted by the F.B.I. with the electrical industry for the production of a film to complete the series of films depicting "Our National Industries."

At an inquest on Monday, the coroner suggested that electrical apparatus should invariably be used to inform signalmen of the position of trains during foggy weather.

Electricity is to replace steam for driving the cargo oil pumps on the new 12 800-ton tanker, the "Mexico," which is building in Norway. The vessel will, in fact, be an "all electric" one.

Demonstrations of industrial and shop lighting effects were given by Mr. Millner, illuminating engineer of the British Thomson-Houston Co., last Friday to members of the Junior Institution of Engineers.

An interesting "lot" in a London property sale yesterday (Thursday) was the rights under an agreement to take a supply of electrical energy for lighting a block of premises. The revenue of the estate under this agreement exceeded £1,500 last year.

In Canada (the "Times Trade Supplement" states) the total output of electricity amounts to 683 kWh per head of the population, a figure which is exceeded only by Switzerland, where the output is 700 kWh. The figure for the United States is 472 kWh.

In the hope that a knowledge of the salinity of sea water may help in determining the approach of icebergs, the U.S. Bureau of Standards has developed a new device by which the electrical conductivity of sea water can be measured in a simple manner said to be quicker and more convenient than the chemical titration method.

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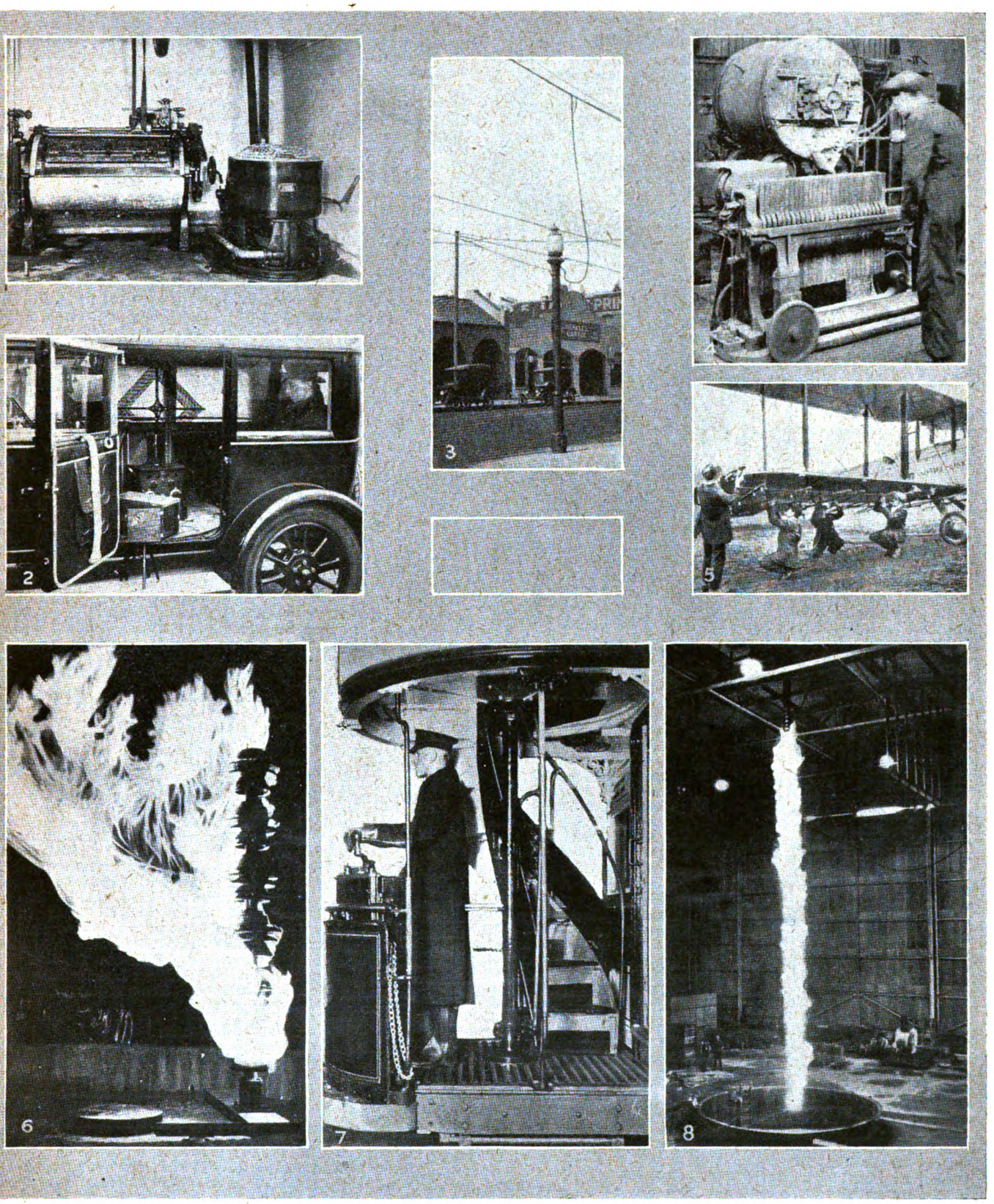

ELECTRICAL NEWS IN PICTURES.

1.—Electric washer and clothes wringer at the Wycombe Memorial Hospital, opened last Sunday. ("Electrician" photo.)

2.—This photo shows the progress that has been made in the adaptation of wireless to the motor car. (p. 675.)

3.—A method adopted in California for feeding lamp-posts from an overhead circuit strung on the trolley span-wires. A two-core cable enters the posts through a porcelain bushing near the top.

4.—A new electric rotating furnace built by a Sheffield firm.

5.—Fixing an electrically illuminated sign to the underside of an aeroplane, the latest British advertising development. (p. 678.)

6.—Taken with a quartz lens this photo shows a flash over of 800 000 V at the High Voltage Laboratory of the Westinghouse Co. at Trafford City, Pa. (p. 679.)

7.—Devised by a member of the London Metropolitan Electric Tramways staff, this reversible staircase effects a considerable saving of time in taking up and putting down passengers.

8.—A 42 ft. arc; claimed to be the longest controlled arc ever made. One million volts were necessary to flash this arc. (p. 679.)

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LEGAL INTELLIGENCE.

B.T.-H. Patent Litigation.

On the further resumption in the Chancery Division of the case of the British Thomson-Houston Co. *v.* British Insulated and Helsby Cables, on November 30th, Mr. H. Ballantyne, in re-examination, maintained that, given an appropriate temperature, worked tungsten behaved more or less like ordinary metals.

Further evidence was given by Mr. Augustus Charles Hyde, managing director of the Vactite Wire Co., of Acton, who manufacture accessories for electric lamp manufacturers. He stated that he had experience of drawing many kinds of wire and the processes used by his firm were common to the trade. The hardest kind of metal which he had made into wire was platinum iridium, which was exceedingly brittle in the cold. This metal was run into sizes by hot rolling through grooved rolls. He knew that an alloy of that nature which was too brittle to be worked cold could only be worked hot. Cross-examined, witness admitted that he was not a lamp maker and had never made a tungsten lamp.

The hearing was resumed on December 4th, when evidence was given by Mr. John Vincent Pletts, a member of the Institution of Electrical Engineers and a Fellow of the Institute of Chartered Patent Agents. He considered that the 1906 specification described an invention for working tungsten hot and for making use of its ductility while hot. There was sufficient description of the invention to enable it to be carried into effect. He had followed what he understood to be the instructions and had drawn tungsten wire by that method. Cross-examined, he said he had no detailed knowledge of the steps of working the metal before the date of that litigation.

Dr. Oberlander was recalled and the evidence was concluded.

Replying on behalf of plaintiffs on December 6th, Sir Arthur Colefax submitted that both the 1906 and the 1909 specifications must be read in the light of the discovery each of them referred to and which, after all, must be the basis of any process. It was important to get a clear conception of what was the discovery stated to have been made in each document in order to appreciate rightly how different they were. One discovery was that by heating alone remarkable molecular changes were produced which gave to tungsten, when hot, a ductility comparable with that of other ductile metals, whereas the 1909 specification described quite a different discovery, which was that if they obtained a sufficient temperature permitting the working of tungsten they induced a fibrous state and with it ductility.

At the conclusion of counsels' speeches on December 7th his Lordship said he would give judgment at some future date.

Electric Fan Dispute.

In the Mayor's and City of London Court, on December 7th, before Judge Shewell Cooper, The Times Electric Co., 140A, Queen Victoria Street, London, E.C., sued E. and E. Gates, Ltd., Arcade Street, Norwich, for £10 4s. 1d. for electric fans supplied. Mr. Atkins, for the plaintiffs, said the claim was for four electric fans at 50s. each and 4s. 1d. for the box in which they were packed. The defence was that the goods were not delivered to time. Then the defendants said the fans were not of standard finish and that they were of incorrect capacity. On July 12th plaintiffs' traveller Brenner saw the defendants' manager Booth, who asked the plaintiffs to despatch them six fans of 220 V each. Brenner told Booth he would do his best to get them off that day by passenger train. As a matter of fact he thought they had the fans in stock and they had not. The next day the plaintiffs' manager got the fans and despatched them by motor van. Defendants said they did not arrive until some time after July 16th.—Mr. Tooth, for the defendants, said the fans arrived on July 18th by goods train and by that time the heat wave was at an end.—Continuing, Mr. Atkins said that on July 16th the defendants wrote that as indifferent weather had set in they would not unpack the fans. If the hot weather continued they would endeavour to sell the fans for the plaintiffs. Plaintiffs explained that they were overwhelmed with orders and that the orders were executed in proper rotation; they would have been willing to take back the goods if the defendants had returned them. On July 30th plaintiffs wrote and said that as the fans had not been returned they presumed they would keep them. On August 22nd defendants returned four of the five fans. Now defendants said that as the fans were not up to the standard and one was of 100 V instead of 220 V it had caused great trouble to their customers. Credit was passed for the fan returned not to order. When the fans were returned they were badly damaged, the guards and blades being badly bent owing to bad packing. The defendants maintained that they had been packed in a proper manner.

Mr. Arthur Booth, manager of the defendant company, said he gave the order on the condition that the fans would be despatched the same day by passenger train. On the 16th they wrote saying that, although the fans were not delivered as quickly as promised, if the hot weather should continue they would endeavour to sell some for plaintiffs. On July 18th five fans were received, three of which went out to customers a few days after. There were complaints from the customers who had received the machines which he sold on behalf of the plaintiffs. Eventually four machines were returned to the plaintiffs on August 27th. In the whole course of his experience he had never seen fans marked with the voltage on the bottom base plate. The mark was usually on the identification plate on the top of the fan. The fans had not the appearance of being new goods when they arrived.—Mr. Tooth, for the defendants, submitted that the plaintiffs had to satisfy his Lordship that the property in the four fans had passed to the defendants before being entitled to recover the price.—The Judge said that on July 16th defendants had the right to reject the goods.—Mr. Tooth said the plaintiffs then sought to place upon the defendants an obligation to pay carriage and return the goods, which was contrary to section 30 of the Sale of Goods Act. Under section 13 of the Act there was an implied condition that articles should answer the description and it was for the plaintiffs to show they had delivered goods in accordance with the contract. Chalmers, in a note under section 35 of the Act dealing with conditional acceptance, said where there was a sale by description, and non-compliance was not found out until after dealing with the goods, there was only a conditional acceptance and the purchaser was entitled to reject when it was found out. The defendants regarded the matter as one of importance even though there was only £10 in dispute.—The Judge held that though the defendants were justified in rejecting the goods they had waived that right and dealt with the goods. Inasmuch as the sale was by description he was not justified upon the evidence in holding that the goods supplied by the plaintiffs did not answer the description. Under the circumstances he gave judgment for the plaintiffs for £10.

A Deal in Electric Cable.

In the Shoreditch County Court, on Tuesday, before Judge Cluer, the Electric Lamp and Supplies Co., of 73, Newman Street, London, W., sued Thomas Kelly and Nat Tarshis, formerly trading as Kelly and Tarshis, of 5, High Street, Shoreditch, electricians, to recover £44 17s. for cable supplied in March. There was a counterclaim by the defendants, in which they stated that they ordered 15 miles of cable, 10 miles of $\frac{3}{4}$ at £5 12s., and 5 miles at £10 a mile, which the plaintiffs did not deliver. They had sold the cable at £7 1s. 5d., and £12 5s. respectively, and owing to the non-delivery they had to purchase it in the open market at £8 4s. and £12, and the loss to them exceeded the plaintiffs' claim, and they counterclaimed £50. When the case was called on, Mr. Coumlie, for the defendants, applied for an adjournment owing to the illness of Mr. Kelly. Mr. Willis, for plaintiffs, objected on the grounds that on November 8th, when the case was first down for hearing, both the defendants were ill in bed. This was a case where his clients were being kept out of £44 odd, to which there appeared to be no defence. Judge Cluer agreed that there appeared to be no defence to the claim, but there was the counterclaim, and if only 14 miles 1 125 yards were supplied, the counterclaim would be good. The plaintiffs could have their judgment, and a day could be fixed for the counterclaim. The defendants would have to pay all the costs.

OBITUARY.

F. Wheeler.

An old member of the staff of the Chester Electricity Department, Mr. F. Wheeler, died at Chester last week. He had been associated with the electricity undertaking over 27 years.

Sir W. Mackenzie.

The death is reported from Ottawa of Sir William Mackenzie, aged 74 years, the founder of the Canadian Northern Railway and one of the real "builders" of Canada. In association with Sir Donald Mann he linked up distant cities with railways, provided electric tramways and electricity supply undertakings in many Canadian towns, and controlled the tramway and power undertaking at Saõ Paulo, Brazil. Knighted in 1911 Sir William was President of the Monterey Railway, Light and Power Co. and the Toronto Railway Co., chairman of the Brazilian Traction Light and Power Co., and the Rio de Janeiro Tramway Light and Power Co., and a director of the Canadian General Electric Co., the Canadian Radio Corporation and other companies.

A. S. Hughes.

We regret to record the death, which took place at Sealladhmohr, Crieff, on December 2nd, of Mr. Arnold Strangman Hughes, formerly chief engineer at the Falkirk Corporation Electricity Department. A native of Dublin, where he received his education in the Royal College of Science, Mr. Hughes served his apprenticeship of five years with Ernest Scott and Mountain, Ltd., Newcastle and Gateshead. On the completion of his apprenticeship he was appointed assistant to the firm's outside superintendent, and in that position he had to do with the electrification of a large number of collieries, the equipment of electric power houses, and the application of electricity to many classes of industry. After two years on the staff of the Newcastle firm, Mr. Hughes went to Falkirk in 1906, and entering the service of Carron Company as electrical engineer, he was responsible for the electrification of the company's works, collieries, etc. He became an associate member of the Institution of Electrical Engineers in 1912. In 1917 he was appointed chief engineer at the Electricity Works, Falkirk, and continued in the service of the Corporation until February of this year, when he was compelled to resign his position on account of failing health. In his capacity of chief engineer at Falkirk he undertook the carrying out of recent extensions which were to consist of the installation of a boiler and a 1 500 kW turbo-alternator. Owing to the state of his health he was unable to see this extension completed. He is survived by his widow and a young family.

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PERSONAL GOSSIP.

New graduates of the Institute of Transport include Mr. W. A. J. Clark and Mr. A. W. Groom, both of the London Underground Railways.

Mr. P. P. Wheelwright, Blackburn's electrical engineer, was one of the M.C.'s at the Infirmary Ball which opened Blackburn's social season last Friday.

Mr. T. Smith of the Newcastle-on-Tyne Electric Supply Co., has been appointed assistant distribution engineer at the Chester Corporation Electricity Works.

Sir Charles Eves, who has just been appointed chairman of Mappin and Webb, Ltd., and its subsidiary companies, is a director of the Sunderland and District Electric Tramways, Ltd.

The staff at the Stockport Electricity Works has presented a gold watch to the chief engineer, Mr. R. Lomax, who has completed 21 years' service. Mrs. Lomax was given a solid silver dinner service.

Miss E. L. Winterton, who has been made the first woman associate member of the Institute of Railway Signal Engineers, is employed in the Signals Department of the Great Western Railway Co. at Reading.

We understand that Mr. Percy W. Davis has resigned the position of engineer to the Cable Accessories Co., Tividale, Tipton, Staffs., which he has held for the past nine years. Mr. Davis has now joined the Credenda Conduits Co. as general manager.

Sir William Forbes, who has retired from the general managership of the Brighton Section of the Southern Railway, a position which he has held since 1899, was associated with the introduction of electric traction in the London area of the Company's system.

Dr. Edmund Knowles Muspratt, formerly a director of the British Insulated and Helsby Cables, Ltd., the Electric Supply Company of Victoria, and the Midland Electric Corporation for Power Distribution, who died on September 1st last, left £438 466, with net personalty £430 744.

We hear that Mr. A. J. Rayment, head of the technological books department of Sir Isaac Pitman and Sons, is severing his connection with them at the end of the year. Pending other arrangements any communications of a personal character may be sent to him, c/o Mr. Theodore Stevens, 50, Lincoln's Inn Fields, London, W.C.2.

Mr. A. E. Val Davies, who has been associated with the Pretoria Portland Cement Co. during the past few years as consulting electrical engineer, has now opened offices at 77 and 79, Winchester House, Loveday Street, Johannesburg, where he intends practising as an advisory engineer and specialist in power plant. Mr. Val Davies retains his connection with the Cement Co. in an advisory capacity.

Sir John Rumney Nicholson, who, following the formation of the London and North Eastern Railway group, was appointed chief engineer for docks of the North Eastern area, including Immingham and Grimsby, and consulting engineer in respect of the whole of the docks of the amalgamated companies, was resident engineer in charge of the erection of the first generating station of the Newcastle-on-Tyne Electric Supply Co. at Pandon Dene in 1889.

Mr. R. H. Houghton, who has retired from his position as chief electrical engineer of the Brighton Section of the Southern Railway, entered the London and Brighton Co.'s electrical department in 1893, having charge successively of the electric train lighting, telegraph and electric light and power work. It will be recollected that his father was telegraph superintendent and chief electrical engineer for many years, and in 1909 Mr. R. H. Houghton succeeded him in that capacity. He was also responsible for the maintenance of the single-phase electric traction equipment designed by Sir Philip Dawson.

The Council of the British Cast Iron Research Association has, we understand, appointed Mr. J. G. Pearce, of the laboratory staff of the Metropolitan-Vickers Electrical Co., Manchester, as director of research in succession to Dr. Percy Longmuir, who relinquished the position some time ago. Mr. Pearce, who is 33 years old, is an associate member of the Institution of Electrical Engineers and a member of the Institute of Metals, and has rendered good service on the Council of the Non-Ferrous Metals Research Association. He received his training at Birmingham University and has been engaged for several years at the Metropolitan-Vickers works in a special study of non-ferrous metals and in electrical work. He is the author of "Works Training" and joint author with Mr. Fleming of a book dealing with the organisation of research.

Sir Alexander Kennedy, who has been asked by the organisers of the World Power Conference to read a paper on "The Application of Electrical Energy," is senior partner in the firm of Kennedy and Donkin, civil engineers, of Westminster. He is, perhaps, best known for his association with University College, London, for from 1874 to 1879 he was its Professor of Engineering, and during that time established the first engineering laboratory there. He has designed electric power stations in Edinburgh, Manchester, Loch Leven, Calcutta and Japan, and has been chief engineer to the Westminster Electric, Central Electric and St. James's and Pall Mall Electric Supply Companies, as well as consulting electrical engineer to the London and North-Western Railway, the London and South-Western Railway, and the London County Council Tramways, and is, of course, still chairman of the Electric Railway Advisory Committee of the Ministry of Transport.

WIRELESS CHAT.

Vocabulary and Definitions Issued by the B.E.S.A.

The British Engineering Standards Association has issued a list of terms and definitions used in radio communication. This forms one section of a vocabulary of terms and definitions used in electrical engineering which will be published shortly.

The present list contains definitions of about 170 terms in general use. Owing to the rapid growth of the subject it is not possible to include every term used in connection with radio science, but such new terms as survive will be incorporated in future revisions of the list. Where the same definition applies to more than one term, the term recommended for general use is printed in bold type, the other terms being given in lighter type as synonyms of the preferred term. In this way the committee responsible for drawing up the list hope to encourage uniformity in the matter of nomenclature, a step which is specially desirable in the case of such a rapidly developing science as radio communication. Copies of this publication are obtainable from the B.E.S.A. Publications Department, 28, Victoria Street, London, S.W.1, price 1s. 2d., post free.

Difficulties of Broadcasting.

At a meeting of the T.O.T. Radio Association at Chelsea, on Tuesday, highly instructive and yet amusing lectures were given by Prof. A. M. Low and Capt. P. P. Eckersley, chief engineer of the British Broadcasting Co. Referring to the trials and tribulations inseparable from broadcasting in this country under the existing arrangements, Capt. Eckersley mentioned that many people situated practically under the aerial of their local station complained that they were unable to hear distant stations with the cheapest apparatus. By erecting a large number of relay stations all over the country the B.B.C. hoped to satisfy this desire for distant reception. Dealing with advances made in the application of a combination of wireless and telephony he thought that at no very distant date items sent out from the other side of the world would be heard distinctly anywhere in the British Isles on "a lump of sugar." Dealing with the prevention of "jamming" Capt. Eckersley pointed out that development in this direction was seriously hampered by obsolescent spark stations at sea. Much work was being done on the problem of producing a really good loud-speaker, and he hoped that something near perfection might be forthcoming in about a year's time.

Prof. Low dealt in a popular manner with the transmission of pictures by wireless and with some of the possibilities of television.

Wireless and Motor Cars.

We reproduce on our picture page this week a photo showing the progress made in adapting wireless to the motor car, a feature which is bound to be of great importance in future. The new portable "Amplion" loud speaker—which is readily stowed away—is used, while the 13.9 h.p. Standard saloon car which has been used is particularly suitable for accommodating radio sets owing to the large amount of room between the front and rear seats. A frame aerial is employed on a small four-valve set, and we understand that excellent results have been received at some distance from broadcasting stations on the loud speaker shown in the photograph. There should be a big future for wireless in the motor car, and next spring and summer should see a tremendous increase in apparatus specially designed for this purpose.

Amateur Transatlantic Wireless.

Last week-end a British amateur, Mr. J. A. Partridge, of Wimbledon, succeeded in getting into touch with Mr. Warner, the Secretary of the American Radio Relay League, both stations using very small power for so great a distance. During the early hours of Monday morning the two stations again got into communication in both directions, and Mr. Warner transmitted several messages from America, one of which was addressed by Mr. Hiram Percy Maxim, President of the American Radio Relay League, to Admiral of the Fleet, Sir Henry Jackson, who last year was President of the Radio Society of Great Britain.

Wireless News in Brief.

Direct wireless communication has been established between Fiume, Rome, Belgrade, Budapest and Vienna.

Courses in home study by wireless broadcasting are being inaugurated at Columbia University, New York, this week.

Wireless installations are to be allowed in London elementary schools provided that the Education Committee is called on to pay the cost of the licences only.

In Paris wireless is being installed in cafés, cinemas, and hotels on the "penny-in-the-slot" system. A coin dropped in the slot instantly brings music or other entertainment to the listener.

Lord Macclesfield, who is interesting himself in the installation of wireless apparatus in village clubs, has offered to supply clubs in the Oxfordshire County Union with advice and information on the subject.

At the last meeting of the Radio Association of Ireland held in Dublin, Prof. W. J. Lyons presiding, Mr. J. J. Dowling read a paper entitled "Facts about Frequency." A programme of papers has been arranged up to April next.

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ELECTRICITY SUPPLY.

Extensions and Developments.

Wimbledon Council has decided to instal a new 3 000 kW turbo-alternator.

Bury (Lancs) Town Council has decided to apply to the Electricity Commissioners for a loan of £70 000 for electricity purposes.

Owing to a large demand for electricity in the King's Langley district, Watford Town Council has decided to erect a sub-station there.

Reigate Town Council has received sanction to a loan of £15 000 in respect of plant at the electricity works, this being on account of £26 000 applied for.

Burnley Electricity Committee has invited representatives of Padiham Council to meet it with a view to completing negotiations for the supply of electrical energy to Padiham district.

Burnley Electricity Committee has decided that it cannot accede to the terms on which Accrington Corporation would be prepared to supply Burnley with electricity in bulk. A sub-committee has been instructed to continue negotiations and report.

Maidstone Town Council has received sanction to a loan of £2 752 for extending the mains in Loose Road to the borough boundary. The following loans have been applied for:—£1 000 for apparatus to be let on hire; £6 000 for mains; £4 000 for house service connections; and £2 000 for transformers and switchgear.

Blackburn Town Council has approved an estimate amounting to £32 000 for additional cables, material, etc., in connection with the laying of a second set of trunk feeders between Whitebirk generating and Jubilee Street distributing stations. Application is to be made for a grant from the Unemployment Grants Committee.

Manx Local Government Board last week considered an application by the Douglas Corporation for borrowing powers for £45 000 for the extension of the local generating station, £15 000 of it being required for new plant. Owners of property adjoining the power station appeared and alleged that the vibrations set up by existing machinery had caused damage to property, and if actions now pending succeeded the expenditure proposed by the Corporation would become abortive. The Local Government Board reserved its decision.

Inquiries and Orders.

The application of the Clyde Valley Electrical Power Co. for a Provisional Order authorising the raising additional capital, conferring further powers in regard to the acquisition of lands, extension of area of supply to the parishes of Avondale, Lesmahagour, Douglas, Carmichael, Covington, Culter, Biggar, Pettinain, Libberton and Symington, in the County of Lanark, the parish of Inverkip, in the County of Renfrew, and the parish of Row, in the county of Dumbarton, etc., will be lodged at the office of the Secretary for Scotland, Whitehall, London, by December 17th, and a copy of the draft order will be deposited at the Private Bill Office of the House of Commons.

Hemsworth (Yorks) Rural Council has decided to apply to the Electricity Commissioners for a Special Order authorising the Council to supply electricity within the Council's area.

Blackpool Electricity Committee is applying to the Electricity Commissioners for a Fringe Order authorising the Corporation to supply electricity to premises in the Thornton Council district.

Weybridge Urban Council has received from the Electricity Commissioners a communication intimating that the Commissioners do not think that any useful purpose will be served by the Council again taking up the question of charges for electrical energy supplied by the Urban Electric Supply Co.

It was reported in Belfast last week that the Bann power scheme will not be proceeded with at the moment, and therefore the Bill will not be presented in the forthcoming session of the Northern Ireland Parliament. At a meeting of the Newry Harbour Trust last Friday, it was decided that representatives be sent to a proposed conference of public bodies for concerted action against the North-East Electricity Bill.

Barnoldswick Council has decided to submit to the Electricity Commissioners objections to Barnoldswick being included in the area of the proposed Joint Electricity Authority for the West Riding (Aire and Calder) District. The Council submits that the natural source from which to draw a bulk supply of electricity, both from a geographical and economic point of view, for Barnoldswick is the Mid-Lancashire district. Negotiations are already taking place for a bulk supply of electricity to the district from Nelson, the Nelson Corporation having obtained sanction to extend the capacity of its generating station to supply Barnoldswick and Earby district.

The Lothians Electric Power Co. has applied to the Electricity Commissioners for an Electricity Special Order to generate and distribute electricity in the burghs of Cockenzie and Port Seton, Haddington, Prestonpans and Tranent, the parishes of Aberlady, Gladsmuir, Haddington, Ormiston, Pencaitland, Prestonpans, Salton and Tranent, in the county of Easth Lothian; the burghs of Bonnyrigg, Lasswade, Loanhead and Penicuik, and the parishes of Borthwick, Carrington, Cockpen, Cranston, Crichton, Currie, Dalkeith, Glencorse, Kirknewton, Lasswade, Mid Calder, Newbattle, Penicuik, Ratho, Temple and West Calder and part of the parish of Kirkliston in the county of Midlothian. Objections to the Secretary, Electricity Commission, Whitehall, London, by December 31st.

SOME OF THE NEW M.P.'s

Electrical Industry's Representatives.

Although practically all the former M.P.s engaged in or connected with the electrical industry offered themselves for re-election at the polls last week only a few of them were not returned.

Sir Philip Dawson (U.), who retains his seat for West Lewisham by a majority of 439, is a consulting electrical engineer and a partner in the firm of Kincaid, Waller, Manville and Dawson. A full member of the Institution of Electrical Engineers since 1896, he has served as a member of the Railway Electrification Advisory Committee set up by the Ministry of Transport, and of the Water Power Resources Committee of the Board of Trade. After receiving his early electrical training at Ghent and Liege, Sir Philip was engaged on early electrification work on tramways in 1891, and later went to the U.S.A. to study electric traction. As consulting electrical engineer to the London, Brighton and South Coast Railway he designed and supervised the electrification of the line from London Bridge to Victoria and the extensions to the Crystal Palace. He was afterwards responsible for the electrification of the whole of the suburban system. He was preparing a scheme for electrification to Brighton and Eastbourne when the outbreak of war stopped the work. In 1912 he was appointed by the Caledonian Railway to prepare an electrification scheme for the company's lines, and was recently appointed by the Great Eastern Railway to plan the electrification of their suburban system. He is the author of several books, including "Electric Tramways and Railways" and "Electric Traction on Railways."

With a majority of 3 975 over the Liberal candidate, Mr. George Balfour, the sitting Conservative member, is again returned for Hampstead, a constituency which he has represented since 1918. He contested the Govan Division of Lanark in 1910–11. A full member of the Institution of Electrical Engineers since 1904, Mr. Balfour is founder and head of the electrical engineering firm of Balfour, Beatty and Co., Ltd., chairman of the Power Securities Corporation, Ltd., and is a director of a considerable number of electrical undertakings, including the Midland Counties Electric Supply Co., the Cordoba Light, Power and Traction Co., the Lancashire Electric Light and Power Co., the London United Tramways, Ltd., the Metropolitan Electric Supply Co., and the United Electric Tramways of Montevideo, Ltd.

In the Everton division at Liverpool, Sir J. S. Harmood-Banner (U.) was re-elected with a majority of 1 510 over his Labour opponent. Sir John, who was Lord Mayor of Liverpool in 1912–13, is a director of the British Insulated and Helsby Cables, the Automatic Telephone Mfg. Co., the Electric Supply Co. of Victoria, the La Plata Electric Tramways Co., the Midland Electric Corporation for Power Distribution, and the Telegraph Mfg. Co. (Colonial), Ltd.

A director of the County of London Electric Supply Co., and of the South London Electric Supply Corporation, Lt.-Col. Sir Frederick Hall has secured re-election as Unionist member for Camberwell (Dulwich) with a majority of 1 367 over his opponent, a Liberal. He succeeded the late Mr. Bonar Law in the representation of this constituency in 1910, and has served for several years as a member of the London County Council.

Although opposed by a Liberal and a Labour candidate, Sir William Bull (U.) goes back for Hammersmith (South) with a majority of 1 210. He was returned for Hammersmith in 1900, and has sat for the Southern Division of the borough since 1918. Last week he made a protest against the practice of bringing pressure to bear on candidates for Parliament by means of *questionnaires*, and in reply to all questions addressed to him said: "I decline to give evasive answers in the hope of catching votes without binding myself." Sir William is a director of Siemens Brothers and Co., Siemens Brothers' Dynamo Works, Ltd., and of the British Broadcasting Co.

Mr. James Falconer secured re-election in the Liberal interest at Forfar with a majority of 847 over his Unionist opponent. He is a director of the Cleveland and Durham County Electric Power Co., the Mersey Railway, and other companies.

Alderman J. B. Burman has been elected as Unionist member for Birmingham (Duddeston) with the large majority of 4 403 over Labour and Independent Liberal candidates.

Sir Edward Manville, the former Conservative member for Coventry, who is a consulting electrical engineer, and a partner in the firm of Kincaid, Waller, Manville and Dawson, was defeated by Mr. A. A. Purcell (Lab.), who obtained a majority of 620 in a triangular contest in which the Liberal candidate secured 15 716 votes, exactly ten less than Sir Edward. In the last election Sir Edward Manville secured 20 986 votes and a majority of 4 699. Another three-cornered fight at Wakefield resulted in Mr. R. G. Ellis (a director of the Yorkshire Electric Power Co.), the former Unionist member, losing his seat to Labour by a margin of 621. At Worcester the late Liberal member, Mr. R. R. Fairbairn, formerly manager of the Worcester tramway undertaking, was defeated by a Unionist, who secured a majority of 1 228.

Of the new candidates, Mr. P. J. Pybus, managing director of the English Electric Co., who stood in the Liberal interest for Shipley, put up a good fight, but lost to Labour by a majority of 1 056. The Unionist candidate secured 1 390 votes less than Mr. Pybus. At Walsall, Mr. S. K. Lewis, an employee of the South Staffordshire Tramways Co., the new Unionist candidate, was defeated by Mr. Pat Collins, the former Liberal member, by 2 163 votes.

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THE GENERAL ELECTION.

1.—Alderman J. B. Burman (U.) elected for Birmingham (Duddeston).
2.—Mr. George Balfour (C.) is again to represent Hampstead.
3.—Sir Philip Dawson (U.) who retains his seat for West Lewisham.
4.—Sir J. S. Harmood-Banner (U.) re-elected by the Everton Division of Liverpool.
5.—Lieut.-Colonel Sir F. Hall (U.) re-elected for Camberwell (Dulwich).
6.—Sir Edward Manville (U.) who lost his seat to Labour at Coventry.
7.—Sir William Bull (U.) will continue to represent Hammersmith (South).
8.—Mr. R. R. Fairbairn (L.) was defeated at Worcester.

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BUSINESS OPPORTUNITIES AT HOME AND ABROAD.

Contracts Open.

MOTHERWELL AND WISHAW CORPORATION.—Electric light wiring and fitting in 130 houses. Schedules from the Town Clerk, Motherwell.

OCEAN COAL CO., TREORCHY (GLAM)—Three or six months' stores, including electrical goods, ironmongery, tools, paints, etc. Forms of tender from the Company.

HULL CORPORATION, December 15th.—Six months' supply of electrical goods, brass, iron and steelwork, etc., for the Tramways Department. Specifications from the Engineer and Manager.

EDINBURGH CORPORATION, December 17th.—Electric wiring and fitting of houses under the Gorgie housing scheme. Specifications from the City Electrical Engineer, Dewar Place, Edinburgh; deposit £1 1s.

FOLKESTONE CORPORATION, December 17th.—Electric wiring at the Fire Station Recreation Rooms. Particulars from the Chief Officer of the Fire Brigade, Church Street, Folkestone.

KEIGHLEY CORPORATION, December 17th.—5 000 kW turbo-generator, condensing plant and auxiliaries. Specification from the Borough Electrical Engineer, Coney Lane, Keighley; deposit £1 1s.

LONDON COUNTY COUNCIL, December 17th.—Electric wiring at new gas-meter testing office (about 38 switch points and 42 lighting points. Form of tender, etc., from the Chief Engineer, Old County Hall, Spring Gardens, S.W.; deposit £1.

NEWPORT (MON.) GUARDIANS, December 17th.—Electric light fittings, ironmongery, etc. Forms of tender, etc., from the Clerk, Queen's Hill, Newport.

WARRINGTON CORPORATION, December 17th.—Motors. Specification from the Borough Electrical and Tramways Engineer, Howley, Warrington; deposit £1 1s.

BELFAST GUARDIANS, December 18th.—Schemes for centralised heating and lighting plant in Institution buildings. Further information from the Clerk, Workhouse, Belfast, on £5 5s. deposit.

LAMBETH (LONDON) GUARDIANS, December 18th.—Twelve months' supply of incandescent lamps. Forms from the Clerk, Brook Street, Kennington Road, S.E.11.

EDINBURGH PARISH COUNCIL, December 19th.—X-ray and other electro-medical apparatus for Craiglachart Hospital. Specification from Mr. R. T. French, Parish Council Chambers, Castle Terrace, Edinburgh.

KEIGHLEY CORPORATION, December 19th.—Supply and erection of poles for two miles of e.h.t. overhead. Specifications from the Engineer, Electricity Offices, Coney Lane, Keighley.

PLYMOUTH CORPORATION, December 20th.—Five e.h.t. main switchboard panels. Specifications from the Engineer, Electricity Works, Prince Rock, Plymouth; deposit £1 1s.

PETERSFIELD GUARDIANS, December 24th.—Electric wiring in the Poor Law offices. Particulars from the Clerk, 16, High Street, Petersfield, Hants.

LONDON COUNTY COUNCIL, December 31st.—One 3-ton three-motor overhead travelling crane, and one 30 cwt. motor-driven portable workshop crane for the tramway central repair depot, with six months' maintenance in both cases. Specifications from the General Manager, L.C.C. Tramways, Victoria Embankment, W.C., on £2 deposit.

BRI CHUALANN (BRAY) URBAN COUNCIL, January 1st.—About 800 yds. of steel tape, armoured, paper insulated, 4-core cable, connecting boxes, etc. Specification from the Electrical Engineer.

CARDIFF CORPORATION, January 14th.—One 40 000 lb. water tube boiler, for the Electricity Department. Specification from the Electrical Engineer, The Hayes, Cardiff. Only manufacturers on the King's National Roll are invited to tender.

ISLINGTON (LONDON) BOROUGH COUNCIL, January 17th.—5 000 kW two-phase turbo-alternator, condensing plant, piping, etc. Particulars from the Electrical Engineer, 60, Eden Grove, Holloway, N.7.

SUNDERLAND CORPORATION, January 21st.—Plant for Hylton Road Electricity Works, including: Section A.—One 10 000 kW alternator, turbine and condensing plant; section B.—two straight tube water-tube boilers, each of 50 000 lb. evaporative capacity per hour; section C.—natural draught wooden cooling towers, and foundations. Specification from the General Manager, Electricity Offices, Dunning Street, Sunderland; deposit, £3 3s. for each section.

Overseas.

COMMONWEALTH OF AUSTRALIA, December 17th (London).—Cable terminal boxes (S.A. 674). January 3rd (London).—Telephone and telegraph apparatus (T. 415). Tender forms, etc., from the Supply Officer, Australia House, Strand, London, W.C.2.

VICTORIAN ELECTRICITY COMMISSION, January 19th.—Transformers, switchgear and accessories for sub-station B. Specification (Nos. 23/145 and 24/2) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS DEPARTMENT, December 19th.*—Transformers for Meek's Road sub-station. February 6th.*—Equipment of two sub-stations February 27th.*—Motor generator sets. February 27th.*—Motor-driven air compressors, and batteries for switch operating.

VICTORIAN ELECTRICITY COMMISSION, December 19th.*—Fibre for insulators. January 3rd.*—Aluminium steel cored cable and accessories.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO, December 27th.* Electrical supplies, including cable, wrenches, insulating compound, lamp shades, also rubber belting, ironmongery, etc.

NEDERLANDSCHE HANDELMAATSCHAPPIJ, AMSTERDAM, January 3rd.—High and low voltage plant for new building. Specification from the company's offices, Heerengracht, Amsterdam, on payment of 35f.

SYDNEY CITY COUNCIL, January 7th (in Australia).*—Electrically driven coal unloading and conveying plant at Darling Island power houses. February 18th.*—Armour-clad switch-gear. February 25th (extended from November 19th.)—Stepdown transformers (Contract 758).

VICTORIAN RAILWAYS COMMISSION, January 9th (in Australia).*—Spring coiling machine with electric motor, and taper rolling machine with electric motor (Contract 36 659); also two small induction motors with starting apparatus.

INDIA STORE DEPARTMENT, January 14th.—Turbo-alternator, condensing plant, cranes, boiler, economiser, pumps, steel chimney, steam and exhaust pipework, switchboard, motor converter, rotary converters, sub-station plant, e.h.t. feeder cables and auxiliaries, for new power station and sub-station at Delhi. Forms of tender from the Director-General, India Store Department, Branch No. 12, Belvedere Road, London, S.E.1.

MELBOURNE CITY COUNCIL, January 14th.—Totally enclosed armoured type 6 600 V three-phase switchgear. Specifications from the City Electrical Engineer.

CITY OF TORONTO, January 15th.*—Centrifugal sludge pump, direct connected to 2 200 V 3-phase 25 cycle variable speed induction motor, running at about 730 revs. per min. at full load (Contract No. 58).

ARGENTINE SANITARY WORKS DEPARTMENT. January 21st.*—Supply and erection of steam-driven electrical generating plant for the waterworks at Posadas.

JOHANNESBURG MUNICIPAL COUNCIL, January 21st.*—240 steel tramway poles with finial and centre clamps; and 5 miles 0·4 in. round section h.d. copper trolley wire.

POST AND TELEGRAPH DEPARTMENT, WELLINGTON, N.Z., January 30th*.—30 000 galvanised iron earthrods.

TARANAKI (N.Z.) POWER BOARD, January 30th.*—Electric generators and switchgear.

SYDNEY HARBOUR TRUST COMMISSIONERS, February 11th.*—Supply and installation on runway tracks in wharf shed, No. 6 Berth, Darling Harbour, Sydney, of one 5-ton electrically-operated overhead travelling bridge crane. (Contract No. 23/36.)

SYDNEY HARBOUR TRUST COMMISSIONERS, February 11th.*—Two double-drum horizontal electric capstans or warping winches. (Contract 23/34.)

ARGENTINE STATE OILFIELDS ADMINISTRATION, February 14th.*—Erection and equipment of 11 250 kW electric power station.

* Particulars from the Department of Overseas Trade.

Tenders Accepted.

SHEFFIELD CORPORATION.—Cammell Laird and Co., 500 steel tramcar wheel tyres (recommended).

MAIDSTONE CORPORATION.—Hackbridge Electric Construction Co., 200 kVA transformer, £205 8s.

CHESTERTON.—Hardy and Sons, electric light wiring at the tramp and receiving wards, £16 17s.

SALFORD CORPORATION.—Enfield Ediswan Cable Works, l.t. and h.t. cable, £1 145 6s. (recommended).

SWANSEA CORPORATION.—British Thomson-Houston Co., 10 000 kW turbo-alternator, £35 097.

POPLAR (LONDON) BOROUGH COUNCIL.—Metropolitan-Vickers Electrical Co., rotary converter, £2 610.

STYLE AND MANTLE, LONDON.—Ozonair, Ltd., pure air ventilation system in premises at Oxford Street, W.

HOVE CORPORATION.—Electricars, Ltd., electric wagon for Cleansing Department, £1 300 (recommended).

GREAT WESTERN RAILWAY.—Siemens Bros. and Co., one-lever system of route signalling for Newport station.

SOCIÉTÉ GÉNÉRALE DE BELGIQUE, BRUSSELS.—Ozonair, Ltd., pure air ventilation system in bank premises.

LIBERTY AND CO.—Ozonair, Ltd., pure air ventilation system at new premises, Tudor House, Argyll Place, London.

HECKMONDWIKE URBAN COUNCIL.—The British Thomson-Houston Co., switchboard for the electricity works.

The First Aerial Electric Sign.

The latest form of electrically illuminated publicity is an illuminated aeroplane, which has been designed to circle London bearing in letters of light the name and style of a London newspaper. The letters consist of metal troughs containing Osram 6 V 3 W lamps. In the design of the sign many difficult problems had to be surmounted, and Travelling Electric Night Signs, Ltd., of 10, Essex Street, Strand, London, W.C.2, who were responsible for the design, are to be congratulated on producing a sign which is claimed to be legible at heights of 4 000 ft. It is interesting to note that this form of advertising has been tried out in America, but has proved quite unsuccessful.

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ELECTRIC TRACTION.

Southport Tramways Committee is considering the question of re-introducing penny fares on the tramcars.

The Scarborough tramways, which stopped working on November 3rd, and are being purchased by a syndicate, were again put into operation on Monday.

Accrington Council is curtailing, for a month's trial, the tramcar service through Haslingden, with a view to minimising the loss at present sustained by Haslingden Corporation.

Blackburn Tramways Committee has been asked to report on the question of the provision of one-man cars and additional covered cars, and on the adopting of illuminated signs for tramway stopping places.

Burnley Corporation has rejected the Tramways Committee's recommendation to accept the offer of a London firm of £1 500 per annum for ten years for the privilege of advertising on the Corporation's tramcars.

The extension of Glasgow Corporation tramways fromShawland Cross to Barrhead was opened for traffic on Saturday. The length of the new section is 6½ miles. There is some local opposition to proposed tramway extensions at Kelvinside.

The Barrowford section of the Nelson Corporation tramways has not been scrapped as there were difficulties in the way of substituting a service of motor omnibuses. Nelson Council has decided to seek borrowing powers to relay the tramway track.

A request for contract tickets for use on the Bolton tramways has been refused. Councillor Horrocks, chairman of the Tramways Committee, states that the Committee is out for a return of pre-war fares for everybody, and not to dole out privileges for one section.

The Manager of the South Shields Tramways, in a report on the subject of weekly tramway passes, suggests that, if the Tramways Committee favour the introduction of such passes, the charge for the 2d. fare distance should be 4s. per week, and, after a trial, *pro rata* charges for the 1½d. and 1d. distances might also be adopted. The committee has decided not to recommend the adoption of the system at present.

The 23 additional " Pay as you Enter " cars ordered in October of last year by Aberdeen Corporation have been built in the Corporation's workshops. The tramways general manager, Mr. W. Forbes, recommends the construction of six more closed-in cars at a cost of £1 290 each. These cars, which have no uncovered seats on the top deck, have a total seating capacity 10 per cent. greater than that of the open-end cars—or about 20 per cent. in wet weather when passengers will not use the end seats.

Fares, Receipts and Passengers.

Amongst the schemes approved by Sheffield Finance Committee as relief works is the supply of 25 double-deck top-covered tramcars at a cost of £54 375.

Electric Railway Items.

A new station on the Metropolitan Railway was opened on Monday at Hillingdon, between Ickenham and Uxbridge.

The existing separate stations of the Hampstead line and the Central London Railway at the junction of Oxford Street and Tottenham Court Road are being converted into one.

A new poster has appeared in London suggesting that Christmas and New Year parcels should be sent by " Metro " (Metropolitan Railway). The Commercial Manager, Baker Street Station, will furnish particulars of facilities.

Reading tramway employees have been making a special effort on behalf of the Mayor of Reading's fund for the unemployed. A decorated tramcar has been in use, and the Tramway Orchestra has been of material assistance.

Interesting tests of electric locomotives built by the General Electric Co., of New York, are reported by a " Times " correspondent. One of these locomotives developed what is said to be the Paris-Orleans Line record speed of 105 miles an hour. The engineers stated that the locomotive could have done 125 miles an hour under favourable conditions. Another electric locomotive, built for service in Mexico was hitched back to back with a steam locomotive of similar weight and defeated it easily in a tug of war.

World's Record Arc.

At a recent demonstration of very high voltages given at the Laboratory of the Westinghouse Electric and Manufacturing Co., at Trafford City, Pa., a 42 ft. arc at a potential of 1 000 000 V was formed. This is said to be the largest controlled arc ever made artificially. It was followed by a demonstration of the efficiency of the horn gap. A 15 ft. horn was constructed and an arc was induced at a potential of 200 000 V. The arc rose slowly, owing to the hot air produced, with a tearing noise, to the end of the horn, blew out, and immediately re-established at the base. It rose again and again until the circuit was opened. This self-extinguishing feature is of course used daily on the power systems to relieve surges and lightning strokes.

Tests of insulator flashovers were also made. In these tests a dry insulator post, built up of several units, was flashed over at a potential of 800 000 V. It was then covered with a heavy water spray to simulate conditions during a torrential rainstorm, and it flashed over a potential of 650 000 V, showing the wet insulator to be 75 per cent. as efficient as the dry insulator.

NEWARK ELECTRICITY.

Electricity Commissioners' Local Inquiry Concluded.

At the resumption of the Electricity Commissioners' Inquiry (reported in our previous issue) into an application of the Newark Town Council to erect a power station at Newark to provide a municipal supply, Mr. Craig Henderson, on behalf of the Rural District Council, the Newark Property Owners' Association, and the local firms opposing the scheme, said the principal power consumers were virtually out of the market as possible users. He thought it would not be in the town's interest to proceed with the scheme.

Mr. A. D. Phillips, of the Derby and Notts Electric Power Co., said his company could supply Newark from Sutton-in-Ashfield and Mr. Harker, also for the Power Co., denied that the company's offer was not a commercial proposition.

Evidence was given by Nottingham Corporation officials criticising the scheme, and Mr. W. J. Board (the Town Clerk) said that Nottingham did not want to act as a rival to a neighbouring municipality. The city thought it could be helpful to Newark, and he thought it would be to the advantage of Newark to take a supply from Nottingham. There could be no doubt that a supply could be sold to Newark at a cheaper rate from North Wilford than Newark could generate it. Ald. Priestley and Mr. Wordingham both admitted that they would be willing to take it, if that were so.

The Town Clerk of Lincoln (Mr. L. O. Need), said there had been two interviews between his Corporation and Newark. As a result, Lincoln offered to supply Newark, subject to Newark putting in the lines and transforming plant.

The inquiry was concluded.

Christmas Electrical Advertising.

The accompanying drawing has been prepared by the E.D.A. for use by electrical dealers during the Christmas season; the Association is prepared to supply electros pierced at the bottom to permit the insertion of the user's name and address. Measuring 6 in. deep by 4½ in. wide, electros of this advertisement will be supplied by the Association at 10s. 6d. each. Stereos are priced at 8s. 6d. Another announcement of similar size shows how to shave in comfort at a cost of ½d. There seems to be no diminution in the stream of excellent booklets and folders emanating from this source, and the latest selection now before us deserves a wide circulation. They include instructions for ironing in comfort by the electric way, a reprint of Mr. Hugo Hirst's broadcasting story of the electrical industry, some interesting facts about fires of alleged electric origin, a concise statement of the advantages of " after-hours " shop window lighting; a pamphlet advising the use of British Standard connections and a clear explanation of the modern way of charging for electrical energy for household purposes. A series of five advertisements on electric cookery is also worthy of mention.

Books Received.

" Engineering Science." By Arthur G. Robson. (London: Chapman and Hall.) Pp. xi 201. 7s. 6d. net.

" The Smoke Inspector's Handbook." By H. G. Clinch. (London: H. K. Lewis and Co.) Pp. xvi 136. 7s. 6d. net.

" The International Mercantile Diary and Year Book, 1924." (London: The Syren and Shipping, Ltd.) 7s. 6d. net.

" Mechanical Stoking " (Double Volume). By David Brownlie. (London: Sir Isaac Pitman and Sons.) Pp. 234. 5s. net.

" Wireless of To-day." By C. R. Gibson and W. B. Cole. (London: Seeley, Service and Co.) Pp. 318. 7s. 6d. net.

" Wireless Telephony Explained." By J. Hartley Reynolds and G. L. Morrow. (London: Cassell and Co.) Pp. 123. 1s. 6d. net.

" Verschleierung der Angaben von Elektrizitätszählern und Abhilfe." By Dr. Ing. A. Gelderman. (Berlin: Julius Springer.) Pp. 126.

" Science Abstracts." No. 301. Sections A and B. Vol. 26, Part II. Issued by the Institution of Electrical Engineers. (London: E. and F. N. Spon.) 3s. per section.

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STOCKS AND SHARES.

We give below a representative list of electrical undertakings—supply, traction, manufacturing and telegraph—whose shares are officially quoted on the London Stock Exchange. No great activity has prevailed in the share market during the past week, but the principal feature has been an upward tendency in electricity supply descriptions. Charing Cross West End ordinary £5 shares have put on a point, reaching 14; and Westminster ordinary shares, which also are of £5 denomination, have risen 5s., and now stand at a few shillings over £10 apiece. Metropolitan ordinary, North Metropolitan preference and St. James' and Pall Mall ordinary all show rises on the week; Kensington and Knightsbridge £5 shares, on the other hand, have fallen half-a-crown to £10. Metropolitan Railway ordinary and 3½ per cent. preference stocks show small percentage falls; District ordinary from 57½ has receded to 56. Among manufacturing undertakings, British Insulated and Helsby Cables preference £1 shares have put on 1s. 10½d. and Henley's Telegraph ordinary 7½d. English Electric ordinary have fallen 3d. In the telegraph divisions the only important alteration is a rise of 5s. in Eastern Extension ordinary stock.

Last Annl. Divi.	Name of Company.	This Week.	Last Week.	1912 to 1922. Highest.	Lowest
	Electricity Supply.				
12	Brompton & K'sington Ord. ..	41/3	41/3	38/–	24/–
4	Cent. Elec. Sup. 4% Deb. ..	87*	87*	100	67
14	Charing X. W.E. & City Ord. (£5)	14	13	7/18/9	2½
4½	,, ,, 4½% C.P. (£5)	86/3	86/3	97/6	50/–
10	Chelsea Elec. Sup. Ord. ..	37/–	37/–	21/–	10/–
15	City of Lon. Elec. L'ting Ord. ..	49/4½	49/4½	46/6	20/3
6	,, ,, 6½% C.P.	24/–	24/–	40/–	15/6
10	County Lon. Elec. Sup. Ord. ..	41/3	41/3	32/3	14/6
6	,, ,, 6% C.P. ..	23/1½	23/1½	24/9	15/3
12	K'sington & K'bdge. Ord. (£5)..	10	10/2/6	8/1/3	3/5/0
10	Lon. Elec. Sup. Ord. (£3) ..	98/9	98/9	62/6	15/–
8½	Metro. Elec. Sup. Ord.	3½ 4½	33/9	26/6	8/–
4½	,, ,, 4½% C.P.	17/6	17/6	19/10½	9/6
5	N'castle & Dis. Ord. (£10) ..	7½	7½	6	3/17/6
2½	,, Elec. Sup. Ord. ..	15/7½	15/7½	23/10½	11/6
6	N. Metro. Elec. P. 6% C.P. ..	22/6	21/10½	22/6	10/1½
6	Notting H. 6% C.P.	9½	9½	10½	6/13/9
14½	St. James' & P.M. Ord. (£5) ..	11½	11½	10½	5½
7½	Shrops. Worc. & Staff. Elec. Deb.	102	102	105½	96
12	W'minster Elec. Sup. Ord. (£5)	10/3/9	9/18/9	9½	4½
4½	,, ,, 4½% C.P. (£5)	90/–	90/–	107/6	65/–
	Yorks. Elec. Power Ord. ..	28/–	28/–	23/7½	12/6
	,, ,, 6% C.P. ..	22/6	22/6	25/–	14/3
	Railways and Tramways.				
5	Brit. Elec. Trac. Ord. Stk. ..	70*	70*	65	24
6	,, ,, 6% Pf. Stk. ..	98½*	98½	96	53
4	Cent. Lon. Rly. Ord. Stk. (asstd.)	73	73	89½	40½
4	,, ,, 4% Deb. ..	81½	81½	103	56½
4	City & S. Lon. 4% Perp. Deb...	80½	80½	102½	50
5	Lancs. Un. Trams. 5% Deb. ..	77½	77½	88	60
4	Lon. Elec. Rly. Ord. (£10) ..	130/–	130/–	104/1½	20/–
4	,, ,, 4% Pf. Stk. ..	79½	79½	80½	43
4	,, ,, 4% Deb. ..	81½	81½	98½	52
5	Lon. & Sub. Trac. A Deb. ..	87	87	86	65
4	Lon. Un. Trams. 1st Deb. ..	59	59	82	30
4½	Met. Elec. Trams. 4½% Deb. ..	82½	82½	101½	49
5	,, ,, 5% Deb. ..	79½	79½	102/17/6	53
3	Met. Rly. Cons. Ord. Stk. ..	74½	70½	75/2/6	10
3½	,, ,, 3½% Pf. Stk. ..	69½	70	88½	40½
3½	,, ,, 3½% Deb.	72½	72½	92½	51
3	Met. Dis. Rly. Ord. Stk. ..	56	57½	51½	12½
4½	,, ,, ,, 4½% 1st Pf. ..	85½	85½	91	45
6	,, ,, ,, 6% Perp. Deb...	121½	121½	146/12/6	80
4	S. Met. Elec. Trams. 4% Deb...	74	74	73½	48½
Nil	Yorks (W.R.) Trams. Ord. ..	16/–	15/–	6/–	1/–
4½	,, ,, 1st Deb.	77	77	87	52
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P.	14 4½	14/4½	22/1½	11/6
15	Brit. Helsby Ord.	48/9	48/9	62/–	26/6
6	,, ,, 6% C.P.	23/9	21/10½	25/6	14/6
6	,, Ericsson 6% C.P. ..	17/6	17/6	21/–	12/7½
7	B.T.H. 7% C.P.	23/–	22/9	21/1½	19/7½
7	,, 7% Deb.	105	105	107	92
15	Callender's Cable Ord.	49/4½	49/4½	85/–	22/–
6½	,, 6½% C.P.	25/–	25/–	24 7½	3/–
7½	,, 7½% B. Pf.	26/3	26/3	26 1½	16/6
Nil	Edison & Swan Elec. Ord. ..	5/–	5/–	28/9	1/11
,,	,, ,, ,, 1st Pf. ..	17/6	17/6	26/–	5/–
10	Elec. Constr. Ord.	29/4½	29/4½	30/3	6/7½
7	,, ,, 7% C.P.	23/9	23/9	22/6	16/–
5	Eng. Elec. Ord.	17/9	18/–	29/3	7/3
6	,, ,, 6% C.P.	19/6	19/6	20/9	10/6
15	W. T. Henleys Ord.	49/4½	48/9	86/6	23/3
7½	Lon. Elec. Wire & Smith's 7½% C.P.	23/1½	23/1½	24/4½	17/6
12½	Metro. Vickers Ord.	27/–	27/–	37/–	13/1
8	,, ,, 8% C.P. (£2) ..	52/6	52/6	67/10	5/–
20	Tele. Constr. Ord. (£12) ..	24½	24½	56/2/6	19½
	Telegraph.				
6	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	68½	40
4	Com. Cable 4% Deb.	77½	77½	87½	60
7	Cuba Sub. Mar. Ord. (£10) ..	7½	7½	11/12/6	5½
10	Direct Span. Tele. Ord. (£5) ..	9/2/6	9/2/6	9/7/6	3/7/6
10	East. Tele. Ord. Stk.	166½	166½	213½	113/2/6
3½	,, ,, 3½% Prf. Stk. ..	67½	67½	84/17/6	49
4	,, ,, 4% Deb.	81½	81½	103½	60
10	,, Exten. Tele. Ord. ..	16/17/6	16/12/6	21½	10/12/6
4	,, ,, ,, 4% Deb. ..	81½	81½	97½	60
22	Gt. Nor. Tele. (£10)	28½	28	42/12/6	19½
7	Indo-Eur. Tel. (£25)	32½	32½	50½	25
15	Marconi's Wireless T. Ord. ..	45/–	45/–	9/16/3	20/6
12½	,, Intern. Mar.	27/6	27/6	5/11/3	14/11
Nil	W. India & Pan. T. Ord. (£10)	1/–	1/–	5/11/10½	3d.
5	,, ,, 5% Deb. ..	35	35	104	50
10	West. Tel. Ord. (£10)	16½	16½	23	11 6 3
4	,, ,, 4% Deb. Stk. ..	81½	81½	100	60 2/6

* Ex dividend.

COMPANY NEWS.

Meetings, Reports and Dividends.

MISSISSIPPI RIVER POWER CO.—A dividend of $1½ per share on the preferred stock is announced.

MACKAY COMPANIES.—A quarterly dividend of 1¾ per cent., less tax, on the common stock is announced.

WAYGOOD-OTIS, LTD.—On the ordinary shares an interim dividend at the rate of 5 per cent. per annum has been declared.

CANADIAN GENERAL ELECTRIC CO.—A dividend of 1¼ per cent. on the common stock for the three months ending December 31st is announced.

INTERNATIONAL LIGHT AND POWER CO.—A dividend of 3 per cent., less British tax, on the 6 per cent. preference shares for the half year to June, 1921, is announced.

PARA ELECTRIC RAILWAYS AND LIGHTING CO.—On account of interest on first debenture stock for the half-year ended November 30th last, 1¼ per cent., less tax, is now payable.

PINCHIN, JOHNSON AND CO.—The usual dividend at the rate of 6¼ per cent. per annum, less tax, has been declared on the preference shares for the six months ending December 31st.

YORKSHIRE (WEST RIDING) ELECTRIC TRAMWAYS CO.—The directors announce a dividend of 3 per cent., actual, on the cumulative preference shares for the half year to December 31.

CLEVELAND TRUST CO.—The net profit for the year ended September 30th was £2 864, and the amount brought forward £334. A dividend of 6 per cent. is proposed, and the carry forward is £409.

BARBADOS ELECTRIC SUPPLY CORPORATION.—The net profit for the year ended June 30th was £5 569, and £1 021 was brought forward; £4 000 is being added to depreciation reserve and £2 590 carried forward.

DELAGOA BAY DEVELOPMENT CORPORATION.—Gross profit for the year ended June 30th, was £40 854 and net profit £5 955. Deducting debit balance of £4 984 brought forward leaves £970, which is carried forward.

PARSONS' FOREIGN PATENTS.—Dividends of 4½ per cent. on the ordinary shares and 2s. 3d. on deferred shares have been declared and £3 525 is being carried forward. The net profit for the year ended June last was £6 907.

MANX ELECTRIC RAILWAY CO.—Net profit for the year ended September 30th was £25 586, compared with £24 457 last year. After providing for debenture interest, dividend has been paid on the preference shares for 1918 and 1919, and balance of preference dividend for 1917–18.

CALCUTTA ELECTRIC SUPPLY CORPORATION.—A progress statement shows that kWh sold in the nine months ended September 30th last were 49 041 435, an increase of 10 532 545 over the corresponding period of 1922. Revenue for the year 1922 was £519 201, against £432 179 in 1921, and the dividend for 1922 was 10 per cent., plus 1 per cent. bonus, as in the two preceding years.

ARMSTRONG WHITWORTH DEVELOPMENT CO.—The past year's profit is £69 489, and £16 674 was brought forward from the previous year. Interim dividends at the rate of 15 per cent. per annum, tax free, on the ordinary shares and 6 per cent. per annum on the preference shares were paid for the half-year ended March, and final dividends at the same rates are proposed, the carry forward being £12 399.

TELEPHONE MANUFACTURING CO.—Gross profit on trading for the year ended May 31st was £76 565 compared with £28 709. Dividends from installation companies, however, only amounted to £31 980, compared with £44 890. An interim dividend of 5 per cent. has been paid, £10 000 is being written off expenses of income bond issue, £17 500 placed to contingency reserve and £6 201 carried forward.

CEARA TRAMWAY, LIGHT AND POWER CO.—At the recent meeting the chairman, Mr. Charles Hunt, referred to the adverse effect of the continued depression in Brazilian exchange upon the company's prospects. The manager had been instructed in regard to the subject of increase of tramway fares. The Brazilian authorities refuse to sanction an increase of fares to compensate for the fall in exchange, although the company has the right under its concession.

EDISON SWAN ELECTRIC CO.—The directors' report for the year ended June 30th, 1923, states that the year's trading results have been satisfactory, and the accounts show a profit of £71 162 after making provision for redemption of debenture stock to the extent of £7 003. The directors recommend that the profit be applied as follows:—7½ per cent. dividend on preference shares, £7 500; 7½ per cent. dividend on ordinary shares, £14 357; and transfer to reserve fund £30 000, leaving to be carried forward (subject to Corporation Profits Tax), £19 304 9s. 4d.

ISLE OF THANET ELECTRIC TRAMWAYS AND LIGHTING CO.—For the year ended September 30th the revenue was £119 972. The disposable balance is £40 611, and the directors propose to place to reserve £10 000, making a total of £40 000, to permanent way reserve £10 000, making a total of £50 000, to rolling stock reserve £5 000, total £30 000, to write £2 500 off cost of motor vehicles, and to pay a further nine months' dividend on preference shares from October, 1909, to July, 1910, making 6s. 3d. per share paid for the year, leaving £7 486 to be carried forward.

OFFICIAL QUOTATIONS.—The Stock Exchange Committee has ordered the following securities to be quoted in the Official List:—11 950 £1 fully paid shares of the Calcutta Tramways Co.; £250 000

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5 per cent. debentures (U.K. tax free) of the Cawnpore Electric Supply Corporation; £100 000 4½ per cent. 2nd debenture stock of the City of London Electric Lighting Co.; 500 000 £1 fully paid, 7 per cent. cumulative participating preference shares of the Power Securities Corporation; £200 000 5 per cent. mortgage debenture stock of the Rangoon Electric Tramway and Supply Co., and £3 000 000 6 per cent. Sterling bonds (in lieu of scrip) of the Tokyo Electric Light Co.

New Companies.

J. W. JONES, LTD.—Cap., £12 000. Electric light engineers, etc. Solicitors: T. J. Smith and Son, 7, Harrington Street, Liverpool.

WARDE-FOX AND CO., LTD.—Cap., £500. Electrical and general engineers, etc. Reg. office: 34, Duke Street, St. James', London, S.W.1.

TRAVELLING ELECTRIC NIGHT SIGNS, LTD.—Cap., £500. Advertisement contractors. Reg. office: 11, Essex Street, Strand, London, W.C.

"SEL-EZI" WIRELESS SUPPLY CO., LTD.—Cap., £500. Manufacturers of and dealers in electrical goods, etc. Reg. office: 40A, Greek Street, Shaftesbury Avenue, London, W.1.

TUBBERCURRY ELECTRIC LIGHTING AND TOWN DEVELOPMENT CO., LTD.—Cap., £3 000. Electricians, electrical engineers, suppliers of electricity, etc. Reg. office: Emmet Street, Tubbercurry.

GWYNEDD TRUST, LTD.—Cap., £10 000. To carry on business as a hydro-electric, electric, hydraulic and other power supply company, etc. Reg. office: Wellington House, Buckingham Gate, London, S.W.1.

C. W. EVANS AND CO., LTD.—Cap., £4 000. Vendors of accessories for electrical and allied trades, electrical engineers, etc. Reg. office: 74, King Street, Maidenhead.

ALPHA MANUFACTURING CO., LTD.—Cap., £2 000. To adopt an agreement with W. Harris, and carry on the business of electrical and mechanical engineers. Reg. office: 26, High Road, Balham, London, S.W.

HAHN AND CO., LTD.—Cap., £100. Manufacturers of, agents for and dealers in electrical apparatus and appliances, including instruments, wire, accumulators, lamps, etc. Reg. office: 13, Farringdon Road, London, E.C.1.

HIGH SALVINGTON ELECTRIC SUPPLY CO., LTD. Cap., £1 300. To acquire electric supply business now carried on by F. R. Cripps and Dorothy S. Cripps at High Salvington, Sussex. Reg. office: 21, Chapel Road, Worthing.

N. L. R. EASTON, LTD.—Cap., £3 000. To acquire business of dealer in motor cars and accessories, telephones and wireless telegraphic apparatus, now carried on by N. L. R. Easton. Reg. office: 6, Warwick Street, London, W.

WHITFIELD ELECTRICAL CO., LTD.—Cap., £500. To acquire business carried on by C. M. Page at 44, 44A, and 46, Whitfield Street, Tottenham Court Road, London, W.1, as the Whitfield Electrical Co. Manufacturers of electrical accessories, etc.

SOUTHERN FOUNDRIES, LTD.—Cap., £60 000. To adopt agreements with F. G. Small and C. A. Bowen, and carry on the business of founders, electrical, mechanical and general engineers, suppliers of electricity, etc. Reg. office: 185, Piccadilly, London, W.1.

KORLAND MANUFACTURING CO., LTD. Cap., £1 000. Manufacturers, importers and exporters of and dealers in mechanical, electrical and general machinery, wireless, telegraphic, telephonic and other machines, etc. Reg. office: 26, Leather Lane, London, E.C.1.

BESTWAY SPECIALITIES, LTD.—Cap., £2 000. To take over and carry on business of electrical appliance manufacturers and electrical engineers, carried on by N. Williams, W. Whittaker and G. Hargreaves, as Bestway Specialities Co. Reg. office: 4, Queen Street, Blackpool.

INTERNATIONAL HYDRO ELECTRIC DEVELOPMENT SYNDICATE, LTD.—Cap., £10 000. To develop propositions or schemes for utilisation of water power in the generation or production of electricity for power, lighting, heating or otherwise. Reg. office: 3, Broad Street Buildings, Liverpool Street, London, E.C.

HYDRAULIC POWER AND MANUFACTURING CO., LTD.—Cap., £4 000. To adopt agreement with Ragnvald Blakstad; to construct maintain and improve power supply works, railways, tramways, electrical and other works; to acquire water power and concessions in respect of waterfalls, rivers and waterways for generating power, etc. Solicitors: Holmes, Son and Pott, Capel House, New Broad Street, London, E.C.

HARRIES RUBENSTEIN AND SONS, LTD.—Cap., £3 000. To acquire the business of electric lighting accessories merchants, etc., now carried on by Harries Rubenstein, Mossy Rubenstein, and Hyman Rubenstein, trading as "Rubenstein and Co," "Harries Rubenstein and Sons," "The All Lighting Co.," and "H. Rubenstein," at 32 and 32A, Stepney Street, Llanelly; The Market, Carmarthen; and 55, Commercial Street, Newport, Mon. Reg. office: 32, Stepney Street, Llanelly.

CROOK-OF-DEVON ELECTRICITY SUPPLY CO., LTD.—Cap., £1 500. To adopt an agreement with Reid and Partners, electrical engineers and contractors, 53, Victoria Street, London, and J. J. Mowbray, of Naemoor, Rumbling Bridge, for the purchase of electricity and for allowing the company to acquire ground and water power for erecting a separate generating station, and to carry on the business of an electric light, heat and power supply company. Reg. office: Kirkland Place, Kinross.

BUSINESS MEMS.

Owing to the renumbering of Park Lane, Leeds, the local branch address of the Siemens and English Electric Lamp Co. has been altered from 85-91 to 129, Park Lane. As the accompanying

SIEMENS AND ENGLISH ELECTRIC LAMP CO.'S NEW PREMISES.

illustration shows, the premises are on the ground floor. There are large showrooms and stores, where an extensive range of the company's specialities is available.

The United States Rubber Company, of 47-48, Farringdon Street, London, E.C.4, announce that, as at the present time the great majority of their sales are of goods of Canadian manufacture, they have decided to change the name of the company from the United States Rubber Co. to the Dominion Rubber Co., under which name they will operate as from December 1st, 1923.

Forty Years Ago.

"The Electrician," December 16th, 1883.

THE FERRANTI DYNAMO.—During the progress of the Fisheries Exhibition, the Government officials watched very carefully the various systems of electric lighting, and as a result we understand that they have given the preference to the Ferranti system, and purchased a dynamo exhibited there, for the purpose of lighting a portion of the South Kensington Museum.

* * *

ELECTRIC LIGHTING IN THE CITY.—The Streets Committee of the Commissioners of Sewers will meet in the Guildhall on the 25th of January to receive tenders for lighting by means of the electric light certain streets of the city for a period not exceeding five years, and the parties contracting for lighting the public streets will have the privilege of laying wires to the houses along the route. The tenders are to be in accordance with conditions to be seen at the Sewers Office, and must be sealed, endorsed "Tender for Electric Lighting," and be delivered or addressed to Mr. Henry Blake, principal clerk, before two o'clock on the above date.

Metal and Chemical Prices.

TUESDAY, December 11th.

		Price.	Inc.	Dec
***Copper*—**				
Best Selected ..	per ton	£66 10 0	10s.	—
Electro Wirebars ..	„	£68 15 0	10s.	—
H.C. Wire, basis ..	per lb.	9⅞d.	1/16d.	—
Sheet	„	10 1/16d.	—	—
***Phosphor Bronze Wire (Telephone)*—**				
Phosphor Bronze Wire, basis	per lb.	1s. 1⅞d.	1/16d.	—
***Brass* 60/40—**				
Rod, basis	„	7½d.	—	—
Sheet, basis ..	„	10⅛d.	—	—
Wire, basis	„	10⅛d.	—	—
***Pig Iron*—**				
Cleveland Warrants	per ton	£5 7 6	2s. 6d.	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 0 0	—	—
***Lead Pig*—**				
English	„	£32 5 0	—	10s.
Foreign or Colonial	„	£31 2 6	—	7s. 6d.
***Tin*—**				
Ingot	„	£230 15 0	—	£7 15 0
Wire, basis	per lb.	39. 0d.	—	1d.
Aluminium Ingots ..	per ton	£120 0 0	—	—
Spelter	„	£32 15 0	—	15s.
Mercury	per bottle	£9 15 0	—	2s. 6d.

***Sulphur* (Flowers)—Ton £8** ***Sodium Chlorate*—Per lb. 3d.**
„ (Roll-Brimstone)—„ £8 ***Sulphuric Acid* (Pyrites, 168°)**
***Copper Sulphate*.. „ £25** **per ton, £7 10s.**
***Boric Acid* (Crystals). „ £48** ***Sodium Bichromate*.—Per lb. 4½d.**
***Rubber*.—Para fine, 1s. 0½d.; plantation 1st latex, 1s. 2⅜d.**

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co.

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COMMERCIAL INFORMATION

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

CARDIFF ELECTRIC AND WIRELESS SUPPLY CO., LTD., electrical engineers. £14 14s. 2d. October 31st; and £15 3s. 4d., October 26th.

FARNBOROUGH ELECTRICAL CO., Farnborough Road, Farnborough. £19 12s. 1d. October 29th.

GREENHALGHS, Cecil, Nelson Square, Burnley, electrical factor. £23 7s. 8d. September 27th.

HUDSON ELECTRICAL ENGINEERING CO., Park Lane, Leeds, electrical merchants. £54 8s. 6d. November 2nd.

LUMENS, LTD., 12–14, Great Ducie Street, Manchester, electrical factors. £25 15s. 11d. November 7th.

POWELL, E., AND CO., 20, Sycamore Road, Aston, Birmingham, electrical engineers. £20 3s. 11d. October 23rd.

SANDERS KENNEDY AND CO., LTD., Apex Works, Burnham, electrical manufacturers. £10 19s. 4d. November 2nd.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

AIREDALE ELECTRICAL AND MANUFACTURING CO., LTD., Bradford. Registered December 1st, £650 (not ex.) debenture, to bank; general charge (subject as to real estate to a prior mortgage). *£850. April 12th, 1923.

BOOTHROYD (H. T.), LTD., Bootle, electrical engineers.—Registered November 28th, charge, to Union Bank of Manchester, Ltd., securing all moneys due or to become due to the Bank; charged on lease of land and works in Bowles Street and Akenside Street, Bootle. *£3 850 5s. 6d. September 15th, 1922.

CHURCH STRETTON ELECTRIC SUPPLY CO., LTD. Registered December 3rd, £1 800 further charge, to Church Stretton Developments, Ltd., 27, Chancery Lane, W.C.; charged on property at Church Stretton, etc. *£6 400. October 25th, 1923.

EAST ANGLIAN ELECTRICITY, LTD., Felixstowe. Registered November 30th, £20 000 debentures (secured by Trust Deed dated November 20th, 1923); charged on properties at Stowmarket, Felixstowe, Sudbury, Framlingham, and Needham Market, also general charge. *£16 100. October 3rd, 1923.

NEW WELDING CO. (SOUTHERN), LTD., London, E.C.—Registered November 21st, £1 000 debentures (filed under section 93 (3) of the Companies (Consolidation) Act, 1908), present issue £450; general charge.

Private Meeting.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

RAYBOULD, W. E., electrical engineer, Wilton Street, Derby. Creditors were called together recently, at Derby, when an offer on behalf of the debtor was made of a composition of 2s. 6d. in the £, payable in cash, which it was decided should be accepted. A statement of affairs was presented which showed liabilities of £541 (trade creditors £371), and the assets £25, insufficient to discharge preferential claim for rent. It was stated that the debtor had previously made an offer of a composition of 5s. in the £, but it fell through as certain creditors refused to accept. He commenced trading in 1919 as an electrical engineer with little or no capital.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-up.

MITCHELL'S ELECTRICAL AND WIRELESS, LTD., 188, Rye Lane, Peckham, London, S.E.15. Meetings of creditors, December 19th, 1923, 11.30 a.m.; and contributories, December 19th, 1923, 12 noon, 33, Carey Street, Lincoln's Inn, London, W.C.2.

Company Winding-up Voluntarily.

LLANDRINDOD WELLS ELECTRIC LIGHT AND POWER CO., LTD. John Owens appointed liquidator.

Bankruptcy Information.

HORSFALL, William Miles, 7, Redcross Street, Liverpool, electrical engineer. First meeting, December 14th, 11.30 a.m., Offices of the Official Receiver, 11, Dale Street, Liverpool. Public examination, January 17th, 1924, 11 a.m., Court House, Pilgrim Street, Birkenhead.

JOHNSON, David, 177, Woodhorn Road, Ashington, Northumberland, electrical contractor. First meeting, December 18th, 11 a.m., Official Receiver's Office, Pearl Buildings, 4, Northumberland Street, Newcastle-upon-Tyne. Public examination, December 20th, 11 a.m., County Court, Westgate Road, Newcastle-upon-Tyne.

M'NAUGHTAN, Robert Vallance, electrical engineer, 5, Gorond Street, Paisley. Alexander Rolland, chartered accountant, Paisley, has been elected trustee. Examination of the bankrupt at the Sheriff Court House, Saint James Street, Paisley, on Wednesday, December 12th, at 12 noon. Second meeting of creditors in the trustee's office, 9, High Street, Paisley, on Monday, January 7th, at 11 a.m. (Edinburgh Gazette.)

ROBINSON, George William, 76, Cemetery Road, Porth, Glamorgan, electrical engineer. Receiving order, December 7th. Debtor's petition.

ROGERS, Harry, Friars Gate and Barbauld Street, both Warrington, electrical engineer and contractor. First meeting, December 19th, 11.30 a.m.; and public examination, February 1st, 1924, 11 a.m., Court House, Palmyra Square, Warrington.

SIDWELL, Stanley, 51, Islington Row, Birmingham, electrical engineer. Receiving order, December 8th. Debtor's petition.

Order made on Application for Discharge.

GORDON, Malcolm Thomas Birch, lately carrying on business at 20, Western Broadway, King Street, Hammersmith, London, electrical and general merchant, trading as THOMAS GORDON. Date of Order, November 9th, 1923. Discharged subject to judgment for £5 (paid).

Partnerships Dissolved.

RAY ENGINEERING CO. (Raymond Saint Clair CARTER and Edward Henry DIXON), electrical engineers, Frogmore Street, Bristol, by mutual consent as from November 1st, 1923. Debts received and paid by R. S. C. Carter, who will continue the business.

TERRETT AND SHEPPARD (William George TERRETT and Samuel Charles SHEPPARD), electrical engineers, 10, Stanley Parade, Wembley, and 15, College Parade, Kilburn, by mutual consent as from June 9th, 1923. Debts received and paid by W. G. Terrett.

Bankruptcy Proceedings.

BURRILL, Edward Frederick, 173, Barnsbury Road, N. This debtor lately carried on business in partnership as an electrical and wireless factor and he attended before Mr. Registrar Mellor at the London Bankruptcy Court on December 5th for his public examination on a statement of affairs in which he had returned his liabilities at £1 274 and his assets at nil. It appeared that for some five years before December, 1918, the debtor was employed as an electrician. In the following March he and two other persons began business in partnership as electrical engineers and they traded in Romford Road, E., under the style of the Standard Electrical Maintenance Co., each partner providing £300 capital. Later on a fourth partner was taken into the firm and provided an additional £500 as capital. In September, 1919, the partnership sold the business to a company for £4 000 payable in shares of which the debtor as a vendor received 1 000. The company undertook to discharge the outstanding liabilities of the business and they had been paid; they amounted to some £700. He acted as a director of the company until it went into liquidation in February of last year. In September, 1922, the debtor and another person began business in partnership as electrical and wireless factors and they traded in Coptic Street, Bloomsbury, under the style of Burrill Wood and Co. The debtor found some £40 capital and the partnership was continued until March when he retired, the business being in a solvent condition. The debtor had since been without regular occupation and attributed his insolvency to bad trade and heavy overhead charges in connection with an hotel business; to liability under a guarantee given by him jointly with another person on behalf of the before-mentioned company for which he received no consideration, to depreciation of his shares in that company, and to another cause. The examination was concluded.

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A Never-failing L.T. Current Supply (*Amateur Wireless*, 2, pp. 437-438, April 7th, 1923). R.800.
A. O. Rankine. The Transmission of Speech by Light (*Modern Wireless*, 1, pp. 415-421, July, 1923). R.800.
E. W. O. Russell and A. F. R. Cotton. Piezo Electricity (*Electrical Review*, 92, pp. 284-287, February 23rd, 1923). R.800.
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H. Stintzing. A Technical high-vacuum mercury vapour pump (*Zeitschrift für technische Physik*, 3, pp. 369-377, 1922). R.800.
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C. A. Hoxie. The Pallophotophone (*Journal of American Institute of Electrical Engineers*, 42, pp. 520-524, May, 1923). R.800.
Reorganisation of National Radio Chamber of Commerce (America) is Effected (*Journal of Electricity and Western Industry*, 50, p. 127, February 15th, 1923). R.800.

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PATENT RECORD.

Specifications Accepted.

196 299 G. Cailler. Electric pocket lamps. (15/4/22.)
203 693 Norske Molybdenprodukter Aktieselskabet. Alloys of molybdenum with improved chemical, mechanical, and electrical qualities. (26/3/21.) (Divided Application on 177 516.)
204 598 S. E. Dawson and Ferranti, Ltd. Machinable non-magnetic high resistance cast-iron alloy. (25/11/20.)
204 352 A. M. Taylor. Means for, and methods of, neutralising capacity currents on poly-phase electric transmission systems. (24/4/22.)
204 354 G. Sperti. Electric meters. (2/5/22.)
204 357 W. Preston and W. Walker. Electric switches. (22/5/22.)
204 361 Lodge-Cottrell, Ltd. (Möller, E.). Process of and apparatus for electrically separating suspended particles from electrically non-conducting, especially gaseous, fluids. (25/5/22.)
204 376 Igranic Electric Co., A. H. Mackley, W. S. Pyrah, and A. H. Curtis. Inductance coils. (24/6/22.) (Cognate Application 35298/22.)
182 135 E. H. Armstrong. Wireless signalling systems. (27/6/21.)
204 383 W. Lawrance. Trolleys for electric tramways of the overhead-conductor system. (27/6/22.)
204 389 J. A. Slee. Means for indicating angular position particularly applicable to wireless direction-finding apparatus. (27/6/22.)
204 398 F. G. Creed and Creed and Co. Telegraphic receiving apparatus for producing punched tape. (28/6/22.)
204 401 W. R. Bullimore. Electric signalling or indicating lamps. (29/6/22.)
204 418 S. J. Frost. Reflectors, shades, and globes for electric and other lamps. (4/7/22.)
204 433 G. A. Juhlin and Metropolitan-Vickers Electrical Co., Ltd. Dynamo-electric machines. (7/7/22.) (Cognate Application, 31594/22.)
204 434 Ward Leonard Electric Co., and L. Kebler. Electric resistance switches (7/7/22.)
204 441 P. Eide. Arc lamps. (11/7/22.)
204 464 H. Workman. Incandescent filament electric lamp bulbs, and lampholders therefor. (10/8/22.)
204 466 R. H. Barbour and J. R. Walton. Electric motor control systems. (11/8/22.)
204 473 British Thomson-Houston Co. (General Electric Co., N.Y.) Control systems for electric arc welding-apparatus. (16/8/22.)
204 474 Veifa-Werke Akt.-Ges., and F. Dessauer. High-tension electric transformers. (16/8/22.) (Patent of Addition not granted.)
204 477 J. Stone and Co., and A. H. Darker. Electric lighting and similar installations on railway and other vehicles. (17/8/22.)
204 482 E. Y. Robinson. Methods of reception in high-frequency signalling systems. 22/8/22.)
204 491 British Thomson-Houston Co. (General Electric Co., N.Y.). Electrical coils and methods of manufacturing the same. (30/8/22.)
204 499 E. Schröder. Device for showing the temperature conditions of electric machines. (5/9/22.)
204 505 T. M. Adair. Turbines for utilising tides or currents for producing electricity and for other purposes. (7/9/22.)
204 543 F. Stacey. Electric apparatus for the production of peroxides of nitrogen. (14/10/22.)
204 546 A. E. Alexander (C. Cory and Son, Inc.) Radio-telephonic receivers. (16/10/22.)
204 558 W. Dornig. Electric speed governors. (24/10/22.)
204 566 British Thomson-Houston Co., and F. P. Whitaker. Dynamo-electric machines. (3/11/22.)
204 592 British Thomson-Houston Co. (General Electric Co., N.Y.) Electric switches. (29/11/22.)
204 611 British Thomson-Houston Co. (General Electric Co., N.Y.) Control of dynamo-electric machines. (23/12/22.)
204 614 Brolt, Ltd., and W. Holt. Electric fuse holders. (30/12/22.)
204 619 F. Fernie. Electric cables. (6/1/23.)
204 624 British Thomson-Houston Co. (General Electric Co., N.Y.) Systems of control of electric circuits. (16/1/23.)
204 625 E. E. Mathers. Trolley heads for use in electric traction systems. (9/11/22.) (Divided Application on 192 986.)
204 626 H. E. Tvermoes. Electric battery lamps. (18/1/23.)
204 633 British Thomson-Houston Co. (General Electric Co., N.Y.) Systems of electric motor control. (31/1/23.)
193 040 G. Kjaer. Suspension of electrical lines especially three-phase lines. (11/2/22.)
204 638 British Thomson-Houston Co. (International General Electric Co. Insulators. (9/2/23.)
193 833 Just-Fele Izzolampa es Villamossagi Gyar Resvenytarsasag. Dr. Manufacture of electric lamps. (27/2/22.)
198 990 E. Miksch. Branch or distributing device for taking electric current from lighting wires. (12/6/22.)
204 647 Electrical Improvements, Ltd., and J. R. Beard. Electric protective systems. (23/2/23.)

Applications for Patents.

November 26th.

29 722 E. V. Appleton. Wireless communication system.
29 728 A. Wilson. Fitting for supporting electric globes, etc.
29 729 X-Rays, Ltd., and S. H. Long. Self-regulating electric switchboard.
29 732 Electrical Improvements, Ltd., and J. R. Beard. Electric distribution systems.
29 733 Belliss and Morcom. Air compressors.
29 740 B. Wilhelm. Electric junction boxes.
29 742 Coventry Automatic Telephones, Ltd., and C. W. Welman. Telephone systems.
29 743 H. Mandelstram. Transmission of sound in wireless apparatus, etc.
29 744 M. M. Houghton. Rheostats and potentiometers.
29 767 E. Baumgartner. Lighting magneto for vehicles.
29 771 Metropolitan-Vickers Electrical Co., and S. Gowan, and S. C. Lloyd. Electrolytic variable resistances.
29 772 W. Doring. Transformers.
29 780 Drake and Gariham and H. Gaskell. Multiple telephone connectors.
29 788 C. B. Tuppen. Combined switch and stand for electric irons, etc.

November 27th.

29 792 F. H. Philpott. Means of adjusting coilholders, etc., for wireless.
29 807 J. Trimble. Electro-mechanical apparatus for fire alarms, etc.
29 808 Schweiz Gluhlampen Akt. Ges. Electric protective devices (26/12/22 Switzerland).
29 812 D. S. B. Shannon. Wireless receiving apparatus.
29 813 and 29 814 D. S. B. Shannon. Wireless signalling apparatus.
29 819 A. H. Boulton. Attachments for telephone receivers.
29 824 W. T. Turner. Dynamo-electric magneto lighting apparatus.
29 828 F. D. Berners and W. Harding. Electric adaptors, etc.
29 833 G. A. Mitchell. Crystal holders.
29 858 Metropolitan-Vickers Electrical Co. Elastic fluid turbines.
29 865 J. R. Quain. Electrical indicators.
29 872 C. A. Vandervell and Co. Electric lighting systems for vehicles.
29 885 W. S. Smith. Submarine cables.
29 887 British Thomson-Houston Co. and D. E. Jewett. Electric ship propulsion.
29 899 H. T. and W. P. Newton. Apparatus for detecting changes of pressure.
29 901 F. H. Griffin and R. E. St. Amory. Tuning device for wireless receiving apparatus.
29 915 and 29 916 W. McGeoch. Electric light fittings.

November 28th.

29 922 F. L. Galley. Inductance coils.
29 924 F. J. Miller. Electric lamps for automobiles, etc.
29 927 C. B. Smith. Battery connections or holders.
29 929 T. Gare. Wireless receiving sets, etc.
29 931 R. E. Beswick and P. N. Glendining. Conducting clips for removable components of electric circuit.
29 933 R. D. Ball. Inductive coil.
29 934 F. Barraclough. Electric lamp holder.
29 943 W. B. White. Combined heating element and radiator.
29 944 A. H. S. Colebrooke. Filaments for thermionic valves.
29 951 F. E. Pernot. Alternating current signalling systems.
29 957 English Electric Co. and F. Morris. Control of electric motors.
29 960 C. G. H. de Laval. Electric condensers, etc.
29 961 R. H. Barbour and J. R. Walton. Electric resistances.
29 969 Siemens Bros. and Co., E. R. Garrod and W. E. Goodwin. Switching keys for telephone systems.
29 974 Metropolitan-Vickers Electrical Co. Fatigue testing machines.
29 978 General Electric Co., Ltd. Manufacture of wire, ribbon, etc., of refractory metals (14/7/23 Germany).
29 983 E. Pfiffner. Choking coils and voltage transformers (28/11/22 Germany)
29 989 Sachsenwerk Licht u. Kraft Aktiengesellschaft, F. H. Aberle and W. Sarfort. Oil-insulated transformers, etc.
30 002 R. L. Murray. Telephone receivers.

November 29th.

30 012 Schweiz Gluhlampenfabrik Akt. Ges. Electric protective devices (24/4/23 Switzerland).
30 025 D. Suchostawer. Dynamo-electric machine.
30 032 D. K. Gardner and J. Stead. Wireless receiving sets.
30 057 W. E. Robinson. Variable condensers for wireless telephony.
30 061 Creed and Co. and F. G. Creed. Telegraph apparatus.
30 063 Lodge-Cottrell, Ltd. (Metallbank u. Metallurgische Ges.) Electrical precipitation of suspended particles from gaseous fluids.
30 072 Western Electric Co. Electric wave-receiving systems.
30 084 Metropolitan-Vickers Electrical Co. and H. Beardall. Electric switchgear.
30 085 Metropolitan-Vickers Electrical Co. and J. A. Kuyser, E. L. N. Towle and A. J. Syers. Cooling, etc., of dynamo-electric machines.
30 089 H. J. Round. Telephones, etc.
30 114 Hotpoint Electric Appliances Co. and H. A. Lingard. Nozzle for vacuum cleaners.
30 116 Phillips' Gloeilampenfabrieken. Gasfilled electric glow lamps (23/12/22 Holland).
30,125 Automatic Telephone Manufacturing Co. and J. E. Ostline. Semi-automatic telephone systems.
30 127 Automatic Telephone Manufacturing Co. Telephone systems (8/1/23 France).
30 132 British Thomson-Houston Co. Electric discharge devices (29/11/22 U.S.).

November 30th.

30 163 G. Bowman. Actuating electric switches for internal combustion engines.
30 168 E. Cuddon. Switch for wireless receiving set.
30 177 Electrical Improvements, Ltd. and W. N. Waggott. Foundations for poles supporting overhead lines.
30 183 Western Electric Co. Acoustic devices.
30 187 Marrec, Ltd., and Y. Marrec. Selective and anti-parasitic systems for electro-magnetic waves, etc.
30 195 A. M. H. R. Brown. Electric oscillation detectors.
30 198 Edison Swan Electric Co. and E. E. Hiatt. Vehicle headlamps.
30 206 Metropolitan-Vickers Electrical Co. Ovens (13/12/22 U.S.).
30 207 W. H. Wilson. Electric condensers.
30 210 W. J. Sharplin. Insulating handles, knobs, etc.
30 218 Connecticut Telephone and Electric Co. Electron discharge devices (1/12/22 U.S.).
30 219 Electrical Engineering Small Tool and Gauge Co., J. L. H. E. and H. Tite. Electric kettles, etc.
30 225 Automatic Telephone Manufacturing Co. and W. O. Passmore. Automatic telephone systems.
30 226 W. S. Smith. Telegraph cables.
30 277 H. J. Garnett and W. S. Smith Magnetic alloys, and their use in telephone cables.
30 773 S. G. Brown. Wireless receiving apparatus.

December 1st.

30 243 C. Terry. Terminals for electrical apparatus.
30 249 Wilkins and Wright, and J. H. and W. H. Hewitt. Crystal detectors.
30 262 P. Priestly. Trucks and brakes for electric tramcars, etc.
30 280 J. Burns, Ltd., and H. Baines. Switches for radio communication apparatus.
30 285 A. Ford-Lloyd. Anodes or cathodes for batteries.
30 288 F. L. Hollister. Regulating devices for dynamo-electric machines.
30 295 A. H. Hunt. Telephones and loud speakers.
30 296 A. H. Hunt. Telephone headbands.
30 307 British Thomson-Houston Co. Electric furnaces (1/12/22 U.S.).
30 312 Magnetos Lucifer Soc. Anon. Magneto-electric machines (21/2/23 Switzerland).

Arrangements for the Week.

Friday, December 14th (To-day).

Manchester Wireless Society.
7.30 *p.m.* At the Houldsworth Hall, 90, Deansgate, Manchester. Lecture on "My Wireless Life," by Dr. Stanley Hodgson.

Physical Society of London.
5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers by Mr. L. F. Richardson on "The Aerodynamic Resistance of Spheres Shot Upward to Measure the Wind"; Dr. E. A. Owen and Mr. G. D. Preston on "X-ray Analysis of Zinc-Copper Alloys"; and Mr. K. R. Brain on "Investigations of Piezo-electric Effects with Dielectrics." Demonstration of "The Neon Tube Oscillograph" by Mr. H. St. G. Anson.

Monday, December 17th.

The Institution of Electrical Engineers.
7 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.2. Informal Meeting. Discussion on "Students in Electricity Undertakings," opened by Mr. G. R. A. Murray.

Tuesday, December 18th.

The Institution of Electrical Engineers. (North-Western Centre.)
7.30 *p.m.* At the Engineers' Club, Albert Square, Manchester. Paper by Mr. D. Brownlie on "Pulverised Fuel and Efficient Steam Generation."

Paisley Association of Electrical Engineers.
7.30 *p.m.* At 30, High Street, Paisley. Paper by Mr. Walter Acton. "Resume of Atomic Theory."

Thursday, December 20th.

Birmingham and District Electric Club.
7 *p.m.* At the Grand Hotel, Colmore Row, Birmingham. Annual Meeting.

The Institution of Aeronautical Engineers.
7.30 *p.m.* At the Royal Society of Arts, John Street, Adelphi, London, W.C.2. Lecture by Mr. John Gray on "Leader Cable Systems for Electrical Steering of Aeroplanes," written by Wm. Loth.

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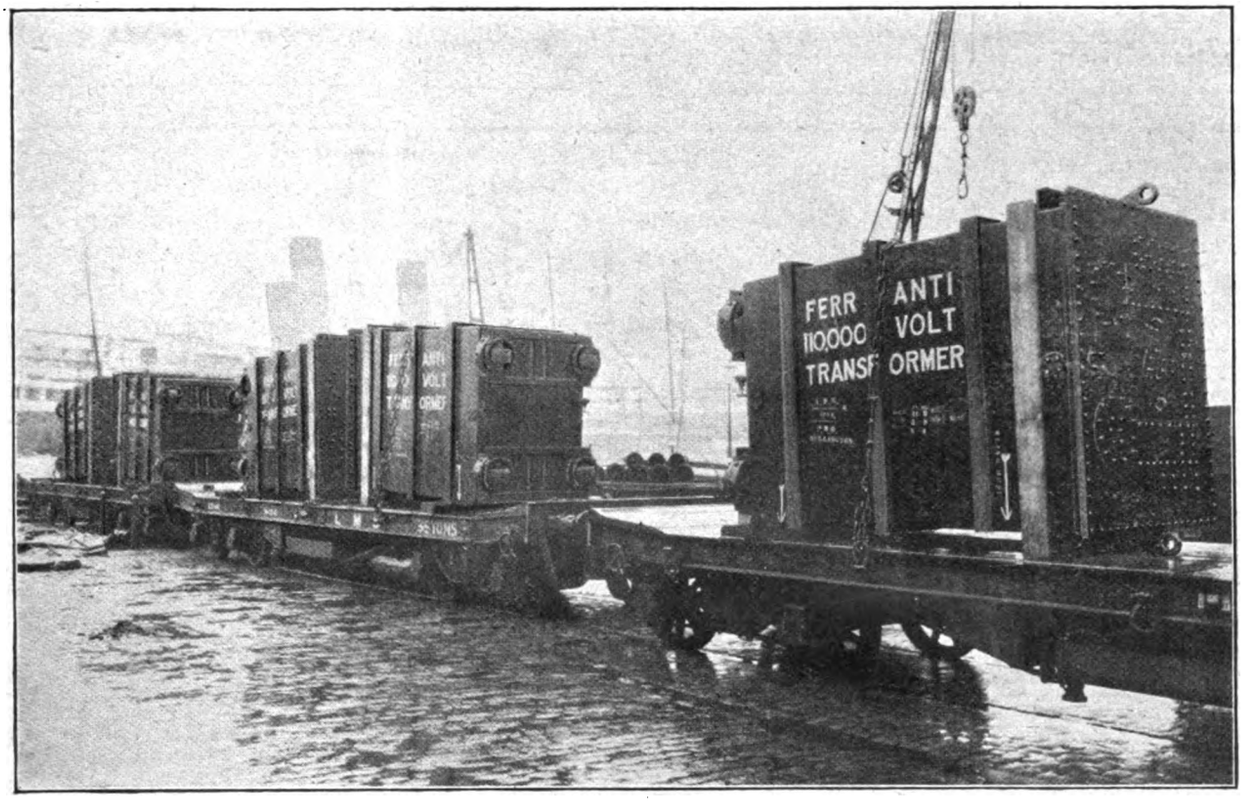

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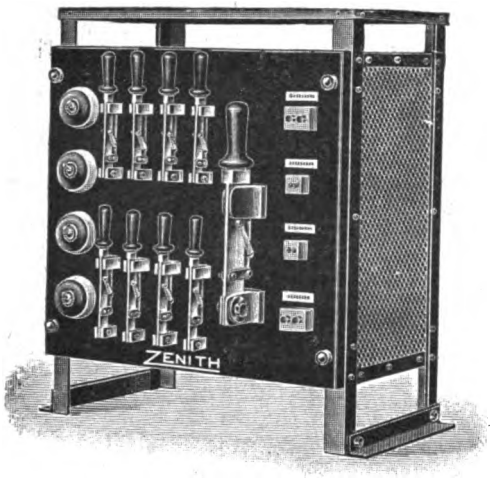

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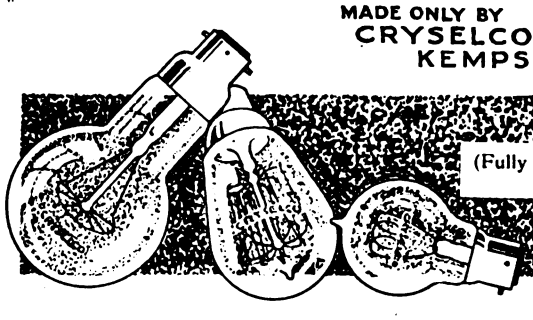

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PULVERISED FUEL.

Scientists and engineers pride themselves on the inhuman detachment with which they deal with the problems presented for their solution. They know that if their work is to be successful they must rigorously free themselves from bias and eschew that cookery of results which is consciously or unconsciously introduced when personal predilection and tradition are allowed to have any sway. Essential as this freedom is it has its disadvantages. If a case is presented with equal consideration for its strength and its weakness the rôle of critic at once becomes difficult, for the author is his own critic. This may explain why the discussions at meetings of scientific and technical societies are often so poor. Contrariwise, the presence of bias in favour of one or other side may be the reason why political gatherings are generally so animated. Though we do not wish that meetings of scientific societies should become like political ones, we do wish to point out that animation is a good thing, and that by adopting either consciously or unconsciously an attitude of attachment rather than detachment in the Paper on "Pulverised Fuel," which he read before the Institution of Electrical Engineers last week, Mr. DAVID BROWNLIE brought about a brighter and more interesting discussion than any we have listened to for some time.

Mr. BROWNLIE'S lengthy Paper contains two main arguments; one that the efficiency of British steam-raising plants is generally much lower than it should be, and the other that this efficiency could be increased to a figure higher than anything that has yet been attained in this country by the use of pulverised fuel. There is a weakness in thus combining these two correlated, but really distinct, questions which was readily taken advantage of by speakers in the discussion. If we take Dalmarnock as an example of the best results that can be obtained when using mechanical stokers, the thermal efficiencies of many boiler plants in this country (not necessarily in central stations) are obviously deplorably low. Mr. BROWNLIE argues that if pulverised fuel were used at Dalmarnock its efficiency could be increased from 76 to 86 per cent., and that the coal consumption would be correspondingly reduced. But this does not really solve the problem he has stated. The efficiency of many boiler houses in this country could be greatly increased by the use of mechanical stokers and especially by greater attention to scientific methods of control. If this were done and the efficiency of the majority of these plants raised to that of Dalmarnock the cause which Mr. BROWNLIE has at heart would be very greatly advanced, even if pulverised fuel did not exist as a practical proposition.

The main argument of the Paper, however, is that good as the results at Dalmarnock are they could be rendered much better by the employment of pulverised fuel owing to the more intimate mixture of the fuel and air, thus reducing the excess of the latter, to the more thorough combustion leading to less ash, to the greater flexibility as regards the qualities of the fuel that can be burnt, to the greater ease of combined working with liquid and gaseous fuels, to the higher overload capacity and flexibility in steam output, to the reduced stand-by and banking losses, to the greater ease of scientific control, and to the lower labour costs; while the cost of preparing the fuel and maintaining the plant are not so high as is generally supposed. Mr. BROWNLIE'S case is based on a large amount of statistical information, and statistics, as was amply born out in the discussion, are dangerous tools.

At the very outset Mr. BROWNLIE weakened his case by comparing a British with an American station. If he had compared an American station using pulverised fuel with an American station using mechanical stokers, he could probably have made out an equally good case, and would not have exposed himself to the criticisms that American coal is different from British coal and that the operating conditions are also widely different. But this is not all. Taking the comparative figures given by Mr. BROWNLIE, Mr. POCHOBRADSKY was able to show that instead of Dalmarnock being less efficient than Lakeside the opposite was really the case, and that the difference in favour of the former station would have been increased had it been possible to use drier coal. Mr. PARTRIDGE indicated that the coal used in America was of higher thermal value than that employed in this country and that that also vitiated the results, while Mr. DAVID WILSON pointed out that another weakness was that test figures were compared with running results. It would therefore appear that on the technical side alone there is considerable over-statement, and that while pulverised fuel can be beneficially used under certain conditions it is not a universal panacea for curing boiler house inefficiences.

But vastly more important than the technical question is the question of cost. If we accept Mr. BROWNLIE'S figures to the effect that if pulverised fuel is used an efficiency of 86 per cent. can be obtained as against 76 per cent. when mechanical stokers are employed, only half, and that the less important half, of the case has been

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stated. As Sir JAMES KEMNAL rightly said what matters is not whether the thermal efficiency is 80 or 85 per cent., but whether a reduced cost per unit generated can be obtained by substituting pulverised fuel for mechanical stokers. On this point Mr. BROWNLIE was significantly silent, though he remarked that for large plant pulver sed coal would be cheaper than mechanical stoking. On the other hand, Sir JAMES KEMNAL thought that the cost would be five or six times greater, and Mr. POCHOBRADSKY estimated that the difference would be even more. Now this question of first cost and running cost is all important, and advocates of pulverised fuel should make it their business to be more definite on this question. There are, of course, other matters, of which ash disposal is one, which require more information than has yet been given, but compared with the cost, they are quite secondary.

The weakness of Mr. BROWNLIE'S Paper, apart from the inclusion of matter which is really irrelevant to the main subject, is that it compares one system of pulverised fuel with the whole range of mechanical stokers, and one station using pulverised fuel with another station using mechanical stokers under entirely different conditions. Nevertheless, it does state a case, a case which is worth careful consideration. British engineers have the reputation of being unduly conservative and conservatism has both its advantages and disadvantages. But in examining this question, as it should be examined, they must have an open mind and not be too ready to condemn. There are probably places in this country where pulverised fuel can advantageously be used. Mr. PARTRIDGE suggests London, if Kent coal be employed, as one of them. There are others where it would show no advantage. But it is a matter for particular rather than general solution, and certainly a matter which should be dealt with for the time being apart from the merits or demerits of any particular system.

Current Topics.

Roads and Main Laying.

In a paper which he read before the recent Public Works, Roads and Transport Congress, Mr. STEPHEN LACEY, distributing engineer to the Gas Light and Coke Co., drew attention to a matter in which those who have been affected by recent upheavals in London should be greatly interested. Roads, we are constantly told, are becoming more and more necessary to our civilisation. From time to time they require repair and the congestion thus caused is superadded to that brought about by the normal traffic. In addition, certain public utility services have the right to break up the roads to get at their mains, and to the uninitiated seem perversely to do so just after the road has been reinstated. This state of things, as Mr. LACEY rightly points out, is caused by the fact that the roads are really used for both overhead and underground transport, and he quotes the figure of one million tons of gas per annum delivered in the Metropolitan area as an example of the way the roads are relieved from the transport of coal by this means. This, however, is really no reason why care should not be taken to disturb the roads as little as possible and we are glad to see that he advocates the laying of service mains under the footpaths. If these footpaths are wide enough their subsoil may also be used for feeders, though from their nature these cause less disturbance of roads than do services. We are rather surprised to find that Mr. LACEY objects to the use of subways for this purpose. He rightly points to the fact that to construct subways where mains are already laid would be very expensive, owing to diversion being necessary, but we do not think the cost need be prohibitive. Nowadays roads are being reconstructed rather than rebuilt, and more attention than has been usual to this way of avoiding subsequent congestion should certainly be given. Mr. LACEY'S argument that subways are particularly vulnerable to aerial attack also applies to mains buried in the roadways at the depths he suggests and is more than set off by the advantages. We hope that transport authorities will carefully consider this question with a view to discovering some means of improving the present inefficient conditions.

Krarup Cable Development.

THOSE who remember the course of events that led to the improvement of speech-transmission through cables by distributing inductance along the circuit, will welcome the article which appears in another column, on recent developments in Denmark of the Krarup type of "loading." Mr. J. S. MOLLERHOJ reminds us that in addition to the system introduced by PUPIN, in which coil-loading is adopted, and to the system associated with KRARUP, in which a continuous whipping of iron-wire replaces PUPIN'S separate "lumps" of inductance, there is the earlier proposal of HEAVISIDE to distribute iron in a divided state throughout the mass of the dielectric. At the time the proposal was made, it would have been natural to condemn it upon the assumption that the addition of iron particles to the dielectric would destroy the insulation. Early experiments with coherers, however, demonstrated that a considerable proportion of metal "dust" can be mixed into a plastic dielectric without causing much consternation among the megohms. The worst that could happen would be a string of iron particles, a fortuitous concourse of atoms, extending between the conductor and the exterior of the core; but this would depend upon proportions, and the danger would not in itself be sufficiently great to discourage experiment. The primary issue is whether the "dust" method is able to provide enough inductance, and whether it is sufficiently harmless in respect to capacity and leakance, when put to the test in the transmission-equation.

Cross-talk and Loading.

ATTENTION may also be directed to the method adopted by Mr. MOLLERHOJ for balancing the respective pairs of conductors in Krarup cables of the multi-core type, for the elimination of cross-talk. His careful analysis of the problem in so far as it relates to permeability, heat-treatment, and magnetising current is illuminating, and he is to be congratulated upon the improvements observed. Cable makers will look forward to any further information that may become available, especially whether the balance obtained by this artifice possesses stability. On the general question of the choice of systems, the opinions of Mr. MOLLERHOJ reflect the views widely held by cable designers. The Krarup type may scarcely be said to compete with the Pupin type of cable. Each has its race to run, and conjointly they are now fairly matched against "radio." It is over comparatively short distances, for land lines, that the Krarup cable is especially useful. For example, it is well adapted for circuits entering a city to reach an exchange where it would not pay to put in "loading" coils. There is also an important use for it across estuaries and rivers, and for linking up islands. The "whipping" process is slow, and it demands a considerable amount of machinery to construct such core at reasonable speed. Reading between the lines, however, it may be inferred that Denmark intends to make head-way in this direction, and it is to be hoped that their example will not be lost sight of in this country.

Scientific Illumination in Practice.

THE paper on "Scientific Illumination in Practice" which was read by Mr. GEO. HERBERT and Mr. R. A. IVES before the last meeting of the Illuminating Engineering Society, put the case for good lighting in a compact form, and discussed some of the problems encountered by

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the lighting expert in advising the consumer. It is probably correct to say that the great mass of consumers understand little about technicalities and are concerned mainly with results. In the industrial field practical benefits, such as freedom from accident, and absence of spoiled work, as a result of better lighting, are the things that count. The question is how to convince the public that these advantages will be gained. Undoubtedly, as the authors point out, a mere expression of opinion will not go far, unless backed up by authentic information. Naturally, it is by no means easy to obtain detailed information on such points as the effect of better illumination on output. Mr. Dow and others who spoke in the discussion, pointed out some of the complexities that have to be considered in a test of this kind, and urged that data obtained by experiment in conjunction with the Joint Industrial Councils would be most valuable to makers of lamps and lighting appliances. If only the conditions of lighting desirable for each industry can be settled by consultation with the leaders of the respective industries, there would be something authoritative to go upon. When approaching any firm the lighting expert could quote an opinion that must command respect, and would largely remove the difficulties imposed by the very variable views held by the public as to what constitutes "good lighting." The same applies, to a great extent, to street lighting. There is a general and doubtless a well-grounded belief that inadequate lighting is largely responsible for many accidents to traffic. But until the existing statistics can be so analysed as to show the relation of the two clearly, the lighting expert is deprived of a most valuable weapon. It was interesting to hear that the Illuminating Engineering Society is trying to initiate this kind of enquiry, and to apply it both to public and industrial lighting, and we hope that they will receive every encouragement in this difficult task.

Submarine Cables and Pulverised Fuel.

THE saying of JOB that there is nothing new under the sun is one of which we have ample opportunity of realising the truth. It seldom happens that any one propounds a new scientific and technical idea without we receive information, either officially or unofficially, that the idea has already received attention. The letter from Prof. SANTORI in our correspondence columns last week is the latest example. But another and more interesting connection between the seemingly new and the really old was given by Mr. W. M. MORDEY, in the course of the discussion on Mr. BROWNLIE'S paper at the Institution of Electrical Engineers last week. Mr. BROWNLIE had pointed out that the first pulverised fuel patent was probably that taken out by WILLIAM CRAMPTON in 1868. As Mr. MORDEY remarked, this WILLIAM CRAMPTON had other claims to recognition by electrical engineers. For besides being the designer of a successful locomotive, he was the first person to lay a submarine cable, which really worked, between Dover and Calais. An earlier cable had been laid which consisted merely of a wire covered by insulating material and was very soon destroyed. CRAMPTON'S cable was laid in 1851 and was "original" in the sense that it has been substantially copied in every other cable that has been laid since. The connection between submarine cables and pulverised fuel may not seem very close, but it will be seen they have an interesting human link which we are glad to be able to record.

A Time for Paying Bills.

BEFORE his conversion, Scrooge regarded Christmas simply as a season for paying bills and hated it accordingly. We have never shared the spleen of his unregenerate days regarding that particular aspect of Yuletide, though we are not prepared to say that Scrooge's facts were utterly at fault, nor that, in the respect alluded to our present Christmas differs very materially from any Christmases that belonged to his particular past. The general experience is that the spirit of Christmas makes most people so wondrous kind that even the payment of bills seems to be less irksome than usual—which in all probability may account, in a measure, for the extraordinary habit such things have of multiplying themselves at this special time of the year. There is one malign influence, however, that persistently refuses to remove its unwelcome presence from Christmas festivities—the shadow cast by the coming Income Tax payment. Let this be a reminder—"lest we forget"—that the industry and commerce of the country are still groaning under the weight of unnecessarily burdensome taxation and that there are yet unexplored ways and means of lightening the taxpayer's heavy load. A serious examination of these paths will never be undertaken unless, by individual and concerted efforts, business men compel the responsible persons to take the necessary action.

Fairness in International Trade.

WE learn that the League of Nations has just invited a number of Governments to send representatives to a meeting of experts to be held in Geneva on May 5th to discuss an international draft convention aiming at the suppression of unfair competition in international trade by the improper use of trade marks, false indications of geographical origin and other such abuses. Cases of this kind are said to have increased in number since the war, and international action is, therefore, urgent. The "Washington Industrial Property Convention" and the "Madrid Arrangement" were attempts to deal with the problems, but they have not succeeded in solving them. Article 23 of the League Covenant prescribes "the equitable treatment of commerce," and nearly two years ago the League, therefore, urged all States-members, who were not already members of the Industrial Property Union, promptly to adhere, and, as a second step, entrusted the study of the problem of unfair competition to its Economic Committee. This Committee eventually drew up a draft international convention, which was sent for comments to all the States-members of the League, as well as to those countries which had adhered to the Industrial Property Convention. The comments of twenty-five Governments have been considered by the Economic Committee and the revised draft convention will come up for discussion at the meeting of experts to be held in Geneva in May.

Another Aspect of the Problem.

IT has always seemed to us that one of the points regarding international trade that needs serious attention, but never appears to receive it, relates to wages and conditions of labour. If the Trade Unionists of this country, for example, are desirous of making a real contribution toward the solution of the unemployment problem at home, they might exert more vigorous efforts than have ever yet been attempted to bring about in the various countries of the Continent something of that standardisation of wages and conditions which they have succeeded in enforcing here. We are quite aware that the subject is no new one, that aspects of the problem differ widely, and that the whole question bristles with difficulties; but the fact remains that so long as workmen in the country of a competitor in any given line of manufacture put in longer hours per week at a lower actual wage an international market inequality exists which the policies of neither Protectionists nor Free Traders can possibly adjust. Moreover, the situation thus created is bound to lessen the chances of any appreciable demobilisation of our tragic, gaunt army of unemployed. If the League of Nations could tackle this aspect of unfairness in international trade and commerce by inducing representatives of the various Governments to consider the points involved, round a table, and if at the same time international representatives of trade unionism addressed themselves seriously to the problem, there might be hope of something being done to prevent unfairness of a very malignant type.

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HIGH VOLTAGE TRANSFORMERS.

The Importance of Insulation Tests and Their Significance.

By F. A. DAHLGREN.

One of the most important tests that is carried out on a high voltage transformer before it is put into service is the insulation or "flash" test. A breakdown between the windings or between winding and earth is a very serious matter on a transformer connected to a large network. Its consequences are often not limited to the cutting out of the power and lighting supply to the area served by the transformer, but serious disturbances may also occur in other parts of the network if the automatic releases do not work quickly enough or if their "selective setting" is not absolutely reliable. If the breakdown occurs between the h.t. and l.t. windings, the l.t. network can be at a high potential to earth before the protection devices come into action, with consequent risk of injury, damage and fire.

Different parts of the insulation in a transformer in service are subjected to different voltage stresses, due to the distribution of the potential within the windings. A star connected h.t. winding will, for instance, cause far higher dielectric stresses in the neighbourhood of the terminals than at the neutral point. Nevertheless, the various Standardisaton Rules specify a uniform flash test on each winding, i.e., the whole of each winding must be tested with a certain potential to all other conductive parts of the transformer. This is necessary in order to render the test a practical one, and it is also justified by the consideration that must be paid to abnormal stresses due to transient phenomena at switching in, travelling surges on overhead lines, etc. Such transient voltages may give rise to free oscillations and internal surges with steep fronts, which strain the insulation at points impossible to predetermine.

It is, therefore, necessary to ensure good insulation everywhere between the various parts of the transformer, and the insulation test must be arranged so that it really does give a uniform potential difference. There are no difficulties in arranging the test, as far as testing the l.t. winding to the core is concerned, as it is sufficient to connect the core and other iron parts of the transformer body to one pole of the voltage supply, while an arbitrary point of the winding is connected to the other pole. When testing the h.t. winding to the core and to the l.t. winding (which two latter parts are connected together and generally earthed), matters are a little more complicated.

It is the object of the following article :—

(1) To give a short theory for the phenomena in the transformer during such a test and to indicate some errors that can occur under unfavourable circumstances, if special precautions are not taken.

(2) To show how to find the magnitude of these possible errors, and to demonstrate that the danger is not so great as would seem probable from a first glance at the problem.

(3) To give a simple remedy for avoiding these errors.

Looking at the question from an elementary physical standpoint we see that the insulation to be tested can be regarded as the dielectric in a condenser. When a voltage is applied across this condenser the latter must receive a certain static charge, and as the voltage is an alternating one—which is always the case in such tests—the charges flowing to and from the condenser constitute an alternating current. This condenser is, however, not formed by plates of solid metal, but the current has to pass through a part of the winding turns, and thus, especially in the h.t. winding, the average path may be a long one, containing a large amount of inductance. If now the voltage is applied in such a way that the magnetic field caused by these capacity currents finds a closed iron circuit through the core the effective inductance will reach a very high value, giving with the current an appreciable electro-motive force. The capacity is, of course, more or less equally distributed along the winding, but the general character of the system will be a combination of capacities in series with inductances. Supplied by an a.c. voltage this system will consequently show the well-known features of such a combination, i.e., the voltages across the condensers will be different from the primary voltage and dependent on the frequency, and in the case of electric resonance will be limited only by the effective resistances. If now the primary voltage is applied in the way mentioned above and the winding is arranged for a very high rated voltage, i.e., contains a large number of turns, the constants of the circuit may be favourable for the creation of voltage disturbances of the nature described. The ordinary commercial frequencies, generally used also for high voltage testing sets, are, as will be shown below, generally too low to cause any appreciable errors in the internal voltages of the transformer, but should the voltage wave contain pronounced over-harmonics of high order there will be a risk of obtaining quite misleading results. As practically no alternator is free from over-harmonics it is always advisable to avoid the connections that will make this kind of error possible.

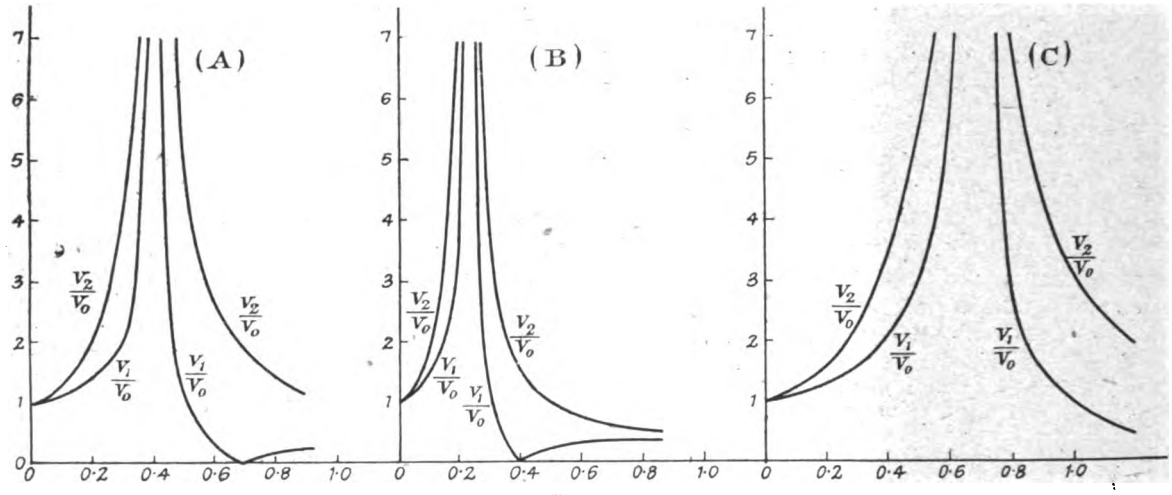

FIG. 1.

In order to find by calculation the order of magnitude of these errors the following simplification is made : the capacity per limb of the h.t. winding to core and to l.t. winding is supposed to be placed in a point in the middle of the limb winding. Denote this capacity (in farads) by C, the inductance through the core relating to one limb winding of a single-phase transformer by L (henries), and the angular frequency by ω. If the study is limited to core type transformers as being the type mostly used in this country, it is easy to prove that the inductance per limb is increased to $\frac{4}{3} \times L$ if the transformer is made three-phase keeping the same limb and yoke dimensions and same number of turns per limb. The mutual inductance between two limb windings is, in the case of a single phase transformer, equal to L and, for a three-phase transformer, equal to $\frac{2}{3} \times L$.

Assuming the voltage Vo (ω) to be applied to *one* terminal of (*a*) a single phase, (*b*) a three-phase star connected, and (*c*) a three-phase delta connected transformer, while no terminals on the h.t. or l.t. side are connected together. Let V_1 be the voltage across the insulation on one of the limbs, the winding of which is directly fed by the voltage Vo, while V_1

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is the corresponding voltage on the other limbs. It is obvious that the star connection will get V_1 on one limb and V_2 on two limbs, while the reverse takes place with delta connection.

Working out the equivalent schemes of the transformers, containing C and L, and applying the well-known method of representing sine vectors by complex quantities, we obtain the following resulting formulæ :—

(*a*) Single phase transformer :—

$$V_1 = V_0 \frac{1 - \frac{3}{2}\times}{1 - \frac{5}{2}\times}$$

$$V_2 = V_0 \frac{1 + \frac{1}{2}\times}{1 - \frac{5}{2}\times}$$

(*b*) Three-phase transformer, star connected H.T. :

$$V_1 = V_0 \frac{1 - \frac{5}{3}\times}{1 - \frac{8}{3}\times}$$

$$V_2 = V_0 \frac{1 + \frac{1}{3}\times}{1 - \frac{8}{3}\times}$$

(*c*) Three-phase transformer, delta connected H.T. :

$$V_1 = V_0 \frac{1 - \frac{1}{2}\times}{1 - \frac{3}{2}\times}$$

$$V_2 = V_0 \frac{1 + \frac{1}{2}\times}{1 - \frac{3}{2}\times}$$

Where $\times = W^2LC$.

Fig. 1 shows curves for $\frac{V_1}{V_0}$ and $\frac{V_2}{V_0}$ as functions of $\times$.

The formulæ give infinite values at one point, but actually the voltage will, of course, be limited by the effective resistances. The curves show all quantities positive, as we are interested only in the absolute values, but in reality the voltage changes its sign when we pass through the resonance point.

From the curves it is obvious that as soon as $\times$ attains some few per cent. of the value corresponding to resonance the internal voltages are very different from the applied voltage, and in the neighbourhood of resonance the errors can amount to any value.

A Practical Example.

It remains to be shown how to find the magnitude of $\times$ in actual cases. The approximate method of uniform variation of the size of a transformer can be applied, keeping the same linear proportions, same space factors and same densities. If f is the rated frequency of the transformer, V the rated voltage per limb, and W the output in kVA for the transformer with two limbs (single phase), it is easy to prove that the product CL is proportional to :—

$$\frac{V}{f^2} \times \sqrt[4]{\frac{f}{W}}$$

Consequently :

$$x = \omega^2 CL = k \times r^2 V \sqrt[4]{\frac{f}{W}}$$

where r is the ratio of applied testing frequency to rated frequency. From the figures for some actual transformers we find that k has the order of magnitude 1×10^{-7}.

Assuming, as an example, a three-phase star connected transformer for 3 000 kVA, 70 000 V 50 periods, tested with 50 periods, we obtain :—

$$r = 1 : \quad f = 50 : \quad W = \tfrac{2}{3} \times 3\,000 = 2\,000$$

$$V = \frac{70\,000}{\sqrt{3}} \approx 40\,000$$

Consequently :—

$$\times \approx 0{\cdot}0016$$

The fundamental wave of the applied voltage will thus be reproduced without any appreciable disturbance across the insulation on all the limbs, as a glance at the curves will show. But for a tooth-harmonic of, say, the twelfth order we get :—

$$\times \approx 0{\cdot}0016\ (12)^2 = 0{\cdot}23$$

This is just near the point of resonance, and even if the amplitude of the harmonic is only some few per cent. of the fundamental wave when measured across the terminals of the alternator, the voltage across the insulation may be increased to a value largely exceeding that desired. At the same time the difference between V_1 and V_2 may be so high as to cause a flash over between the windings of adjacent limbs, thus spoiling the insulation of the coils.

Some Conclusions.

From the preceding the following conclusions can be drawn :—(1) Even if the testing voltage is applied to the h.t. winding in the most unfavourable way, the fundamental wave of the voltage will, on commercial transformers, be very nearly correctly reproduced across the insulation to be tested. The insulation will never be strained *less* than expected, as it is seen from the curves that the slight disturbance that may arise always means an increased voltage. (2) Over-harmonics of high order (tooth-harmonics) are, on the other hand, able to raise the dielectric stress considerably, due to resonance phenomena, if the windings are in open circuit and the voltage is not applied to all h.t. terminals simultaneously. (3) If the terminals of the winding are connected together (which means closing the magnetic circuits through the air and thus cutting down the inductances to very low values) not even the tooth-harmonics will be able to cause any errors in the voltages across the insulation.

INDUSTRIAL RESEARCH.

During the course of the discussion on Mr. Wilson's paper on "Industrial Research" before the South Midland Centre of the Institution of Electrical Engineers, Mr. F. R. Combes emphasised the need for greater co-operation between universities and industrial concerns, though the final development could only be undertaken by the manufacturers. Great importance was to be attached to taking full notes during tests. Mr. Wilson had rightly stressed the need for highly trained men. Practically every important discovery had been made by a man who devoted his life to the work. Technical training was necessary to enable a man to distinguish what was valuable from what was impracticable or useless.

Prof. W. Cramp remarked that the paper was opportune as discussion was needed on the functions of research departments in works and in universities and technical schools. The work of an industrial development department was entirely different from that undertaken at a university. "Atmosphere" was important. In a works there were always limitations of time ; enquiries into fundamental matters required leisure. In universities the research involved in the complete development of a new apparatus would ultimately disappear, as would tests of complete machines. The applied science research department would show how basic physical principles could be applied, preparing the way for the development department. Universities had the important duty of training men capable of doing works research, and Mr. Wilson's summary of training was hardly adequate. Research men even in the fifth year still needed advanced lectures and training in the application of mathematical functions, as well as the attitude of mind to be adopted in research. It was high time that works' directors devoted attention to providing an adequate organisation for giving men so trained the practical specialised training to render them fully efficient in a development department.

Specialisation Necessary.

Dr. M. Kahn remarked that industrial research had reached a new stage. Specialisation and sub-division of the work enabled the development department to be set free to concentrate on matters outside the daily routine work of manufacturing. The narrowing effect of specialisation must be guarded against. Hence the need of choosing for the development department men with a comprehensive training, favourable to versatility.

Mr. W. Lawson doubted whether the British manufacturer was even yet wholly convinced of the value of the measures advocated by the author. Many standard lines of electrical products still lacked finality of design, and there were instances of misdirected development. The attitude of the manufacturer towards technical research was not due to national decay, conservative outlook or temperamental inability to co-operate, but probably to the peculiar trade conditions applying in this country. Epoch-making discoveries rarely came from untutored sources, but it was equally true such discoveries rarely originated in development departments of industrial concerns. He thought the author attached insufficient value to suggestions from outside sources. Many articles had only been brought to perfection as a result of suggestions from users. The public was acquiring an "electrical sense" and hence their suggestions might be more valuable in future.

[An abstract of Mr. Wilson's Paper appeared on p. 510 of our issue of November 9th, 1923.]

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PULVERISED FUEL.*

Its Part in Efficient Steam Generation.

By DAVID BROWNLIE.

The original Paper, which runs to great length, is a detailed consideration of the whole question of the application of pulverised fuel to steam generation, more especially from the point of view of the "Lopulco" system for large water tube boilers and of the efficient generation of electricity in power stations. Extensive data is given relating to the pioneer large pulverised fuel-fired electricity station, the "Lakeside" station of Milwaukee, together with a description of the River Rouge power plant of the Ford Motor Co. at Dearborn, Detroit, where pulverised fuel and blast furnace gas is used. The author stated this was probably the most remarkable power plant in the world. For comparison there were given the figures of the Dalmarnock electricity station, Glasgow. A thorough consideration then follows, based on these actual results, of the advantages and disadvantages of pulverised fuel.

The general principles consist in crushing the coal and passing it over a magnetic separator to get rid of any iron particles. The crushed coal is then dried down to 1 to 2 per cent. moisture, the latest type of drier being a continuous small vertical installation using only the waste flue gases in the chimney base. The dry coal is then pulverised in ball mills, the latest average practice as regards fineness being that 90 per cent. will pass through a 100 mesh (100 holes to the linear inch, 10 000 holes to the square inch), and 65 per cent. through a 200 mesh. The pulverised coal is conveyed through troughs to bunkers, and then to "feeders," which mix the coal with 10 per cent. of the air required for combustion and deliver it to the burners, after which 90 per cent. of the air, preheated to a high temperature, is then added. The result is under the boilers an intensely hot flame of over 2 000 deg. F. with complete combustion, 17 to 18 per cent. CO_2, no CO, and entire absence of smoke.

The "Lopulco" System.

The "Lopulco" system of pulverised fuel embodies, however, many refinements and improvements which have made possible the remarkable success that has been obtained. The chief of these is undoubtedly the water screen, a series of water-cooled 4 in. steel tubes in the bottom of the furnace, which prevents "slagging," that is, the ash from becoming molten. The brickwork is hollow, with cold air circulating through, and the resulting heated air at 300 to 700 deg. F. is then used to supply the 90 per cent. of secondary air to the burners, already mentioned, thus resulting in extraordinary efficiency.

At the present time in America there are eight large boiler plants working on the "Lopulco" system, with 43 water-tube boilers, mostly very large, a total of 360 130 sq. ft. heating surface. At 300 000 sq. ft. in constant operation and conservative figures of 0·75 lb. coal or 6·50 lb. of water per sq. ft. of heating surface per hour, this is 702 800 tons of coal per annum (7 000 hours), equivalent to 47 standard large British power station boilers of 50 000 lb. evaporation per hour. There are now under construction on the "Lopulco" system 29 plants comprising 91 boilers, including many of the largest water-tube boilers in the world, having a total heating surface of 1 405 230 sq. ft. Assuming, as before, conservative estimates, this equals a consumption of 2 695 300 tons of coal per annum, that is 142 standard 50 000 lb. British power station water-tube boilers in constant operation. In less than six months from now there will be 3 400 000 tons of pulverised coal per annum in operation for steam generation, equal to half the capacity of the whole of the power stations of Great Britain put together, or 16 Dalmarnock stations. In Great Britain, however, there has been practically no headway at all, and even at the present time there is only one large boiler plant at work, that of the Hammersmith Electricity Station, on pulverised coal, with three boilers of 45 000 lb. evaporation, together with a small installation at Peterborough, and one or two odd experimental boilers.

In comparing the data given, attention is called to the extraordinary efficiencies being obtained with pulverised coal. Lakeside is running regularly at 85 to 86 per cent. boiler plant efficiency, the most efficient station in the world, and 89 per cent. has been obtained on ordinary short tests. The loss of heat in the chimney base is only 8 per cent., the unburnt carbon in the ash about 0·5 per cent., and the excess air for combustion over the theoretical 10½ to 25 per cent.

The guarantee for the Vitry Station is 84 per cent.; at the new Cahokia Station, St. Louis, the figure is 85 per cent; and at the Detroit Edison Trenton Channel Station, with six boilers of 29 000 sq. ft. heating surface, 86½ to 88 per cent., with 83 per cent. at the overload of 13·8 lb. of water from and at 212 deg. F. evaporated per square foot of heating surface per hour—that is, no less than 400 000 lb. of water per boiler per hour. Mechanical stoking on water tube boilers cannot touch these figures. Amongst the finest long duty performances with mechanical stokers are Dalmarnock (Glasgow), running at 76·6 per cent. efficiency on 34 per cent. load factor, and probably 78·5 per cent. on 60 per cent. load factor, and in the United States the Connors Creek plant at 75 per cent., the Colfax power station 76·5 to 78·5 per cent. Delaware is said to be 79·1 to 81·0 per cent. The best possible mechanical stoker practice is 81 to 82 per cent. efficiency, with 40 per cent. excess air. Pulverised coal, therefore, will give, say, 86 per cent. efficiency and mechanical stoking 81·5 per cent., a saving of 5¼ per cent. in the coal bill. Under normal conditions, however, mechanical stoker efficiency is only 75 per cent., so that the saving would be 12¾ per cent., and if pulverised coal was installed in most mechanically fired power stations, British or otherwise, the saving would be 15 to 20 per cent. of the coal bill.

Maintenance Costs.

The maintenance costs of pulverised coal, contrary to what is thought, are not excessive, being actually less than mechanical stoking itself. At the "Lakeside" plant, Milwaukee, 15 months' running showed a cost of 1·17d. per ton of coal in repairs to the plant, and the "Lopulco" guarantee for the air-cooled brickwork is now actually three years, which no mechanical stoker can equal. The danger of explosion and fire is not a serious matter, and as regards ash troubles, these also cause little difficulty. Careful tests at "Lakeside" show that 12 to 25 per cent. of the ash is blown out of the chimney top in an extremely fine state of division, 25 to 50 per cent. falls to the bottom of the combustion chamber, and 25 to 35 per cent. is caught in the chimney base. The labour costs with pulverised coal are approximately 20 per cent. less than with mechanical stoking. At the "Lakeside" plant, Milwaukee, several years' running shows a labour cost, in equivalent English money, of 1s. 3d. per ton, whereas at Dalmarnock, Glasgow, the figure is 1s. 7d. The total auxiliary power used for pulverised coal is now only 1 per cent. of the steam production of the plant. The very latest stoker performance is slightly less than 1 per cent., but the average is 2 to 3 per cent., and at Dalmarnock is 1·68 per cent. The unburnt material in the ash of pulverised coal is 0·40 to 0·75 per cent. carbon, whereas the best stoker figures are 2 per cent., with 3 to 5 per cent. for a large number of stations. Other advantages of pulverised coal are the flexibility in the quality of the coal that can be burnt, so that differences in the heating value do not affect the efficiency of the plant, as with mechanical stoking. Pulverised coal will work in with other fuels, whether blast furnace gas, coke oven gas, oil, or pulverised coke, whilst the flexibility in evaporation is astonishing, overloads of 100 per cent. being taken with ease for long periods.

The stand-by losses are considerably less with pulverised coal, and in the case of plant with long banking up periods show a saving of 3 to 5 per cent. in the coal bill. The ease of scientific control is so remarkable that boilers on pulverised coal can be worked entirely from a distant switchboard by one attendant, as at the Ford plant, Detroit. It is difficult to obtain authentic figures for the capital cost, but roughly there is not much difference between pulverised coal and mechanical stoking.

One of the most significant facts about pulverised coal for steam generation is not only 3 500 000 tons per annum will soon be in operation, but that many of the newest, largest, and most efficient power stations in the world have adopted it. The author, therefore, gives it as his considered opinion that a serious investigation of the whole question of the use of pulverised coal in Great Britain is imperative, especially for large power station plant.

* Abstract of a Paper read before the Institution of Electrical Engineers on Thursday, December 13th, 1923.

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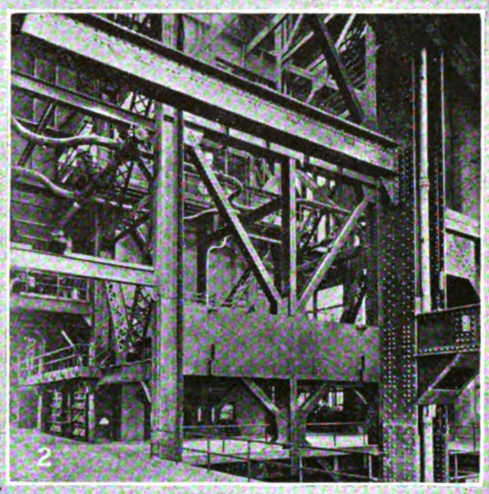
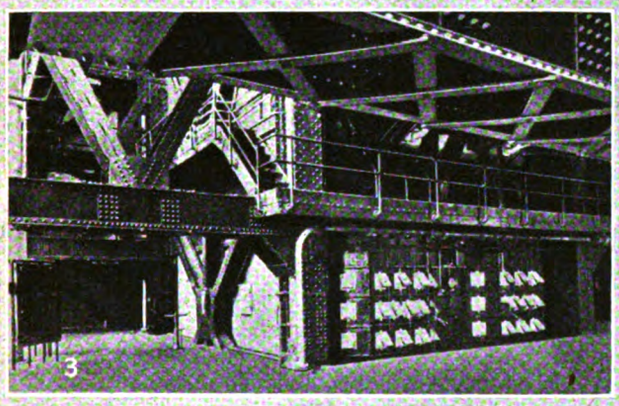
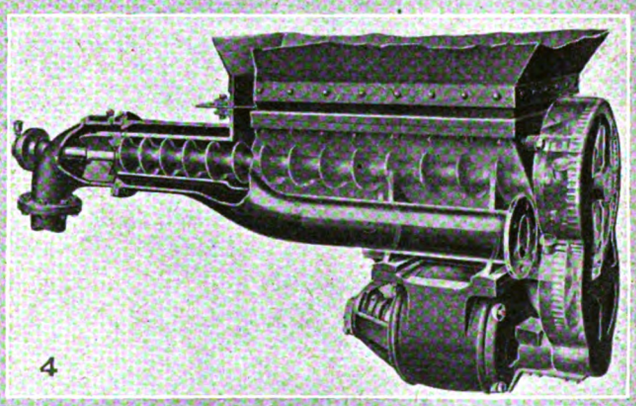
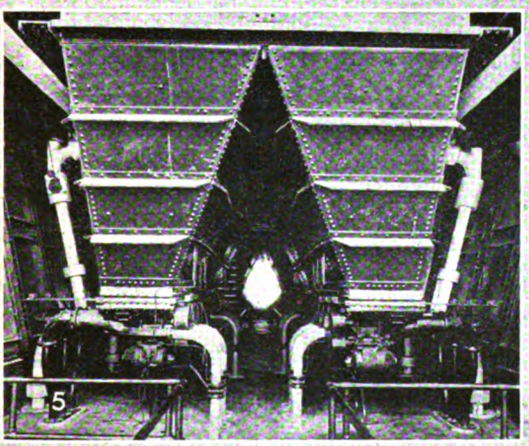
PULVERISED FUEL ILLUSTRATED.

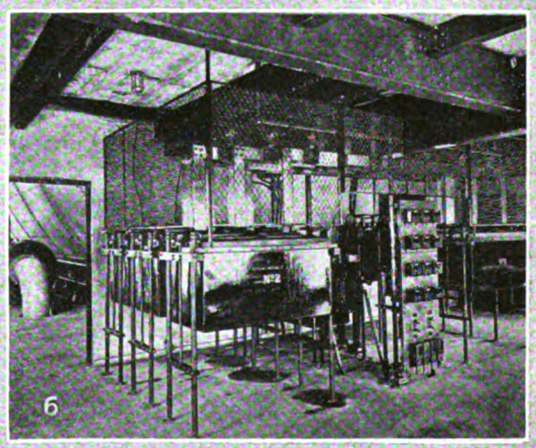
Some Views in the River Rouge Station at Detroit which supplies the Ford Motor Car Company's Works.











1. The electric control panel, one of which is used for the control of each boiler, in the River Rouge Station, Detroit. The gauges from left to right are for line pressure, chimney draught, flue draught, boiler pressure combustion, steam meter, flue gas temperatures and draught.

2. Another view at River Rouge. Note the cleanliness in this illustration and also in Fig. 3.

3. General View in the Boiler House, River Rouge, Detroit, showing the air louvres for the furnaces.

4. A Standard Lopulco 5 in. feeder for mixing the coal from the bunkers with 10 per cent. of air for combustion.

5. The "Lopulco" feeders and pulverised coal bunkers at River Rouge, showing motor drive and discharge pipes.

6. View showing the pulverised coal bunkers at the back. River Rouge.

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KRARUP CABLE DEVELOPMENT IN DENMARK.

During the last few years several important contributions to the theory and practice of "loading" telephone cables have been made in Denmark. According to "Teknisk Tidskrift" of October 6th, 1923, rapid development has taken place in methods for the increase of inductance in conformity with the Pupin system; but, since the death of Krarup, progress with "continuous" loading has diminished in that country. The history of the Krarup cables was dealt with by Mr. S. P. Madsen in a lecture to the Northern Electrical Engineering Conference at Copenhagen in 1920. Further advance is now expected as the result of recent investigations by Mr. J. S. Mollerhoj with regard to the relative advantages and disadvantages of the two systems. It is only possible here to give an abstract of the account of his work on the subject; but it is understood that he has applied for patents concerning his proposals.

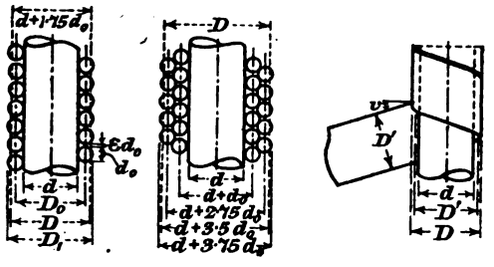

FIG. 1.

THE FORMULÆ AND SYMBOLS EMPLOYED.

$B=\frac{R_1}{2}\frac{1}{2}+\frac{A}{2}.2$ = attenuation coefficient.
$R_1=R+\eta L_D$ ohm/km = effective resistance
R OHM/km = continuous current resistance.
$\eta=\frac{\pi\omega^2\mu d^2}{\varepsilon 10^7 G}D$ = increase in effective resistance / increase in self-induction
ω = cyclic frequency
μ = initial permeability.
GOHM $\frac{m}{mm^2}$ = specific resistance of iron
$L_D\frac{2\pi\mu d_s 10^{-7}}{Da(1+\varepsilon)}$ h/km = increase in self-induction per layer of iron.
D mm = mean-winding diameter.
$d_0(1+\varepsilon)$ mm = pitch.
ε = manufacturing constant.
$z=\sqrt{\frac{L}{C}}$ ohm = characteristic impedance.
$L_1=L+\varepsilon L_D$ H/km = self-induction.
$L=Ca06\ 10-3$H/km = self-induction.
C farad/km = mutual capacity.
A siemens/km = leakance.

The objections hitherto raised against the Krarup system are summarised by Mr. Mollerhoj as: (1) That it is inferior to the Pupin system when compared on a basis of cost for a given attenuation; and (2) that it presents difficulty in regard to cross-talk.

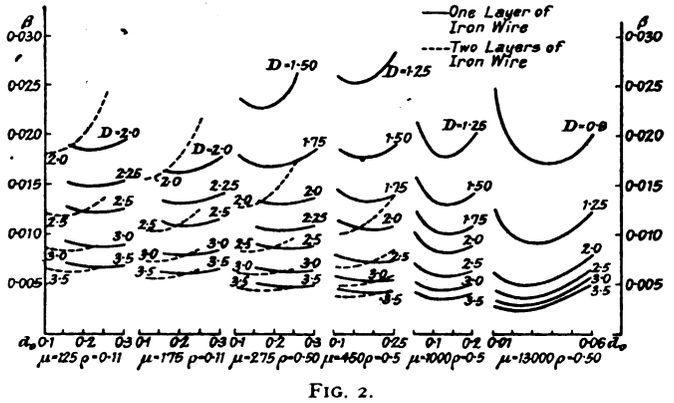

FIG. 2.

ATTENUATION CO-EFFICIENT PER KM OF KRARUP CONDUCTOR.

Cost of the Krarup Cable.

Costs require to be considered from the point of view of installation and manufacture. Other things being equal, the cost of installation diminishes with the diameter of the cable; but the cost of manufacture of a Krarup cable with a given number of quads, corresponding to a given attenuation, does not necessarily decrease with the diameter. Cheap construction implies selection and preparation of the best material for the iron "whipping," a correct design, and proper means of manufacture.

With regard to the theory of the Krarup cable, Mr. Mollerhoj follows closely the well-known equations of Larsen ("E.T.Z.," 1908, p. 1030) for the attenuation in terms of the dimensions and electrical constants. He points out, however, that instead of assuming the effective diameter of the whipped conductor to be the diameter of the copper *plus* twice the product of the number of layers of iron-wire and the diameter of the iron-wire, it is better to take a somewhat less value. From investigations with a conductor whipped with a single layer of iron-wire, he deduces that if d is the diameter of the copper, and d_0 the diameter of the iron-wire, the effective diameter is approximately

$$D=d+1{\cdot}75d_0$$

It is concluded that with more layers a somewhat similar relation would hold; for the layers would enter one another to a certain extent. Thus, generally, he assumes that the effective diameter is equal to the diameter of the copper *plus* twice 1·75 times the product of the number of layers of iron-wire and the diameter of the iron-wire.

CABLE COST PER KM QUAD EXCL. CONDUCTOR.

		C=0·030		C=0·035μF		C=0·040μF		C=0·045μF		C=0·050μF	
DOBB. PAR.	TRAAD DIAM.	UARM	ARM	UARM	ARM	UARM	ARM	UARM	ARM	UARM	ARM
5	1·0	101	138	88	124	80	113	75	107	68	100
	1·5	157	208	135	182	118	162	106	148	99	135
	2·0	224	288	190	246	165	218	151	201	133	181
	2·5	304	376	254	320	218	280	195	251	174	229
	3·0	394	474	326	399	281	347	245	311	220	280
	3·5	517	609	415	497	344	420	304	374	270	338
10	1·0	75	100	63	86	55	77	51	70	47	65
	1·5	121	154	103	132	90	117	80	105	72	97
	2·0	187	226	153	189	130	164	113	145	103	133
	2·5	269	316	214	255	179	218	155	193	136	170
	3·0	357	425	282	330	236	280	204	244	180	219
	3·5	466	529	366	420	305	355	260	306	229	272
20	1·0	58	74	48	62	42	55	38	50	34	46
	1·5	101	121	83	101	71	88	62	79	55	70
	2·0	161	186	130	153	107	128	94	113	83	102
	2·5	236	268	186	213	154	178	131	154	115	137
	3·0	330	368	255	288	210	238	177	203	152	180
	3·5	—	—	339	376	280	314	232	263	200	228
40	1·0	47	57	38	49	33	41	29	37	26	34
	1·5	89	102	70	82	51	70	51	61	45	54
	2·0	146	163	114	130	95	109	80	92	70	82
	2·5	—	—	169	188	138	156	117	132	102	116
	3·0	—	—	—	—	—	—	160	178	139	156
	3·5	—	—	—	—	—	—	—	—	185	206
80	1·0	41	47	32	38	27	32	24	29	21	26
	1·5	81	90	64	72	52	60	44	50	38	44
	2·0	—	—	106	117	88	97	73	81	63	72
	2·5	—	—	—	—	—	—	—	—	93	103
	3·0	—	—	—	—	—	—	—	—	—	—
	3·5	—	—	—	—	—	—	—	—	—	—

FIG. 3.

CALCULATION BASIS.

Iron tape 0·14 Kr per kg.
Lead 0·30 Kr per kg.
Tin 3·00 Kr per kg.

Another refinement is to use the formula of Erlang for the increase in self-induction per layer of iron-wire. This formula, and particulars of the notation, are given in Fig. 1.

When iron-strip is used, the pitch of the winding is far greater than in the case of iron-wire whipping, and the result is unfavourable on account of magnetic resistance. Moreover, for the same value of the ratio of increase of effective resistance to increase in self-inductance, the thickness of the strip may only be about 0·6 times the diameter of the corresponding wire. The question whether wire or strip should be adopted consequently becomes very much a matter determined by cost. According to Mr. Mollerhoj, wire will generally be cheaper, even if the whipping takes a little longer than the lapping. He consequently bases his calculations upon the assumption that wire will be employed.

To reduce the attenuation and the cost of Krarup cables it has been proposed to use iron of higher reversible (initial) permeability and specific resistance than are obtained with ordinary Swedish iron or soft steel. With increase of permeability, however, great variations of inductance and of effective

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resistance are to be expected, with consequent difficulties with regard to cross-talk. Iron of high permeability is very susceptible to mechanical influences. For example, well annealed Swedish charcoal iron of reversible permeability between 175 and 200 may, when whipped, give a value of μ between 110 and 125, as measured for a Krarup cable. Again, an annealed iron alloy of reversible permeability 275 to 300 may, when whipped, resemble ordinary Swedish charcoal iron. Hence it has proved to be a necessary procedure for the best utilisation of the iron to anneal the whipping *in situ*. Heat treatment is difficult, however, because the copper is apt to become brittle, and the heat causes variations in reversible permeability which results in cross-talk trouble. Possibly these are the reasons why iron of high permeability has been but seldom used for Krarup cables, and why heat treatment has not been generally adopted.

Mr. Mollerhoj has sought to determine the most favourable design of various types of Krarup cable for a given attenuation, especially with paper-air insulation. For a given diameter of conductor, capacity, and number of quads, the cost, excluding that of the whipped conductors, can be determined for a cable, armoured or unarmoured, respectively, independently of the proportion between the copper and the iron. Comparative costs of material in Danish kroner are tabulated in Fig. 3. These costs of material are for ordinary construction, per kilometre quad, exclusive of the Krarup conductors, for equivalent conductor-diameters from 1 to 3·5 mm., and for mutual capacities from 0·03 to 0·05 microfarad per kilometer, from 5 to 80 quads, iron tape armoured

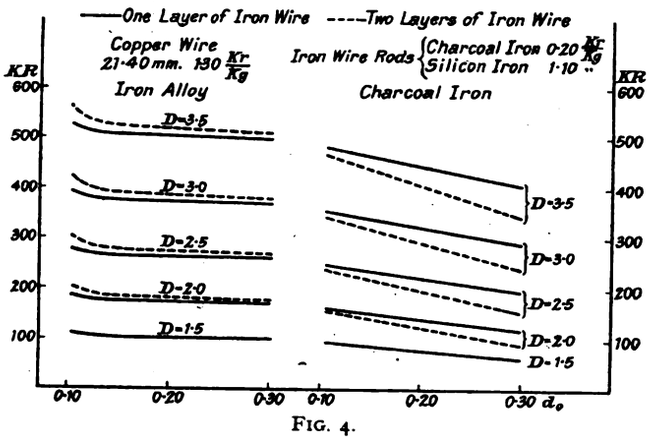

FIG. 4.

and unarmoured, respectively. The costs increase with decrease of capacity and with decrease of the number of quads.

In Fig. 2 is a series of curves representing the attenuation constant β at $\omega=5000$ as a function of the diameter of the iron wire, for 1 and 2 layers respectively, and for various equivalent conductor diameters, assuming a given capacity of 0·04 mfd. per km., and with $A/C=20$, as defined in Fig. 1, corresponding to different values of permeability and specific resistance, ρ, for the iron-wire.

If A/C is assumed to be constant, β is found to increase nearly in proportion to $\sqrt{C}$, so that curves can be calculated for other values of C. For a given equivalent conductor diameter, the iron-wire giving the lowest β, or a certain percentage deviation from the lowest β, is thus the same for other capacities. There is no advantage in increasing the number of layers of iron-wire beyond two. The curves for reversible permeability 125 and specific resistance 0·11 correspond to most of the Krarup cables with charcoal-iron whippings constructed up to the present.

$\mu=175$ and $\rho=0{\cdot}11$ correspond to Krarup conductors with charcoal-iron and suitable heat treatment after winding.

$\mu=275$ and $\rho=0{\cdot}50$ can be obtained without particular care, with heat treatment, using silicon iron.

$\mu=450$ and $\rho=0{\cdot}50$ experimental values obtained in A/S Nordiske Kabel-og Traadfabriker of Copenhagen by heat treatment with silicon iron.

A further set of curves has been drawn to represent values as high as $\mu=1000$ and $\rho=0{\cdot}50$. With regard to such high values attention is directed to "Permalloy," made by the Western Electric Co., and described in THE ELECTRICIAN of June 22nd, 1923. This material contains approximately 80 per cent. nickel and the remainder pure iron, of reversible permeability up to 13000. This alloy is included in the calculations assuming $\rho=0{\cdot}50$. Supposing "Permalloy" to be used in the form of wire for whipping Krarup conductors, the diameter of the wire of the whipping will be exceedingly small—practically too small for drawing.

Here may be recalled the original proposal of Mr. Oliver Heaviside in THE ELECTRICIAN, 1887, Vol. xix, p. 79, to cover the conductor with iron in the form of powder mixed into a suitable insulating layer. This process might advantageously be

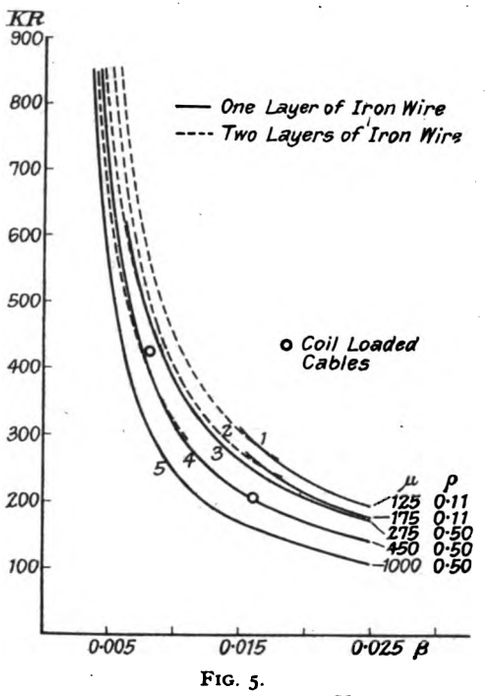

FIG. 5.

ATTENUATION AND COST FOR ARMOURED KRARUP CABLES WITH 20 QUADS.

adopted for iron of high permeability. Mr. Mullerhoj is of opinion that by this means it would probably be possible to obtain Krarup covers with any resulting magnetic resistances required, corresponding to permeabilities below 13000, and that at the same time the isolation of the iron particles by the dielectric would open out the magnetic field of the layer and would render it more resistive to magnetisation. This, he considers, will be of great importance in a material which, as permalloy, is about saturated with magnetism by the earth field only, and even silicon iron already commences to become rather soft in magnetic respect when heat treated to $\mu=450$.

Fig. 4 shows the cost of the Krarup conductors, per km. quad, as a function of the diameter of the iron-wire, for given

WIRING DIAGRAM FOR THE BALANCING.

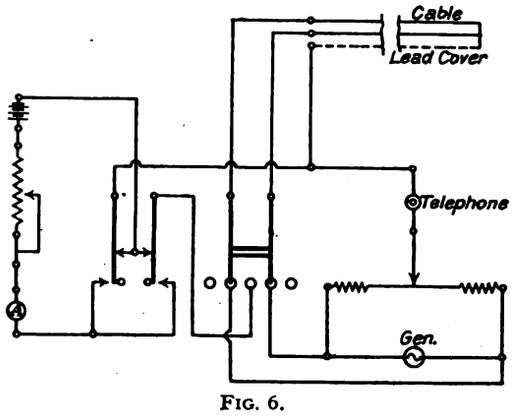

FIG. 6.

EXAMPLE OF MODERN KRARUP CABLE WITH HIGH CHARACTERISTIC IMPEDANCE AND A HIGH DEGREE OF BALANCE.

Cross Talk.	Millionths.	*BL*
Maximum	200	8·5
Mean	140	8·75
Minimum	40	10·
Cross talk $S-S$	0	
Cross talk P_H-P_H	0	

equivalent diameters, with 1 and 2 layers respectively, for charcoal iron and for iron alloy.

Referring to Fig. 5, curve No. 1 represents a construction somewhat better than the average of what has hitherto been manufactured. No. 2 and No. 3 represent what can easily

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be obtained with charcoal iron and silicon iron respectively, by suitable heat treatment of Krarup conductors. No. 4 shows what has been obtained in experiments with silicon iron. No. 5 is what may eventually be obtained with a suitable alloy used as a wire whipping or in accordance with Heaviside's proposal. In Fig. 5, for comparison, two points corresponding to Pupin cables have been inserted on the same basis as accurately as possible. It is seen that Pupin cables are materially superior to Krarup cables hitherto known, but that there is a prospect of getting this relationship altered. Mr. Mullerhoj observes that where space is to be taken into consideration the Pupin cables are more favourable than those of Krarup type.

Cross-talk with Krarup Cables.

To obtain a low value of cross-talk from phantom to side in a telephone cable it is necessary to have uniformity of the two wires of each pair, with regard to capacity, inductance, and effective resistance, within relatively short lengths of the cable. With Pupin cables this can be done, but with Krarup cables it is necessary to develop means for neutralising differences of inductance and of resistance for the two wires of single pairs. When heat treatment is employed this is still more essential.

For two similarly constructed Krarup conductors to have equal effective resistances at all frequencies they must have equal d.c. resistances and equal increases in resistance when measured at a single frequency. The iron contributes to the effective resistance nearly as the square of the frequency and of the reversible permeability.

With regard to inductance, the iron is artificially aged by heat in vacuum, and differences may arise in previously balanced pairs. Moreover, the increase in inductance is proportional to the first power of the reversible permeability.

Mr. Mollerhoj has introduced a process for balancing, based partly upon the well-known fact that the reversible permeability may be reduced by magnetisation of the iron, and partly upon the observation that the higher the reversible permeability the more easily may it be reduced by magnetisation. The method consists in magnetising the iron whippings, whereby there is imparted a certain amount of residual magnetism. A suitable magnetising current is passed through the wire having the highest self-induction, until balance is restored. Preferably the method should be applied to the various sections during installation. It is stated that experiments indicate that, in the absence of powerful disturbing influences, there is "hardly any probability of variations of importance." Considerable attention has been given to the question of the best value and the best direction of the magnetising current. Fig. 6 shows the general arrangement for applying the magnetizing current for the reduction of cross-talk in the case of a Krarup cable recently manufactured by A/S Nordiske Kabel – & Traadfabriker. The cable is said to be balanced to great perfection, and it is claimed that it compares favourably with the best coil-loaded duplex cables. It is suggested that by this means the use of Krarup cables will be extended to toll cables and to submarine cables of greater length than could hitherto be dealt with by this form of loading.

Unusual problems are met in the lighting of power stations on account of individual arrangement of equipment, severe service conditions and exacting requirements. The successful lighting system must be reliable, economical, easy to maintain and adequately suited to the specific local requirements, which differ throughout the station. The most reliable and economical source of energy is usually the station auxiliary bus. The distribution wiring should be of the particular quality best suited to meet power station conditions, and should be designed to give the best possible voltage regulation consistent with economy. An emergency lighting system should be provided, and of several possible arrangements, the one giving greatest dependability should be selected. All equipment, such as cabinets, switches, receptacles, lamps, globes, shades and reflectors, should be carefully selected to give maximum operating convenience, long life and high efficiency. An instructive article on this subject appears in a recent issue of the "Electrical World."

Consideration is being given by the London County Council and the Westminster City Council to the desirability of exercising direct control over electrically illuminated advertisement signs.

A COMPREHENSIVE SHOW.

The French Physical Society Exhibition.

Anyone who rashly seeks to describe the French Physical Society's Exhibition which has recently been held in Paris after a day's inspection, is likely to give up the attempt as impracticable. Hence the original idea of giving a detailed account in this article must be replaced by some reflections of a general character. For many years the Société Française de Physique has held a successful exhibition at Easter. This year, possibly owing to the jubilee celebrations of the Society which have just been held, it was decided to be much more ambitious and to have a wireless exhibition also. The result has been three weeks of unqualified success.

When it is said that the exhibition is being held in the Grand Palais, which yearly accommodates the automobile show, the largeness of the present display will be realised. It is by no means confined to physics and wireless telegraphy (indicated by the convenient French abbreviation T.S.F.) but covers metallurgical and engineering subjects also. As another indication of size, an exhibit of overhead e.h.t. line construction may be mentioned, complete with steelwork, suspension insulators, and two sets of Delle interrupters for 1 000 000 kVA at 150 000 V, all for outdoor use. Another attraction is an electric carbide furnace, shown in operation, and the cutting of steel under water by the oxy-acetylene blow-pipe.

Wireless telegraphy occupies about a quarter of the space. Valve sets are to be seen on every hand. A noticeable difference between this exhibition and those which have been held in London is that the needs of the amateur do not seem to be met nearly so fully in Paris. It looks as if the French amateur is not so anxious to be his own constructor as is his English *confrère*. Apart from the lack of minor accessories there is also a lack of crystal sets. Such as are shown appear to be much more cumbersome than is necessary.

Excellent Demonstrations.

An excellent feature of the exhibition is the number of minor demonstrations in electricity and light. These are given each afternoon at intervals, and they attract crowded audiences. As an example, the demonstration of the colours of thin plates, concluding with Lippmann colour photographs, may be mentioned. These are not often to be seen, and are remarkable for their brilliancy. Another interesting exhibit is that showing some of the properties of inaudible sound waves. Mishio Ishimoto is showing a detector for such waves, consisting of a piezo-electric (quartz) crystal in combination with a valve.

Some Holweck transmitting valves are on view. These are made up with joints, mainly metal, so as to be readily dismantled, and are permanently run on a molecular air pump.

Some details are shown of the electromagnet used at Meudon for obtaining intense fields. This is wound with silver ribbon, 4 cm. wide and 0·5 mm. thick for the first 40 turns and 0·75 mm. thick for the remaining 22 turns. Water is circulated between the turns. With a current of 6 000 A at 95 V a field of 48 600 gauss was obtained without iron. With an iron core this reached 70 000 gauss. The volume that could be placed in the field was 100 cub. mm.

An exhibit of particular interest is the cathode ray oscillograph with which Dufour has obtained records of high frequency currents. It is made up with metal and is of such a size that photographic plates can be operated within the vacuum chamber. A new insulating material of particularly high qualities for electrostatic instruments is shown and is said to be "acrolein gel." It is not clear from this name just what the material is.

Mr. Soulier is showing a three-phase squirrel-cage induction motor running with self-excitation. Maurice Leblanc has shown that if such a motor is run above synchronism it will act as a generator, taking the necessary magnetising current from the mains. If such a motor is connected up with a condenser independently of a network it also becomes a generator, the condenser supplying the required magnetising current. This is the arrangement shown.

There are innumerable other things of interest, but space and time forbid their description. One of the features of the exhibition is the use of large Gaumont loud speakers for giving the news and musical selections, both inside and outside the exhibition building. From hearing them, the impression left upon our mind is that the loud speaker, at least the public address type, is much more perfect in Paris than in London.

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INSTITUTION OF ELECTRICAL ENGINEERS.

Discussion Discloses a Variety of Opinions and Reasons against the Use of Pulverised Fuel.

At the meeting of the Institution of Electrical Engineers on December 13th a paper on "Pulverised Fuel" was read by Mr. David Brownlie. Prof. E. W. Marchant presided. An abstract of the paper will be found on p. 690 of this issue, and we give an account of the interesting discussion that took place below.

Discussion.

Sir James Kemnal said his firm had closely followed the development of pulverised fuel, and felt that whilst it filled a want in many cases, it was not yet of universal application. American coals were more friable than any European coals, as was shown by the fact that whereas in England a mechanical stoker of more than 9 ft. width could not be used, in America a width of 24 ft. was possible. It was not his experience as the author had stated, that it was possible to utilise a greater variety of fuels with pulverised fuel than with mechanical stokers. Although he did not wish to dispute the author's figures of efficiency, it should be noted that the central station engineer did not care much whether he got 80 or 85 per cent. so long as his total costs per unit generated were kept down. There was such a thing as scientific apparatus which would improve the efficiency, but whose capital costs more than outweighed the advantage this obtained. No mention was made in the paper of the capital cost of the Lopulco system, but he took it that it was some four or five times greater than that of an installation of mechanical stokers of the best type.

Mr. G. W. Partridge (London Electric Supply Corporation) said that whilst the pulverised fuel system was worthy of close consideration, the author had not given full credit to the latest developments in mechanical stokers in making his comparisons. He entirely agreed with Sir James Kemnal that the most important point for the power station engineer was the cost of evaporation, and not the efficiency. If high efficiency could be obtained, so much the better, but one of the most important things in regard to any such system as the Lopulco was its capital cost. On this point the author had very little to say. As to the comparative efficiency in American stations and British stations, the fuel used in American tests was not the same as that at the disposal of station engineers in this country. It was essential in this country to have a stoker which would burn any class of fuel. One drawback of the pulverised system was that it threw out dust; according to the author something like 25 per cent. of the fuel being blown away in ash. The author said it was never seen again, but he was afraid that in London it would be seen. At the same time, having regard to the high quality of Kent coal and its proximity to London there might be a great future for the pulverised fuel system in making it usable.

Statistics a Dangerous Tool.

Mr. B. Pochobradski said that the difference in the efficiencies of Lakeside and Dalmarnock, which was made much of in the Paper, was due neither to pulverised fuel nor to mechanical stokers. It was due altogether to the difference in the working conditions. The moisture content of the coals used was not the same, and if Dalmarnock had used a coal with the moisture content of Lakeside, it would have resulted in a 1·1 per cent. higher efficiency. At Dalmarnock the leaving temperature was 414 deg. F., and at Lakeside only 205 deg. F. Correcting for this, Dalmarnock would improve its efficiency by 3·4 per cent. Making other corrections of this nature to bring the conditions of the two stations into line, the speaker remarked that he obtained an efficiency, on test, for Dalmarnock of 88 per cent. against 87 per cent. for Lakeside. He agreed that it was not possible to regulate the amount of CO_2 with the mechanical stoker in the same way as with pulverised fuel, and he therefore, reduced the figure for Dalmarnock by 2 per cent. on this account, bringing the total for Dalmarnock to from 85 to 86 per cent. against the 87 per cent. at Lakeside. But a correction had to be made for the difference in the load factors of the two stations—viz., 60 per cent. at Lakeside and 34 per cent. at Dalmarnock, and the result of this was to bring the efficiency for Dalmarnock down to 82·4 per cent. against 85 to 86 per cent. for Lakeside. That, however, was not the final comparison, because the cost of the power used on the pulverising plant had to be taken into account, together with capital cost, labour, maintenance, etc., and he, therefore, came to the remarkable result, allowing for all these things, that the efficiency at Lakeside was 82 per cent. and 82·97 per cent. at Dalmarnock. This, he added, was a just comparison of the mechanical stoker and the pulverised fuel system, taking the figures in the Paper. The boiler did not enter into it. There were, however, certain advantages in pulverised fuel, and that there would be cases where it would be advisable to use that system. The unit system of pulverised fuel was more efficient and less costly than the Lopulco.

Mr. D. Wilson said the author had given figures of the number of Lopulco plants which had been erected during recent years, but had stated nothing concerning the number of mechanical stoker plants erected during the same period. It would be found that that number was very much larger than that for the Lopulco system. Then the author compared a figure of 85 per cent. efficiency for Lakeside with 75 per cent., or thereabouts, for Dalmarnock. As a matter of fact there was a small station in the north of London giving 80 per cent; regularly, and there were other plants doing quite as well as Lakeside, and using mechanical stokers. As an instance of the flexibility of mechanical stokers, he mentioned that the Birmingham Corporation had found that it could get the same results with coals varying from 5 per cent. volatile to 26 per cent. volatile. On the other hand, the fuel used at Milwaukee had a calorific value of from 11 500 to 12 000 B.Th.U., which was not what we should call a low-grade fuel in this country. He had yet to find a pulverised fuel plant which would cover the range he had mentioned. To make comparisons between stations not working under similar conditions and not equally scientifically operated was merely clouding the issue.

A Chemist's View.

Dr. R. Lessing, speaking as a chemist, pointed out that a large percentage of ash material in coal does not belong to the coal, as such, and steps ought to be taken to prevent it being sent away from the collieries. He had calculated that 25 to 40 million tons of ash was carried up and down the country every year, or an amount equal to some 10 per cent. of our total mineral traffic. This was a factor to be considered in relation to the adoption of the pulverised fuel system, for if all this ash were blown into the atmosphere he was afraid that the smoke problem in large cities would be replaced by a dust problem.

Mr. S. F. Evans (Underfeed Stoker Co.) said he knew from bitter experience the difficulties of dealing with varying qualities of coal in mechanical stokers. This was partly due to lack of trained operators. One of the reasons why pulverised fuel was bound to come to the front sooner or later was the advent of the large turbine. These required boilers with a capacity of some 300 000 lb. of steam per hour, which, in the case of a station like Dalmarnock, meant five 60 000 lb. boilers with a sixth in reserve, which led to difficulties in connection with mechanical stoking. At Manchester, there were boilers evaporating 115 000 to 130 000 lb. of water per hour in each of which there were four mechanical stokers. With the increasing demand for large boilers it would soon be necessary to instal eight mechanical stokers per boiler, which meant eight possibilities of a "let-down." If pulverised fuel were used, it was highly improbable that all the burners would go out of action at the same time, and if one did, then the load could be taken by the others. The Medical Officer of the Lakeside district had his offices opposite the Lakeside power station and he said that there had never been cause for complaint on account of dust from the station.

Mr. W. M. Mordey said it was a special satisfaction to know, as stated in the historical part of the paper, that an old vice-President of the Institution, Thomas Russell Crampton, had done some of the earliest pioneer work in connection with pulverised fuel.

Mr. J. S. Atkinson (Power Fuel Plants Co.) said that his firm at one time endeavoured to develop the central system of using pulverised fuel, but after wasting much time and money came to the conclusion that the unit system was the best. Boiler tests when using the unit system showed figures of 85 per cent. efficiency and by the use of this system he claimed to be able to get much higher efficiencies than could be obtained with mechanical stokers, even when using lower grade fuels.

Mr. Brownlie, in reply, said there were very few plants running on the unit system, and one of its chief disadvantages was that it did not lend itself to distant control. The trouble was that it made an attempt to dry, pulverise and separate all at the same time and at maximum efficiency, and that simply could not be done.

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OBSOLETE AND MODERN LIGHTING.

By W. E. BUSH (Lighting Service Department, B.T-H. Co., Ltd.

Profit in manufacturing is so closely related to keeping down overhead expenses that the management of every factory is compelled to control such expenses by the most searching analysis. So much attention is given to reducing overhead costs that frequently a "penny-wise-pound-foolish" policy is adopted, especially in regard to lighting expenses. The factory manager is tempted to pare down lighting expenditure, and does not realise that for every penny he is saving on reduced lighting costs he is losing probably one pound in decreased factory output.

It is perfectly obvious that both the amount of light and the way it is spread over the working area have a direct effect on the quantity and quality of manufacturing production. As a matter of fact light may be considered as a tool, and just as a tool becomes blunted with use, and necessitates sharpening or readjustment, so does a lighting installation

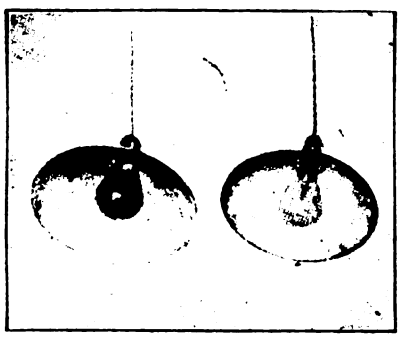
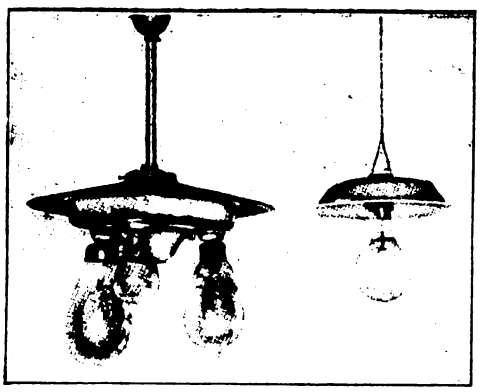


FIG. 1.

demand care and continual consideration if it is to meet modern requirements.

In the majority of industrial interiors to-day it cannot be said that the lighting installations meet modern requirements by any means. Of course, when these installations were planned in the first instance, the material which was fitted was probably the best that could be obtained at that period, but the march of progress has produced so much more efficient equipment that the efficiency of the old type is very low when compared with what are now considered ideal standards. Again, when these obsolete systems of lighting were installed, the points were fitted and lamps placed in lamp holders, and were afterwards left to take care of themselves. No attention was given to them and, even to-day, in many industrial interiors old carbon filament lamps can be seen with blackened globes fitted in cracked and rusty enamelled iron shades, just as they were fitted years ago, and this is termed—electric light.

Fig. 1 illustrates two 10 in. enamelled iron shades, lamp holders and lamps, which were taken down from the store of an



(A) (B)

FIG. 2.

iron foundry in the Midland counties. Of course, it is understood that lighting equipment in a foundry requires more attention than that fitted, say, in an office, but this is all the more reason why this attention should be given. In the illustration it will be observed that the globes of the lamps are extremely dirty, the reflecting portion of the shades is covered with grime, and that the tops of the shades where the lamp holder enters is eaten away through electrolytic action caused through the production of sulphuric acid from condensation of water and sulphur fumes from castings.

Fig. 2 illustrates two units which were taken down from a wood working shop of a factory in Lancashire. Here (A) the fitting was considered to be the acme of efficiency and light distribution when it was designed some years ago, and no doubt it was more efficient than some of the fittings which were

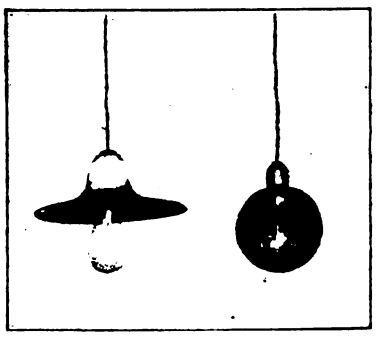


FIG. 3.

installed at that period. But, as will be seen from the illustration, lamps of different sizes have replaced those which were originally supplied with the fitting, a fact which goes to prove that the general opinion appears to be that any lamp with any reflector, will meet any requirements. The proof of this argument is confirmed if one considers (B) for a moment. Here it will be observed that the lamp protrudes below the antique porcelain shade for a depth almost as great as the reflector is wide. This reflector is, therefore superfluous and is serving no good purpose, since the bright filament produces glare, the evil effects of which are felt no matter how low the unit may be fitted.

Fig. 3 illustrates two units which were discovered in a chemical works in Cheshire. Comment is unnecessary.

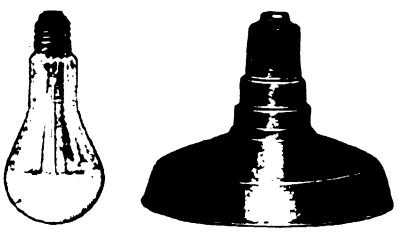


FIG. 4.

Experience has made it quite clear that the shades illustrated in this article are entirely unsatisfactory when used with modern lamps, being absolutely useless as reflectors and allowing the bright lamp filament to be seen. The same experience gained by lighting engineers with various types of reflectors over a period of several years, has resulted in the design of a standard reflector which, with the bowl enamelled gasfilled lamp gives a lighting unit which has great possibilities as a "standard" unit for a wide variety of industrial interiors. This reflector, which gives a dispersive distribution of light, and the bowl enamelled gasfilled lamp with which it should be used, is illustrated in Fig. 4. It is estimated that this combination will meet the requirements of 90 per cent. of industrial interiors.

When considering production costs, every factory manager should remember that in late afternoons and on overcast days, work lags! Poor light dulls the keenness of every workman. Swift hands become heavy, ease becomes effort, and inaccuracy increases the size of the scrap heap. In every plant the failure of the sun is costly unless good dependable electric light is instantly available.

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HOW TO ADVERTISE ELECTRICAL APPARATUS.

What was described by many speakers as one of the best papers ever presented at the Salesmanship Conferences of the E.D.A., was read by Mr. W. E. Warrilow at the December meeting, which was held on Friday at the London School of Economics, Kingsway.

In opening his remarks, Mr. WARRILOW said it could be proved that advertising was one of the most powerful factors in business building, and what it had done for pills and paints, foods and frocks, and so on, it could also do for electric wiring, lamps and lighting, cooking and heating, domestic utilities, and also, though to a lesser degree, for boilers, turbines and switchgear. There were problems for the advertising man proper in giving publicity to electrical products, which he did not meet with in other industries, and, whilst he (the speaker) believed that the electrical advertising man should have been trained in electrical matters, the advertising expert had enormous scope in the industry.

There was need for greater courage and confidence on the part of all branches of the industry in their attitude to advertising owing to (1) the growth of home and foreign competition; (2) the constant need to reach both new and present markets; and (3) the existence of an excellent trade press. He would like to hear less of the expression of opinion that, in the case of plant and machinery, advertising was unnecessary, and also that domestic electrical utilities sold themselves because of their unique character and excellence.

Referring to progress in printing, and its influence on advertising, he said that the "presentment" of the "story" was now possible in a style of type and character of illustration which raised many advertisements to the level of good art. As to advertising machinery or plant, he welcomed the healthy tendency of many firms to spend money on good photographs, because it converted the business pages of the trade press into good matter, to which the reader (especially abroad) turned with ever-renewed interest.

Advertising and Domestic Apparatus.

Coming to domestic apparatus, he said that in regard to the manufacturer advertising through the trade press to the retailer, the industry was plentifully served with trade journals and the retailer could be reached for a moderate outlay. The field of advertising to interest and instruct the public was almost undeveloped from an electrical point of view, and great prospects awaited progressive advertisers who extended in this direction. Though, compared with trade paper advertising, the cost was greater, the "audience" was infinitely larger, and results were almost immediately obtained through the retailers.

One of the most important facts was that when an advertising man had a standardised, named product to deal with he was able to prepare in advance the copy for a complete campaign. It enabled the advertising to be carried out in direct relation to the retailer, and, in certain cases, in conjunction with him. Such campaigns could be conducted locally, with great effect. He could put forward no more powerful argument for a determined attempt at standardisation of these products than that they were most effectively advertised in that form.

Another form of co-operation was that in which the retailer placed a definite order with the manufacturer for a minimum number of pieces, in return for which his name and address were given a prominent place, with those of other retailers, in the advertisement space which the manufacturer reserved in a national newspaper. The success of this kind of advertisement had been proved again and again.

Mr. Warrilow drew special attention to the need for the immediate availability of advertised goods, a factor which had an important bearing on the production of the goods themselves. To the manufacturer it meant lower works cost, because he could plan for so many thousand pieces, on the assurance that the advertising scheme and the assistance of the retailer would dispose of them. To the retailer it meant the removal of the uncertainty he felt in handling products the design of which was changing almost indefinitely. Standardisation must not be carried to the extreme which prevented further progress; he was pointing out that advertising was an aid to standardisation of standardisable products to an extent which would enable them to be marketed in the most efficient manner.

The practice adopted by some retailers, of buying or loaning blocks and "copy" matter from the manufacturer, and "calling his wares" in his own local papers, was a step in the right direction. Facilities for local advertising were available from most manufacturers, and were a valuable aid to retailers who stocked named and advertised goods. Greater progress would be made in advertising electricity supply when the station men fully realised that a huge mass of the public was still ignorant of the merits of the domestic electric service. The central station man's advertising could be most effective in his own area if it were arranged to assist local retailers.

Finally, Mr. Warrilow put in a word for the ladies as advertisement designers and "copy" writers, because they could put the merits of the electric service from the housewife's point of view. He looked forward to a national electrical advertising campaign, and appealed for generous contributions to the coffers of the E.D.A.

Discussion.

Mr. W. R. RAWLINGS said as the manufacturer reaped the reward, he was the man to do the advertising. A journal to represent the industry, but which would be suitable for home reading was required. Urging co-ordination of the technical press, he said that if they had one good journal it would be infinitely better for the advertiser, the reader and the publisher than the present number.

Mr. W. E. ROGERS (West Ham) said that supply companies did not believe in advertising as a paying proposition.

Mr. R. W. HUGHMAN, to illustrate the value of local publicity, gave an account of a campaign at Hartford (Connecticut) where the supply company, who had 36 000 residences on their mains. They selected a 150 W fitting, and decided to get it installed in as many kitchens as possible. The fittings were put up by the contractors, who were paid the standard figure, and the consumers were given a month's free trial. If they decided to keep the fittings, they paid for them in three monthly instalments. Contractors were invited to co-operate, and as a result of the campaign, 7 000 fittings were sold.

Mr. G. CAMPBELL (Benjamin Electric Co.) said that increased trade would only come if the price of electrical goods were reduced, and if more advertising were done.

Mr. A. C. MORTON said figures showed that trade papers in this country had a larger circulation than those in America, on the basis of the number of electrically wired homes in the two countries.

Mr. ALDERSON SMITH said that central station engineers and contractors were not doing their share of publicity work; British trade journals were doing their part; and they were well received and widely read. But the trouble was that large undertakings often bought only a dozen copies, which had to circulate to about 200 men. The publishers received enquiries for copies weeks and weeks old, because information had taken several weeks to reach a man.

Mr. L. L. ROBINSON (Hackney) referring to Mr. Hughman's story, said it was a great mistake to oversell to any consumer; it should be the duty of engineers and contractors to see that consumers were given service at the lowest possible prices.

Mr. HUGHMAN said that matter had been clearly explained to the consumers. There was a two-rate tariff and the current used for the particular fittings referred to ran out at 2·75d. per kWh.

Mr. H. T. YOUNG (Troughton & Young), said that if manufacturers would go all out for a national advertising campaign, retailers would be happier with a little less immediate profit on an article, because they would be better off in the aggregate. He emphasised the necessity of educating architects in the value of electrical appliances.

Mr. LEWIS HART said he would like to see electrical goods branded more, and urged retailers to make more use of their windows.

Mr. H. KING (Ilford) testified to the success of an electrical exhibition locally, at which contractors, as well as the supply undertaking, had exhibited. The number of consumers had increased by 1 000 during the year, and many new appliances had been connected. In fact the supply undertaking could not take any more radiators for the time being until additional plant was put in.

THE CHAIRMAN (Mr. H. Marryatt, of Marryatt and Place) asked for advice to small contractors as to utilising space, because a lot of money was frittered away which might be better spent.

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CORRESPONDENCE.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

ELECTRONS AND ETHER.

[To the Editor.]

Sir,—Mr. Sayers' article, "Electrons and Ether," in The Electrician of September 21st, 1923, consists largely of an attempt to show that the modern electron theory and the electromagnetic theory of Maxwell are in direct disagreement. Now the modern quantum theory, which is a development of electron theory dealing with thermal radiation and atomic structure, does definitely abandon classical electromagnetic theory wherever it suits its purpose to do so. The examples dealt with by Mr. Sayers, however, do not show any disagreement between the electron theory and Maxwell's theory. The electron theory as formulated by Lorentz is in complete agreement with Maxwell, except that discrete particles of electricity, or electrons, are postulated instead of a continuum of electricity. In fact, in the free ether the differential field equations are identical in the two theories.

Under the heading "Fields in the Ether" it will be recalled that Mr. Sayers postulates a "directed magnetic field set up in a perfect dielectric," and he reasons that the electric field produced by the growing magnetic field must be in time quadrature to the magnetic field. This conclusion, which is not true in general, is reached by Mr. Sayers because of his erroneous view that the produced electric force is proportional to the time rate of change of the magnetic force. Actually, according to Maxwell's own theory, it is not the electric force itself that is proportional to the time rate of change of the magnetic force, but rather it is the line integral of the electric force (namely, the induced electromotive force) around a contour traced in the field. In fact, it will be recalled that Maxwell's second fundamental differential equation of the electromagnetic field (second curl law), namely:

$$\text{curl } f = -\frac{1}{c}\frac{\delta h}{\delta t},$$

connecting the electric force f with the magnetic force h, is merely a statement of the above law when applied to an infinitesimal contour (c being a constant depending only on the units chosen). Thus the time rate of change of the magnetic force at a point does not completely determine the produced electric force there, but determines only its curl; so that further particulars of the circumstances are necessary. Since the curl of f (or of any quantity) can be expressed in terms of its space derivatives the determination of f from curl f requires the carrying out of operations having the nature of space integrations.

That there is no universally fixed phase relation between the electric and magnetic fields and, in particular, that they are not in general in quadrature, will be realised also by recalling the following recognised facts regarding the electromagnetic fields occurring in practical applications. At low frequencies (such as power frequencies) and near the sources of the field the phase relation is indeed one of approximate quadrature, consistently with the well-known fact that there is only very slight radiation of energy. At high frequencies and far from the sources, however, the two fields are approximately in time phase, consistently with relatively large radiation of energy—as in a train of radio waves, and in a beam of light; indeed, the possibility of energy radiation and transmission by electromagnetic waves is contingent on the electric and magnetic forces *not* being in quadrature. Under intermediate conditions of frequency and location the phase relation may be intermediate.

It may very well be that Mr. Sayers has in mind not the general case of a changing magnetic field but the particular case constituted by a simple harmonic plane wave rectilinearly polarized (sometimes called "plane polarized"). But even then Mr. Sayers' conclusion would be erroneous, as will be seen from the non-mathematical reasoning of the next paragraph herewith, which is verified by the simple mathematical reasoning of the two succeeding paragraphs.

In arriving at his conclusion that the electric field produced by the growing magnetic field must be in time quadrature to the magnetic field Mr. Sayers reasons that the produced electric field is strongest where the magnetic field is zero, since there the time rate of change of the magnetic field is greatest. The fallacy in that argument can be seen by considering a long narrow loop traced in the magnetic field, with the plane of the loop perpendicular to the magnetic field and the width of the loop in the direction of space variation of the magnetic field (that direction which is perpendicular both to the magnetic and to the electric fields). The resultant electromotive force in this loop-circuit will indeed, according to Maxwell's own theory, be greatest if the loop is situated where the magnetic field is changing most rapidly with time. But this resultant electromotive force in the loop is the difference between the electromotive forces induced in the two long sides of the loop, and thus is proportional to the space rate of change of the electric field rather than to the electric field itself. Thus, the space rate of change of the electric field is a maximum where the space rate of change of the magnetic field is a maximum; that is, the two fields are in time phase (not in time quadrature). An alternative demonstration can be set up by imagining the loop to be traced at a place where, at the particular instant contemplated, the magnetic field is strongest and hence its time rate of change is zero. The resultant electromotive force in the loop is then zero and hence the electromotive forces in the two sides of the loop are precisely equal; that is, the space rate of change of the electric field is zero, and hence the electric field itself a maximum there—where the magnetic field is a maximum.

This conclusion that the electric field of this case is in phase (not quadrature) with the magnetic field can, of course, be readily verified analytically by application of Maxwell's fundamental equations. To begin with, the assumed wave character of the magnetic force h is represented by the equation:

$$h = H \sin 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right),$$

H, T and λ denoting the amplitude, period and wave-length respectively. Let k and dx denote the length and the width of the loop and f the electric force. The following equation then expresses the fact that the resultant electromotive force e induced in the loop is equal to the difference of the electromotive forces induced in its two long sides:

$$e = kf - k\left(f + \frac{\delta f}{\delta x}dx\right) = -k\frac{\delta f}{\delta x}dx,$$

dx being taken small compared with the wave-length. But also, by application of the law of induced electromotive to the loop,

$$e = -\frac{k}{c}\frac{\delta h}{\delta t}dx,$$

c denoting a constant depending on the units chosen. Consequently:

$$\frac{\delta f}{\delta x} = \frac{1}{c}\frac{\delta h}{\delta t} = \frac{2\pi H}{cT}\cos 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right)$$

and thence, by integration as to x,

$$f = -\frac{\lambda}{cT}H \sin 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right) = -\frac{\lambda}{cT}h.$$

This demonstration will be recognised as a particular application of Maxwell's second curl law, namely:

$$\text{curl } f = -\frac{1}{c}\frac{\delta h}{\delta t},$$

which for a plane wave rectilinearly polarized reduces to $\delta f/\delta x = \delta h/c\delta t$.

The demonstration can be based also on Maxwell's first curl law, namely:

$$\text{curl } h = \frac{1}{c}\frac{\delta f}{\delta t}.$$

In the present application curl $h = \delta h/\delta x$ and therefore

$$\frac{1}{c}\frac{\delta f}{\delta t} = \frac{\delta h}{\delta x} = -\frac{2\pi H}{\lambda}\cos 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right).$$

Hence, by integration as to t,

$$f = -\frac{cT}{\lambda}H \sin 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right) = -\frac{cT}{\lambda}h.$$

This is consistent with the value $f = -\lambda h/cT$, because $c = \lambda/T$.

A case where Mr. Sayers' conclusion (but not his reasoning) regarding the quadrature phase relation would be correct is that where there is present a completely reflected wave train in addition to the direct wave train, so that the resultant is a stationary or standing wave train. In such case the electric and magnetic fields are in space quadrature and also in time quadrature. For the resultant magnetic field is always changing most rapidly at points midway between its nodes, and consequently at those mid-points are situated the nodes of the electric field, whence the two fields are in space quadra-

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ture. That they are also in time quadrature follows from the fact that the space rate of change of the produced electric field at the magnetic antinodes is greatest at the time when the magnetic field there is zero, since then the magnetic field there is changing most rapidly. These conclusions can be readily verified analytically by starting with the equation expressing the assumption that the magnetic field is the resultant of a direct wave train and a reflected wave train :

$$h=H\sin 2\pi\left(\frac{t}{T}-\frac{x}{\lambda}\right)+H\sin 2\pi\left(\frac{t}{T}+\frac{x}{\lambda}\right)$$
$$=2H\sin 2\pi\frac{t}{T}\cos 2\pi\frac{x}{\lambda}.$$

Then, by Maxwell's second curl law,

$$\frac{\delta f}{\delta x}=\frac{1}{c}\frac{\delta h}{\delta t}=\frac{4\pi H}{cT}\cos 2\pi\frac{t}{T}\cos 2\pi\frac{x}{\lambda};$$

whence, integrating as to x,

$$f=\frac{\lambda}{cT}2H\cos 2\pi\frac{t}{T}\sin 2\pi\frac{x}{\lambda}.$$

Comparison of this equation for f with the second form of the equation for h shows immediately that f is in time quadrature and in space quadrature with h. Then, by application of Poynting's theorem, it is seen that there is no resultant transmission of energy but merely a surging to and fro. Since f can be written also in the form :

$$f=-\frac{\lambda}{cT}H\sin 2\pi\left(\frac{t}{T}-\frac{x}{\lambda}\right)+\frac{\lambda}{cT}H\sin 2\pi\left(\frac{t}{T}+\frac{x}{\lambda}\right),$$

it is seen, by comparison with the corresponding equation for h, that the direct waves of electric and magnetic flux are in antiphase with each other, and the reflected waves are in phase with each other, though the resultants are in quadrature.

To remove Mr. Sayers' difficulty appearing in the first paragraph under the heading " An Energy Difficulty " it will doubtless suffice to remark that current and voltage can be in phase not only where there is a sink of energy, but also where there is transmission of energy. Such is indeed the case in a beam of light and in a train of radio waves ; in fact, as already remarked, the transmission of energy by electromagnetic waves is contingent on the electric and magnetic fields *not* being in quadrature, as can be seen by application of Poynting's theorem.

In the second, third and fourth paragraphs under the same heading (" An Energy Difficulty "), Mr. Sayers' difficulty in conceiving the existence of an electromagnetic field in free space (that is, away from electrons) can probably be dispelled by the consideration that the electromagnetic field at any point does not depend merely on electrons in the vicinity, but depends on the electrons in all space, the contribution from each electron being propagated with light velocity. For instance, a radio wave in free space (that is, away from electrons) is the resultant of the disturbances sent out from all the vibrating electrons of the source (antenna) and propagated with light velocity ; similarly in a beam of light, originating from incandescent matter. This is the very essence of the propagation theory of electromagnetic phenomena, as distinguished from any theory involving the concept of " direct action at a distance."—I am, etc.,

RAY S. HOYT,
American Telephone and Telegraph Co.,
Department of Development and Research.

New York City,
November 27th, 1923.

INSULATION FAILURE.

[TO THE EDITOR.]

SIR,—I condensed my criticism of the deductions made by Mr. Fernie in his article of the 23rd ult. to four points and the author has replied to each in turn.

Under No. 1 Mr. Fernie still claims that the insulation resistance of a dry impregnated cloth was independent of temperature up to 130 deg. C. An organic material without a temperature coefficient ! In the absence of more details of the experiment than he gives, I can only assume that his galvanometer was either not very sensitive or had stuck.

My objection under No. 2 is admitted.

The remarks by Mr. Collins in this week's issue entirely confirm my contentions under No. 3 that pin-hole punctures cannot be taken as evidence against the pyro-electric theory. Non-homogeneity of the dielectric is the real factor of importance here.

Under No. 4 Mr. Fernie thinks that I make a fetish of absorption. I find that the dictionary definition of a fetish is " An object capable of being appropriated by an individual whose possession of it procures the services of a spirit lodged within it." In this case I will admit the charge, for I am confident that the elusive spirit of the dielectric will reveal itself through studies of absorption phenomena sooner than by any other means, and, in making this claim, I am not overlooking the very close connection between absorption phenomena and alternating current dielectric losses.—I am, etc.,

P. DUNSHEATH.

W. T. Henley's Telegraph Works,
Research Dept., Gravesend.
December 17th.

[TO THE EDITOR.]

SIR,—I have some difficulty in replying to Mr. Collins's ingenuous letter, in your issue of last week ; for it appears to be self-contradictory. Whilst Mr. Collins sets out, apparently, to show that there is no such thing as a partial failure of insulation, he goes on to explain how it takes place, viz., " The true explanation of these pin-holes or partial punctures . . . "

The explanation that the voltage gradient varies inversely as the capacity, Mr. Collins applies correctly when the low capacity is due to a low dielectric coefficient, but, apparently, he does not think it applies when the low capacity is caused by geometrical shape. Since, however, Mr. Collins does not regard either air or oil as " insulating material," I may have mistaken his meaning.

When Mr. Collins says it is " erroneous " to describe a hole extending part way through an insulation as a " partial breakdown, one can only suppose that he thinks the holes were made intentionally.

Mr. Collins's argument amounts to this. Because in his experience he has not noticed the phenomenon, therefore it cannot happen. I feel inclined to quote Hamlet's lines to him beginning " There are more things in Heaven and Earth. . . ."

I may add that I believe two things are necessary to produce the effect, excluding air spaces (Mr. Collins must surely be unique in including them in his insulation).

1. An unequal voltage gradient across the dielectric.
2. An exceptionally strong dielectric, such as is perhaps outside Mr. Collins' experience.

I am, etc.,

F. FERNIE.

Hayes, Middlesex.
December 17th.

STEEL-CORED ALUMINIUM CABLE.

[TO THE EDITOR.]

SIR,—In your issue of the 7th instant we notice a paragraph at the foot of page 646 relating to the use of steel-cored aluminium cable as a combined catenary and feeder cable by the Lake Erie and Northern Railway Co. of Canada.

It may interest you to know that the steel-cored aluminium cable and accessories were supplied in 1916 by our affiliated company, the Northern Aluminium Co., Ltd., Toronto, Ontario, Canada.

A full description of this installation, which we understand is giving very satisfactory service, was published in 1917 in the form of a small illustrated handbook, entitled " Aluminium in Railway Catenary Construction," by the Northern Aluminium Co., Ltd.—I am, etc.,

H. G. WILLIAMS,
Northern Aluminium Co., Ltd.

London.
December 14th.

Model Engineering Exhibition.

The seventh annual exhibition organised by " The Model Engineer " will be held at the Royal Horticultural Hall, Westminster, S.W., from January 4th to the 11th. All the space available for trade exhibits has been allotted, and the display in this section will include wireless and other electrical equipment. Three 72-foot model railway tracks, with steam and electric locomotives at work, will be shown under the auspices of the Society of Model and Experimental Engineers, live passenger loads being hauled on two of the tracks. The exhibition will be open to the public from noon to 10 p.m. each day.

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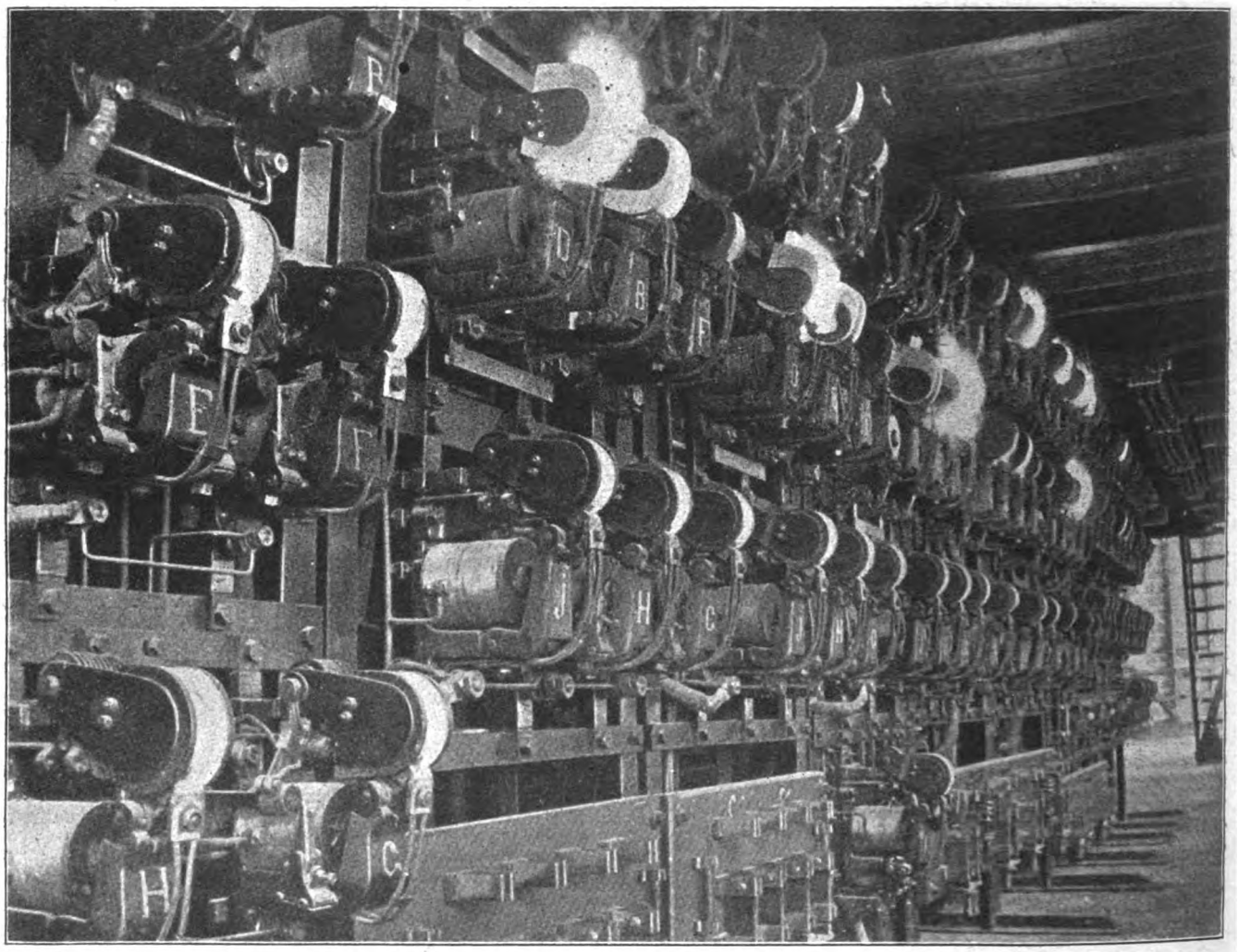
CONTROLLERS FOR STEEL MILLS.

Details of Automatic Contactor Equipment for Auxiliary Plant.

Steel works engineers are not all agreed as to whether alternating or direct current is most suitable for driving their auxiliaries. Each system has its advantages, but whichever is preferred, the severe service and frequency of operation necessitate the use of automatic controllers.

Control gear specialists with experience of steel works practice have long since realised that the ordinary commercial type of automatic controller, even of the so-called heavy duty pattern, is not suitable for steel works service. The conditions are exceptionally severe and demand a controller specially designed to operate satisfactorily against the heavy loads, the frequent operations and the rough handling, and with that adequate margin of reliability which is essential to the steel works engineer. Very often auxiliaries such as live rolls have to operate as frequently as 600 times an hour, starting and accelerating the motor from rest to full speed against heavy starting loads. Maximum torque is usually required at the moment of switching on, and the necessity of rapid reversals imposes severe tests on both motor and controller.



A Contactor Installation for the Automatic Control of Steel Works Auxiliaries (Electric Control, Ltd.)

Contactor type control gear is now universally adopted in all modern steel works for operating auxiliaries and a typical installation of direct current contactor controllers actually in service is shown in the above illustration. The controllers were manufactured by Electric Control, Ltd., of Glasgow, and form part of a complete installation of over ninety controllers, about half of which were for alternating current motors.

A glance at the illustration will at once convey the mechanical robustness of the apparatus. The contactors are mounted on massive square steel bars insulated with mica, no slate being used. This form of mounting, besides considerably reducing the dead weight and making the arrangement of the controllers very compact, renders them and their connections far more accessible. The current accelerating relays are combined with the magnetic blow-out coils, which further reduces the space occupied and at the same time simplifies the design.

The operating coils are liberally designed to withstand full voltage so that no series or economy resistances are used. The method of fixing the coils to the contactor is specially rigid, the coils being supported on a strong base of insulating material. The armatures are of cast steel of massive construction and so balanced as to entirely eliminate any tendency to rebound. The bearing of the armature is solid and of exceptional length. The contacts are of hard drawn copper and both moving and stationary contacts are the same shape and size. On closing they touch at the tips first and the moving contact then rolls over the fixed one until, when finally closed, contact is made along a line lower than the original line of contact. By means of a special torsional spring the pressure on the contacts remains the same even after the contacts are considerably worn after long service. When opening, the contacts roll in the opposite direction.

Powerful magnetic blow-outs are employed, the shields being lined with a special arc-resisting material and arranged to swivel upwards to allow of easy inspection of the contacts.

A glance at the relay interlocks, some of which are clearly seen on the left hand side of the photograph, will reveal the strong mechanical arrangement employed. The clever design, which ensures perfect contact at every stage and also enables the point of contact to be changed round as required, brings the interlocks into line with the massive construction of the rest of the controller. This patent relay interlock will operate satisfactorily in the dirtiest of atmospheres.

The manufacturers have aimed at reducing the number of moving parts to a minimum and at producing a controller which provides a maximum of reliability for the extremely severe duty of controlling steel works auxiliaries.

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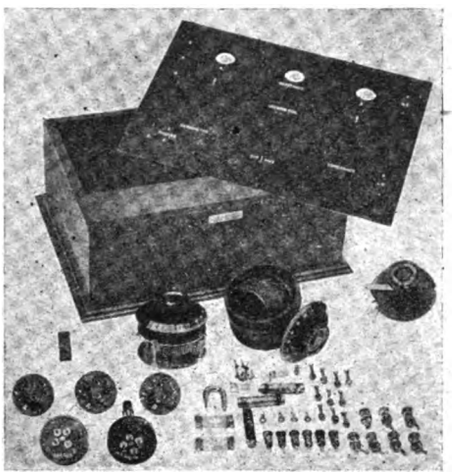
MERCHANDISE TO SELL & PROFIT BY.

Gecophone Constructors' Sets.

Realising that to many the lure of wireless is the ability to build one's own set, the General Electric Co. has produced and marketed a constructor's set of component parts, all of which are identical with those employed in the well-known "Gecophone" two-valve cabinet sets. When completed, the constructor's set takes the form of the company's model "B" set. The ebonite panel is supplied ready drilled and engraved, and all the components are included, as



Two-valve Constructors' Set. By the General Electric Co.

well as a pair of pliers, a screwdriver and a soldering iron. In view of the new position regarding the licensing of home-constructed apparatus, this outfit should prove an attractive line for wireless dealers.

A Handy Light Economiser.

Many householders leave the light burning in a room which they are not using, but to which they will return during the course of the evening, in order to avoid fumbling for the switch in the dark. A simple little device made by the Hendon Electric Lamp Co. is designed to obviate this. The "Spot-o'-Lite," as it is called, is similar in appearance and size to a drawing pin, except that in the centre of the top part is a circle of luminous material. One placed over every switch will obviate the inconvenience referred to. "Spot-o-Lites" are packed a dozen in a box to sell at 3s. 6d.

"Foolproof" Valve Cap.

Many wireless enthusiasts have at some time or another suffered the loss of a precious valve by accidentally getting the filament pins across the h.t. supply. To avoid this possibility the Edison Swan Electric Co. have introduced a simple little idea in its valve caps, which they claim to be absolutely foolproof. The filament pins are cut off at unequal lengths, one being shorter than the other, and both shorter than the grid and anode pins, which are of the standard length. It is thus quite impossible to make accidental surface contact with the grid or anode circuit sockets, and the filament cannot go into circuit until the grid and anode pins are pushed well home in their correct sockets. We understand that this little idea has been patented, and that all Ediswan valves will in future be provided with the new safety cap.

Tubular Earth for Wireless.

As dealers handling wireless apparatus are aware, the "listening-in" public pays considerable attention to the erection of the aerial, but doesn't, as a rule, recognise the importance of having an efficient earth connection. The actual earth contact should always be as short as possible, and the "Gecophone" (Hedges patent) tubular earth, which sells complete at 10s. 6d., has been designed to avoid the necessity of running long lengths of wire to water pipes. This tubular earth consists of a 3 ft. length of specially pointed tube with a cap screwed to the top end by set screws. The earth wire from the set is threaded through the brass washer provided for a distance of 3 ft., and then through the iron cap. The cap is then filled with lead yarn which is tamped into a recess in the cap. The pointed end of the tube is then driven into the ground till the top is just below ground level. The wires are then inserted into the tube, and carbon poured into the tube to fill it to the top. Holes are provided in the cap to permit moisture from the ground to enter the tube and keep the carbon moist, thus maintaining perfect electrical connection.

Clix Universal Contacts.

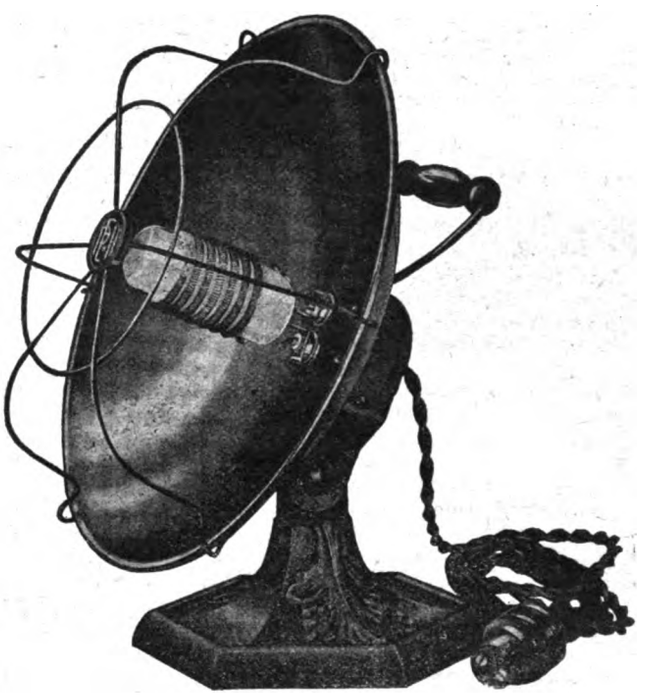
Described by the makers (Autoveyors, Ltd.) as "the electro-link with 159 uses," the "Clix" universal contact is a combined plug and socket, designed to meet the demand for a simple and effective contact or terminal, which may be connected or disconnected quickly and without trouble. It does away with the trouble of wire or lead tracing, as every "Clix" is identified by the colour of its insulator. The device retails at 4d. complete.

The "Adjusto-lite" Lamp.

"The lamp with the clamp" has become such a popular expression in the trade that it is not necessary to mention that it is the "Adjusto-lite" lamp marketed by Guitermann and Co. "The Adjusto-lite" will make an ideal present, combining the qualities of a substantial and useful device. It has a very handsome appearance when finished in nickel. Owing to the multitude of uses to which it can be put it will command the interest of a wide choice of buyers. It is suitable for clamping on the piano, on the dressing table, on a shaving mirror, on the typewriter, and on a sewing machine. Apart from the more homely duties which the "Adjusto-lite" performs, it is an excellent lighting unit for an easel or drawing board. In satin brass the lamp sells at 21s., and in nickel-plate at 23s.

A New Pedestal Heater.

We illustrate below a new electric pedestal heater which has just been placed upon the market by Premier Electric Heaters, Ltd. Made in two sizes, selling at 22s. 6d. and 32s. 6d., both models embody features which are claimed to produce the maximum volume of heat for the energy con-



Pedestal Heater. By Premier Electric Heaters, Ltd.

sumed. With base and fittings finished oxidised copper, these heaters are supplied complete with flex and B.C. adaptor. Highly polished solid copper is used for the reflector bowls, which are of a shape designed to project the heat as far into the room as possible.

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NEWS IN A NUTSHELL.

Instruction in domestic electricity is now compulsory in Austrian elementary schools.

A German firm is reported to have secured a large contract for the erection of power stations near Moscow.

Last year American electrical machinery and materials to the value of £137,000 were imported into South Africa.

A. H. Bull, Ltd., of Broad Street, Reading, are the first to instal a scintillating electric sign in Reading's main thoroughfare.

The first commemoration dinner of the Whitworth Society will be held to-day (Friday) at the Holborn Restaurant, London.

It is reported that the Austrian Government has now consented to the Viennese municipal authority taking over the electrification of the Stadtbahn.

The seventh annual concert of the E.T.U. London Station Engineers (No. 1 Branch) will be held this (Friday) evening at the London and Brighton Hotel, Peckham.

A comprehensive bulletin on the ventilation of electric central and sub-stations has been issued by a sub-committee of the American National Electric Light Association.

Forty-eight shopkeepers and residents in George Street, Oxford, have petitioned the City Council to light the street by electricity. The matter has been referred to a sub-committee.

Copper consumption in the United States at the present time is about 70 per cent. of the world's production. More was used during the first three quarters of 1923 than in the whole of 1922.

Tests have proved that better lighting increases the average sale of goods per customer by 29 per cent., according to Mr. F. T. Groome, who is conducting an educational campaign in Canada on wisdom and economy in the use of light.

The Prescott employees of the British Insulated and Helsby Cable Co., have been dispensing good things provided by their Father Christmas Fund. Adult relatives of the firm's employees in the local hospitals were visited and presented with gifts.

In 1924 the Government of Indo-China will embark on a large scheme of extensions to the telephone system, including the linking up of the large towns in Cochin-China. All supplies will be obtained from the Ministry of Colonies in Paris.

Delivering his presidential address to the Midland Section of the Junior Institution of Engineers at Birmingham, Dr. C. C. Garrard, of the General Electric Co., insisted on the importance of establishing and conserving the professional standard of the engineers' work.

The electrification of flax spinning mills on heat economy lines formed the subject of a paper read by Mr. F. Green before the Belfast Association of Engineers. The lecturer pointed out that the electric drive reduced the risks of accident in a mill, and no power was lost in driving idle shafting.

A proposal by Southport Electricity Committee to open a showroom was opposed at a meeting of the Town Council, it being contended that such a scheme might lead to municipal trading. Eventually the electrical engineer was authorised to hold an electrical exhibition and to prepare a report on the showroom proposal.

Reporting on economic conditions in South Africa, Mr. W. G. Wickham states that the first Union automatic telephone exchanges are to be installed at Pietermaritzburg and Port Elizabeth, and adds that it is highly satisfactory that this contract should have been secured for an all-British system and material against keen international competition.

A Montevideo firm is desirous of getting into touch with British manufacturers of electrical fittings suitable for a large building which will include a hotel, tea rooms, arcade, and cinema. Applications should be addressed to the Department of Overseas Trade, 35, Old Queen Street, London, and the reference number 9 061/F.L./M.C./2, should be quoted.

Mr. S. E. Povey read a paper on "The Development of the Formby Power Station" of the London, Midland and Scottish Railway, last week before the Mersey and North Wales Centre of the Institution of Electrical Engineers. Dealing with the reconstruction of the station, which has just been commenced, Mr. Povey gave details of the new type of boilers to be introduced, and of the new generating machinery.

Several electrical dealers are pushing wireless receiving sets as "Christmas Gifts for Invalids."

Satisfaction is expressed in Havant at the electric street and shop lighting which began to function last week.

Crawling on to the (London) District Railway near Turnham Green Station on Monday a four-year-old child was electrocuted.

It is understood that the Dunblane Electricity Supply Co. has been purchased by Balfour, Beatty and Co., of London.

The "Elfay," an American yacht to be renamed the "Magdalene," now at Southampton, has been fitted with Diesel-electric drive.

Two hundred and thirty thousand new electricity meters were installed by New York State supply undertakings in the first nine months of this year.

A new London electric tramway extension to be opened in the New Year will connect up two places which are only 3½ miles apart by a route 11 miles long.

Toronto electrical dealers have had their Christmas window displays arranged free under the co-operative window-dressing scheme of the Electric Service League.

A special effort is to be made by the Ministry of Transport to secure the passage through Parliament of the London Traffic Bill at the earliest opportunity.

It is reported that a second telephone cable is to be laid between this country and Holland, and that the cable has been ordered from Siemens Brothers and Co.

Beautiful colour lighting effects were obtained at the Royal Command Performance at the Coliseum, London, last Thursday by means of colour-sprayed gas-filled lamps.

Two deaths and a great deal of damage resulted from a collision at Gosforth, near Newcastle, on Tuesday, between a goods train and an empty electric passenger train.

It is reported that an Austrian telephone manufacturing company has obtained a licence for the manufacture of the Relay Automatic Telephone Co.'s patents for a period of ten years.

Mr. W. G. Turner, the Southampton borough electrical engineer, read a paper on "Steam Turbo-Alternators" before a meeting of the Southampton University College Engineering Society last week.

As the result of further representations by Mr. C. G. Morley New, the city electrical engineer, Cardiff's Elctricity Committee has now decided to subscribe 150 guineas towards the cost of the electrical display at the British Empire Exhibition.

During 1922 the South African Government imported telegraph and telephone material of the value of £50 000 from Sweden. Canada supplied £6 000 worth of cable, America and Germany sending £6 500 worth between them.

Bristol Tramways Co. is touring the principal streets with an illuminated and decorated tramcar in connection with the Lord Mayor's Fund for Christmas dinners for the children of the unemployed. Last year the company collected £1 170 in this way.

A brilliant display of coloured electric lights was a feature at the fifth annual ball of the Electrical Trades' Benevolent Institution (North-East Coast Section) held in Newcastle-on-Tyne last Friday. Mr. Robert Robson, of Robson and Coleman, and Mrs. Robson were the host and hostess.

The first experimental report of the Atmospheric Corrosion Committee of the British Non-Ferrous Metals Research Association, submitted to the Faraday Society on Monday, deals chiefly with the tarnishing of metals. Quantitative measurements have been made of the relative behaviour of different metals and alloys, both indoors and out of doors.

A verdict of "Death due to electric shock received from a defective cable connection on an electric hand lamp" was passed at an inquest at Halifax, last Thursday, into the death of Mr. Henry Booth, an engineer employed by Fletcher Brothers, Halifax. The coroner drew attention to the importance of a strict adherence to the Home Office regulations.

Addressing the Scottish Centre of the Institution of Electrical Engineers in Glasgow on Tuesday, Lord Weir said that in technical design and construction over the entire field of electrical activity Britain was now second to none. We were not, however, progressing rapidly with any far-sighted policy of reform, and there was much waste and inefficiency —for example, in and around London.

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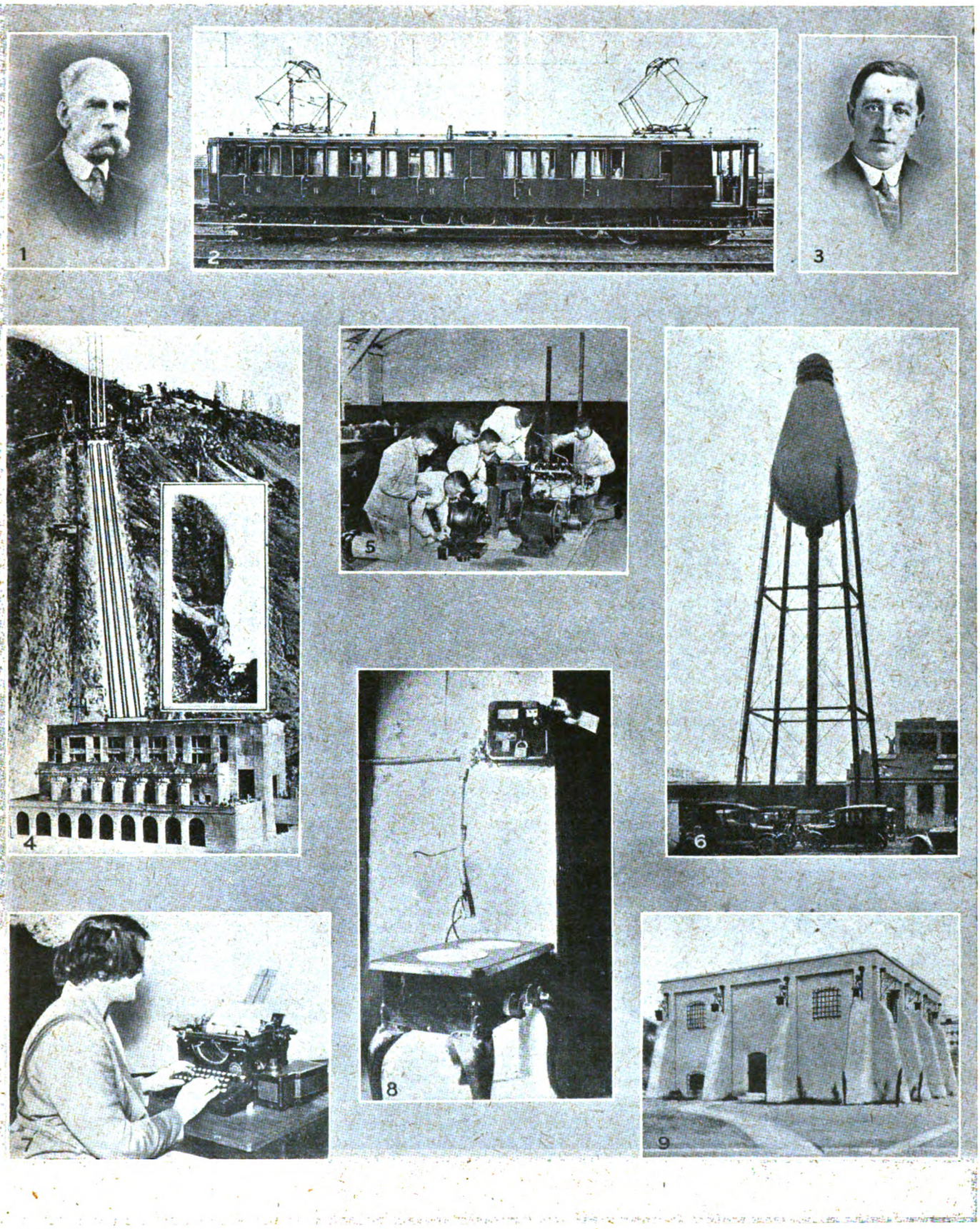

ELECTRICAL NEWS IN PICTURES.

1.—Mr. J. Dyer, a well-known electrical engineer, whose death is announced.

2.—A motor coach on the Midi Railway converted by the English Electric Co. from single phase to 1 500 V d.c.

3.—Mr. R. Lomax, the electrical engineer of the Stockport Corporation electricity undertaking, has received a presentation on the completion of 21 years' service.

4.—The "Electric Giant," the largest water-driven power house on the Pacific Coast. Inset is a view of the plant looking down the Grand Canyon of the San Joaquin River in the Fresno County of California.

5.—Boys enlisted into the Army for technical training under the competitive examination scheme, at work testing dynamos and motors.

6.—A tank in the form of an electric lamp at an American lamp works is quite a landmark.

7.—This new electrically-operated typewriter is said to enable the typist to increase her output with a smaller expenditure of energy. The keys are only touched lightly by hand, the striking force being supplied by electrical means.

8.—Canadian tourists can use this electric stove by placing a coin in the slot above the cooker.

9.—Sub-stations need not be quite as ugly as they so often are in this country. The photo shows a simple but effective way of making them more pleasant to look at without sacrificing utilitarian considerations.

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WIRELESS CHAT.

New Wireless Regulations in France.

New regulations concerning the use of wireless apparatus by the general public will be made public within the next few days. According to a "Morning Post" correspondent, the forecasts that are now published indicate that in some respects these regulations will be much more liberal in character than those in force in either Great Britain or Germany. In Germany private receiving sets are installed by the postal department, and the wave-length is fixed once and for all, while subscribers are called on to pay a somewhat high annual fee for their permits to receive communications. Only appliances furnished by the Government are permitted, and the whole set, with the exception of a single lever, is enclosed in an officially sealed box, which the subscriber is forbidden to open.

The new French regulations, on the other hand, will allow users to instal any kind of apparatus they think fit, including that made by themselves. No fee will be demanded by the Government, the only stipulation being that intending users must register their names at the local post office and produce evidence of French nationality. Private users will, it is stated, also be authorised, free of all charge, to instal sending appliances with a predetermined wave-length for experimental purposes.

Reception on 100 Metres.

Lecturing before the Radio Society of Highgate last Friday on "Reception of Telephony on 100 Metres," Mr. G. A. V. Sowter described in detail the apparatus he uses for the reception of the station KDKA, an American broadcasting station working on a fundamental wavelength of 320 metres. The peculiarity of this station is that its third harmonic (about 109 m) is remarkably strong and steady, there being a very marked absence of fading. There is, of course, also a pleasant freedom from "mush" and other interference on such short wavelengths. The main secret in successful reception on 100 metres, said Mr. Sowter, lies in the use of a very small and finely adjustable condenser in series with the aerial. An ingenious variable condenser was shown specially constructed for the reception of KDKA. This condenser has a maximum capacity of 41 micro-micro-farads and a minimum of 7 micro-micro-farads, and the vernier arrangement allows a variation of one-tenth of a micro-micro-farad to be made. During the discussion which followed, Mr. Andrewes recounted his experiences in the reception of KDKA, and Mr. Hogg reported that he had succeeded in establishing 2-way communication with an American amateur.

Irish Broadcasting Plans.

Plans for the establishment of wireless broadcasting in the Irish Free State have now taken definite shape, and in a White Paper which has been issued by Mr. J. J. Walsh, it has been decided in the first place to licence sets constructed by private individuals. It is considered advisable that all apparatus should be imported through a Clearing House to be set up by the Irish Broadcasting Co., which should collect at the Clearing House the amount due to it on each apparatus as a contribution to broadcasting expenses. The Broadcasting Co., which will operate under licence from the Post Office, will consist of the following firms:—The Cork Radio Co., 50, South Mall, Cork; The Irish International Trading Corporation, 4, Lapp's Quay, Cork; Irish Developments, Ltd., 3, Molesworth Street, Dublin; Dixon and Hempenstall, Ltd., Suffolk Street, Dublin; and Mr. Philip Sayers, 16, St. Andrew Street, Dublin. Membership of the company will be open to any bona fide firm or person carrying on the business of manufacturing wireless apparatus or dealing in such apparatus in the Free State, on subscribing for one or more £5 shares in the company, and on paying a deposit of £50. It has been decided to erect the first and principal station in Dublin. It is anticipated that in Ireland there will be a limited sale for receiving sets, especially expensive valve apparatus, and for this reason, in order that the proposed Irish company should earn sufficient revenue to afford to pay for good programmes, it is considered necessary to charge a higher fee for licences for ordinary "listeners" and for "constructors" than in Great Britain.

Wireless for Ships' Lifeboats.

The improved Marconi wireless set for ships' lifeboats, which was recently demonstrated at Gravesend before the Seafarers' Joint Council, is claimed to represent great advances in apparatus of this kind. The transmitting power is said to be about four times that which could previously be obtained, with a corresponding improvement in range of about fifty per cent., while the arrangement of masts and aerials is such that they can easily be handled in an open boat at sea, the apparatus and operator being afforded adequate shelter from the weather. The directional receiver enables the actual direction of a rescuing vessel to be determined with sufficient accuracy up to the full distance over which boat signals can be received by ships' apparatus in most common use. A 600 metre wave and spark telegraphy are used, and the power involved is nominally 0.25 kW. The whole of the wireless outfit, excepting, of course, the masts and aerial, is contained in a weatherproof case. Two aerials are used in this system. One, termed an open aerial, is used both for transmission and reception, and has no directional effect, so that receiving signals will have the same strength regardless of the bearing of the distant station. The other, a frame aerial, is used for direction finding purposes.

LEGAL INTELLIGENCE.

Theft of Electricity.

At Cheltenham, last Thursday, Albert E. Durn, of 4, Birdlip Place, Bath Road, was fined £5 for the theft of electricity.—The Town Clerk, for the Cheltenham Corporation, explained that the defendant was an electrician and wiring contractor. His premises were connected up for power and lighting with the Corporation's electricity undertaking. On May 25th last the electricity supply was discontinued. The fuses were removed from the Corporation fuse-boxes, and the boxes sealed up so that no supply could be taken without breaking the seal. On November 2nd the Corporation's mains superintendent noticed that electric lights were burning in the defendant's house. Eventually it was discovered that the fuse box had been broken open and new fuses put in. There were also temporary wires which had been connected with the fuse box so that current could be used which did not pass through the meter. A temporary installation which would enable several rooms to be lighted was also found. Altogether seven rooms were connected and had lamps available for use. The reading of the meter showed that some of the current used had passed through the meter, and the actual quantity of current consumed since the supply was disconnected was 39 6 kWh which passed through the power meter, and 5 8 kWh which passed through the light meter.

Giving evidence, the defendant said he pleaded guilty to breaking the seals of the fuse box, but denied stealing the electricity, declaring that every unit he had used since the fuses were taken out had passed through the meter. Asked why the seals were broken, he said it was impossible for him to carry on an electrical business without a supply of electricity. He had to have some lamps tested, and his brother took the fuses out. Questioned regarding the temporary wires, defendant declared that these had been there all the time since he had been taking a supply from the Corporation. There had never been any permanent wiring except in the case of two lights in the shop.

JAPANESE EARTHQUAKE DAMAGE.

Electrical Manufacturing Company's Losses.

A translation of a report of an investigation into the damage to factories caused by the earthquake in Japan, which has been issued by the Department of Overseas Trade gives the following particulars regarding electrical works:—

MEIDENSHA CO.—The company's works at Ozakicho suffered little damage on the whole, but the walls of the works devoted to the manufacture of large electrical machinery are cracked and the foundations of the heavy machines have slipped, making readjustment essential. Extensive repairs are not necessary in the case of the smaller machinery and there is every prospect of an early re-opening. The output of small machines will suffer no change, but some time is needed for reconstruction in the factory for large machines. There is a stock of small machines but, materials are scarce and a rise in price is feared.

TOKYO ELECTRIC CO. (Tokyo Denki).—The damage to the Oil factory, which manufactures electric bulbs, is small. Part of the brickwork of the outer walls collapsed, but there is little interference with the continuation of work, and the machinery has not suffered at all. Though operations can soon be resumed the date of re-opening cannot be fixed upon on account of the lack of gas necessary for fusing the glass. The crucibles for glass melting were entirely destroyed, but repairs were taken in hand immediately. An ample stock of raw material exists. The company's Kawasaki factory suffered severe damage. The laboratories and engineering shops collapsed, killing several employees, and stocks of materials and manufactured articles appear to have been destroyed. Other parts of the works, too, suffered a similar fate and it is impossible to say when the factory will be reconstructed. The manufacture of the better class bulb which used to be carried on at this factory is to be transferred to the Oi works.

TOKYO ELECTRIC HATAGAYA WORKS (Tokyo Denki).—Manufacturing electric lamps. Practically no damage, and work will probably be resumed immediately.

Books Received.

"Oil Engines." By A. L. Bird. (London: Methuen and Co.) Pp. 281. 12s. 6d. net.

"Mechanical World Year Book, 1924." (Manchester: Emmott and Co.) Pp. 348. 1s. 6d. net.

"Elementi di Telegrafia e Telefonia senzia fili." By P. Barreca. (Livorno: Raffaello Giusti.) Pp. lxxxix+450.

"Modern Radio Communication." By J. H. Reyner. (London: Sir Isaac Pitman and Sons). Pp. 208. 5s. net.

"Der Radio-Amateur." By Dr. P. Lertes. (Dresden and Leipzig: Theodor Steinkopff.) Pp. 216. 6s. net.

"Railway Amalgamation in Great Britain." By W. E. Simnett. (London: The Railway Gazette.) Pp. 270. 15s. net.

"The Practical Electrician's Pocket Book, 1924." Edited by H. T. Crewe. (London: S. Rentell and Co.) Pp. lxxviii+570. 3s. net.

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PERSONAL GOSSIP.

Alderman Wilkinson has been appointed chairman of the Luton Electricity Committee for the 29th time.

Dr. T. F. Wall has been appointed external examiner in electrical engineering in the Queen's University, Belfast.

On account of his health Mr. J. Davey has resigned from the board of the Delabole Electric Lighting and Supply Co.

Councillor J. L. Burleigh has been elected chairman, and Councillor P. A. Sanders, deputy-chairman, of Colchester Electricity Committee.

Portsmouth Town Council has appointed Mr. William E. Newberry as mains assistant at the electricity works at a salary of £300 per annum.

Councillor W. J. Stapleton has been elected chairman of the Hackney (London) Electricity Committee for the ensuing year. Councillor G. Green has been appointed vice-chairman.

Mr. S. T. Allen, chief engineer and general manager of the Wolverhampton Electricity Department, has consented to act as adjudicator in the competition for a non-technical explanation of "Power Factor" promoted by the Electrical Apparatus Co.

With reference to our recent announcement respecting the death of Mr. G. W. Black (late sales manager of Heenan and Froude, Ltd., Worcester), we are informed that Mr. G. M. B. Hilton has been appointed to the position of chief of outside sales and Mr. A. H. Jeffcoat to that of head of the sales department at Worcester.

Mr. Sidney Parc Ives, for eight years chief electrical engineer to Higgs and Hill, Ltd., has resigned his appointment in order to take an active interest in the firm of Pinching and Walton, general and electrical engineers and contractors, 52, Cannon Street, London, E.C.4, to which address communications should be sent.

Alderman J. B. Burman, M.P., chairman of the Birmingham Corporation Electric Supply Committee, has intimated his intention to resign the chairmanship owing to the heavier calls upon his time. He will probably be succeeded in that position by Councillor Beale. There are now two members of Parliament upon the Birmingham Electric Supply Committee—Alderman Burman and Alderman Jephcott; both will continue to serve on the City Council.

Forty Years Ago.

"The Electrician," December 22nd, 1883.

JACK-OF-ALL-TRADES.—We notice in a recent issue of the "London Gazette" that a certain tradesman in Nottingham has become bankrupt. He is described as a "fancy draper, hosier and electrician." We wonder whether he was a fancy draper before he was an electrician, or an electrician before he was a fancy draper—but perhaps he was only a fancy electrician.

* * *

SHOPLIGHTING.—An intelligent lad of seventeen, the son of Mr. E. Storey, ironmonger, of Oundle, has for twelve months past lit up his father's shop and premises, economically and well, with the electric light, and gas, we understand, has not been in use there since. To the credit of young Storey, it must be added that he also made the engine which drives the electric lighting machinery.—"Martineau and Smith's Hardware Trade Journal."

* * *

DISCOVERY OF ELECTRO-MAGNETISM.—Some few months ago, Dr. Tommasi once more raised the question, in the pages of "Cosmos Les Mondes," did Œrsted or Romagnosi first discover electro-magnetism? Dr. Tommasi suggested that the electricians then about to meet at Vienna should endeavour to clear up the matter once for all. Captain Francis Lund, of the Danish navy, and one of the Danish Commission sent to Vienna, laid the question before Prof. Holten, Professor of Physics at the Copenhagen University, and he asserts that Œrsted was unquestionably the first to discover electro-magnetism. M. Valette adds to the Professor's letter containing his reasons for coming to this conclusion, that he entirely agrees with Prof. Holten. He states that he has repeated Romagnosi's experiments, being guided by the description of them given by Isarn, and published in 1802, and that they confirm Prof. Holten's view of the matter.

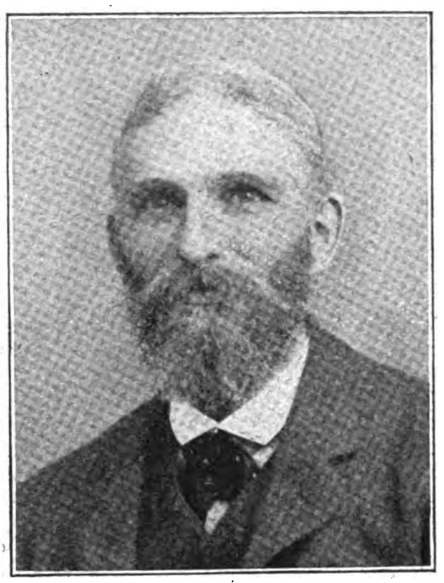
Power-Signalling Installation.

An extensive power signalling scheme is to be installed at the Newport Station of the Great Western Railway, the contract having been awarded to Siemens Brothers & Co. for the supply and installation of their one-lever system of route signalling. The contract includes the supply of generating plant and storage batteries at East and West cabins, the necessary electrical apparatus for working 200 signals and 100 points, and the station limit track circuits with illuminated diagrams at each cabin. This will be the first large application of the new signalling system. A small trial plant installed at Winchester twelve months ago for the same company, is understood to have proved the efficiency of the system. The advantages resulting from the operation of a whole route by a single lever are obtained by local circuits in the relay control case of the cabin.

OBITUARY.

C. H. W. Biggs.

We have to record the death, which took place at Honor Oak, London, on December 13th, of Mr. Charles Henry Walker Biggs, who was the first editor of the second series of THE ELECTRICIAN, which was commenced in 1878. For some years after that time he not only acted as editor of both THE ELECTRICIAN and the "Contract Journal," but he also held the post of Secretary of the



THE LATE MR. C. H. W. BIGGS.

Statistical Society. When Mr. Biggs left the service of the then proprietors of THE ELECTRICIAN, some 30 years ago, he continued to be editor of the "Contract Journal," and soon after he acquired a holding in the capital of "The Electrical Engineer," which he converted from a monthly into a weekly journal. However, after a few years it ceased publication, at any rate, on a commercial scale. More recently Mr. Biggs left the "Contract Journal" and established the "Contractor's Record," which he edited up to the time of his death. Mr. Biggs was in his earlier years engaged in tutorial work at Reading.

Lord Shaughnessy.

The death is reported from Montreal of Lord Shaughnessy, chairman of the Canadian Pacific Railway Board. The new Baron is Mr. W. T. Shaughnessy, who is a director of the West Kootenay Power and Light Co. and of the Canadian Pacific Railway.

W. T. Stubbs.

Mr. William Thomas Stubbs, of Altrincham, who died suddenly in Bournemouth last week in his sixty-sixth year, was a well known figure in engineering quarters in the north of England. He was chairman of Joseph Stubbs, Ltd., machinists, Ancoats, and chairman of Electro-Motors, Ltd. For several years he had been prominently identified with the Manchester Engineers' Club. Mr. Stubbs was president of the Manchester Chamber of Commerce from 1910 to 1912.

J. Dyer.

We publish on page 703 a photograph of the late Mr. John Dyer, of Charlton, who died recently in his 68th year. An engineer with considerable practical experience, he was, as a young man, engaged under his father in Bilbao as locomotive engineer on the Bilbao-Toledo Railway. He returned to this country in the early '70's, and completed his apprenticeship in Manchester. After some years as foreman of a wire works at Barrow-in-Furness he came to London and gained his first electrical experience in the works central station of Siemens Brothers and Co., Woolwich. This was in the early days of bi-polar dynamos driven by Willans central valve engines. While at Siemens' works he became acquainted with Dr. S. Z. de Ferranti, to whose firm at Charterhouse Square he later transferred his services. While with this firm he was engaged on the first single phase 10 000 V alternators at Deptford. He later installed machines for Ferranti's in numerous power stations, such as Cardiff, Harrogate, Bolton, Sheffield, Edinburgh, etc. He always had a keen interest in Spain, and journeyed to Gijon, Oporto and Vigo for the firm of Jessop and Appleby, and erected cranes on their behalf. For a number of years he was engineer for Peek, Frean and Co., and converted their plant from steam to electric drive. He retired prior to the war, but returned to active service later and was engaged on munition production, being released to go to Portugal to erect machinery for the Portuguese Government. Mr. Dyer was also associated for a while with the American Westinghouse Co., and erected a machine for them at the Willesden power station of the North Metropolitan Electric Supply Co.

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TRADE IN NOVEMBER.

Month's Electrical Exports Show Further Increase.

With the exception of arc and incandescent lamps and switchboards there are increases in the imports of all the classes of goods enumerated below. The rate of increase in the whole list for the month is, however, considerably less than in September and October, when the increases were about 100 per cent. and 50 per cent. respectively. For the eleven months, the increases in imports of telegraph and telephone wires and cables, telegraph and telephone instruments were particularly heavy, while electrical instruments increased by 50 per cent. The comparative import figures are:—

	Month of November.		Eleven Months.	
	1922.	1923.	1922.	1923.
	£	£	£	£
Electrical Machinery	72 539	81 232	1 100 297	935 970
Electric Wires and Cables, Insulated—				
Rubber Insulated (other than Telegraph or Telephone)	11 299	17 152	109 584	119 406
Insulation other than Rubber (not other than Telegraph or Telephone)	5 883	7 648	80 234	136 283
Telegraph and Telephone Wires and Cables (not Submarine)	4 673	9 377	27 920	81 783
Submarine Telegraph and Telephone Cables	—	—	—	—
Telegraph and Telephone Instruments and Apparatus (except Wireless Valves)	41 879	57 852	259 829	501 349
Carbons	7 030	15 055	38 187	82 313
Electric Glow Lamps and Parts	28 090	25 495	172 720	192 504
Arc Lamps and Searchlights	—	505	1 134	3 390
Parts of Arc Lamps and Searchlights	1 255	688	11 243	11 826
Batteries and Parts	17 799	18 977	114 658	139 013
Electrical Instruments, Scientific and Commercial (including Ammeters, Voltmeters, etc.) and House Service Meters	6 337	16 311	61 884	93 928
Switchboards	4	—	2 551	1 927
Electrical Goods and Apparatus, all other Sorts	52 794	87 555	468 716	789 414
Total of Electrical Machinery, Apparatus and Material	250 182	337 847	2 448 957	3 089 106

Export Advance Maintained.

Exports for the eleven months, valued at considerably over 11 million pounds, still show a great preponderance over the imports, which are only slightly over 3 million pounds. Exports for the month—compared with the corresponding month last year—increased by £195 500, as against an increase of about half that amount in imports. It is gratifying to note that exports of electrical machinery were £120 000 up on the month, and exports of batteries were nearly double those of the preceding month.

	Month of November.		Eleven Months.	
	1922.	1923.	1922.	1923.
	£	£	£	£
Electrical Machinery—				
Railway and Tramway Motors	14 593	36 412	175 472	311 362
Other Motors and Generators	144 232	192 853	1 944 179	1 740 845
All other Sorts	137 596	187 589	1 705 135	1 846 997
Electric Wires and Cables Insulated—				
Rubber Insulated (other than Telegraph or Telephone)	88 764	114 317	658 934	1 019 351
Insulations other than Rubber (other than Telegraph or Telephone)	90 683	85 117	951 107	827 888
Telegraph and Telephone Wires and Cables (not Submarine)	27 325	55 328	521 753	792 489
Submarine Telegraph and Telephone Cables	51 255	18 242	339 427	616 396
Telegraph and Telephone Instruments and Apparatus (except Wireless Valves	157 254	156 576	1 756 170	1 656 708
Carbons	2 967	4 866	50 820	63 512
Electric Glow Lamps	28 235	25 162	341 876	309 568
Arc Lamps and Searchlights	—	—	—	—
Parts of Arc Lamps and Searchlights	702	975	5 350	7 038
Batteries and Parts	32 950	62 030	452 142	502 037
Electrical Instruments, Scientific and Commercial (including Ammeters, Voltmeters, etc.) and House Service Meters	32 037	32 997	308 544	314 777
Switchboards	10 090	5 479	201 508	97 730
Electrical Goods and Apparatus, all other Sorts	123 273	161 625	1 137 865	1 385 517
Total of Electrical Machinery, Apparatus and Material	944 074	1 139 576	10 557 004	11 134 417

Mr. G. N. Barnes's Book.

The political kaleidoscope moves so rapidly, and industrial and economic problems have become so involved, that it is difficult for the ordinary man to get the whole picture into right perspective. The charming and straightforward story which Mr. George N. Barnes has now given to us in "From Workshop to War Cabinet" (Herbert Jenkins, 7s. 6d.) will therefore be very welcome to thousands who remain unattracted by the higher flights of more accomplished politicians. In his quiet, unaffected way he pours a mixture of human wit and wisdom upon the political hothead, irrespective of party. Barnes's gentle and effective way of dealing with extremists is perhaps the nicest thing about him. He has written one of the most delightful of current political volumes. It has a special interest for industrialists, and contributes not a little to the solution of current problems.

I.E.C. IN PARIS.

Proposed Conference on Terms and Symbols for Radio Communication.

It having been found impossible to hold a plenary meeting of the International Electro-technical Commission in Rome this year as had been proposed, a meeting of the Council was held in Paris on December 3rd, when delegates from ten of the National Committees were present. Dr. C. O. Mailloux, the President, who came from New York, Colonel R. E. Crompton, C.B., the honorary secretary, and Mr. C. le Maistre, the general secretary, were also present. Signor Guido Semenza, of Milan, was elected President of the Commission, and Dr. Mailloux, the retiring President, to whom the Commission owes so deep a debt of gratitude, was elected Honorary President.

The Council appointed a committee to assist in giving effect to the decisions, to co-operate with the Central Office in carrying out its objects, and to co-ordinate the work of the National Committees as well as of the Advisory Committees. This committee will meet once or twice a year and it is hoped thereby to accelerate the work of the Commission. The Council also authorised the Central Office, in consultation with the President and Past President, to take the necessary steps towards the calling of a completely International Conference on Terms and Symbols for Radio Communication.

Reference was made to the International Conference on High Tension Installations then sitting in Paris, and the Council considered that this international conference, to which they wished every success, could be of great assistance to the I.E.C. in its work, by preparing the ground and carrying matters to the point where recommendations on any of the particular subjects the conference was dealing with could be submitted to the I.E.C. for action.

In Czechoslovakia, Hungary and Poland, national committees in conformity with the Statutes of the I.E.C. have been set up and no objection was raised by the Council to these countries taking part in the work of the Commission through their properly constituted committees. A full report of the present position of the work of the I.E.C. was presented and considered in detail, and it is hoped that through the efforts of the Committee now appointed, material progress will be made towards obtaining concrete results which can be put before the next plenary meeting.

DAYLIGHT LAMPS.

Interesting Applications in Various Trades.

Since the introduction of the Osram gasfilled daylight lamp, a large number of interesting applications have been brought to our notice. Some of the most interesting of them, briefly noticed below, may suggest to dealers and contractors new ways in which they can make sales for these lamps. Printing works, especially those in which colour printing is carried out, use these lamps to a very large extent, and their use in textile mills, dye works, showrooms, shops, etc., is an obvious application. Another interesting application is to be found at the Arley Colliery, near Birmingham, where a number of 300 W daylight lamps are used to enable the operation of sorting coal from dross to be carried out under artificial light Previously this work could only be carried out during the daylight hours. Numerous other installations have recently been completed in various parts of the country for this purpose. The medical profession makes use of these lamps, especially in surgeries and operating theatres, where they are preferred to real daylight on account of the constancy of the light and the ease with which it can be controlled. Incidentally a dental manufacturer uses these lamps for matching false teeth, and opticians have reported that they are invaluable when matching artificial eyes. Another application of the daylight lamp is reported by a manufacturer of spectacle lenses, who stated that under the light of these lamps minute scratches and other defects in lenses can be detected, which would be passed if scrutinised under ordinary artificial light.

The "Electric Giant."

On our picture page we reproduce illustrations of the "Electric Giant," the largest water-driven electric power house in the Pacific West, and recently started up by the Southern California Edison Co. The energy generated by this plant will be supplied to some 300 towns in Southern and Central California, and a bulk supply will be given to Los Angeles. The "Electric Giant" is capable of developing 105 000 H.P., a figure which will be doubled when the Florence Lake tunnel, the longest water power tunnel in the world, is completed some two years hence. This tunnel, which is nearly 14 miles in length—more than a mile longer than the Simplon tunnel—will tap the enormous water sheds which lie beyond one of the main ranges of the High Sierras.

The entire project when completed will develop 1 407 000 H.P., which will be generated from new power stations which are being built and by increasing the capacity of the four already built. One of the novel features of the new plant is the omission of a separate lubricating oil system. In this installation each bearing of the main unit has its own lubricating oil pump, thus eliminating all outside oil filters, pumps, supply tanks and pipings.

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ELECTRICITY SUPPLY.

Extensions and Developments.

Doncaster Corporation electricity department made a net profit of £8 533 last year.

Bath Town Council has received sanction to a loan of £9 875 for mains and services extensions.

Boston (Lincs.) Town Council has decided that all the main streets shall be lighted electrically.

Peterborough Town Council has applied for a loan of £15 000 for extensions in connection with the electricity undertaking.

Whitby Urban Council has decided to apply for a loan of £6 000 for extending the supply of electrical energy to Ruswarp and High Stakesby.

Dublin Port and Docks Board has decided to close down its power station at Alexandra Basin and to take a supply from the municipal undertaking.

Canterbury Town Council has applied to the Electricity Commissioners for a loan of £5 000 for providing and laying two new feeder cables.

Beckenham's municipal electricity undertaking is said to have advanced to the first place in its class in London for efficiency, and the second in the kingdom.

Bath Electricity Committee recommends the installation of two 3 000 kW turbo-generators with boilers and auxiliary plant at the municipal electricity works.

Tynemouth Town Council is promoting a Bill in the next Parliamentary session to confer further powers on the Council with respect to the electricity undertaking.

Chiswick Council has decided to obtain a report from a consulting electrical engineer as to the Council's proposed acquisition of the Electricity Supply Co.'s undertaking.

Sheffield Corporation Finance Committee recommends that the laying of an e.h.t. feeder cable from Fulwood to Millhouses, at a cost of £13 545, be carried out as soon as possible.

The Electricity Commissioners have informed Carlisle Town Council that they decline to sanction a loan of £5 000 for electricity mains, until the balance of £4 988 13s. 4d. in hand is nearing exhaustion.

Luton Town Council has received £14 000 from the Disposals and Liquidation Commission in settlement of the Council's claim under an agreement with the Ministry of Munitions to instal certain electrical plant for war purposes.

Manchester Lighting Committee's recommendations that certain streets should be lighted by gas has been referred back by the City Council with instructions that the Committee give favourable consideration to lighting by electricity.

Malvern Urban Council has applied to the Electricity Commissioners for a loan of £1 700 for a new boiler and superheater, etc., for the electricity works. The Council hopes to obtain a bulk supply of electricity from Worcester by the end of January.

Urged to run underground cables only to a new housing estate, Sheffield Electricity Committee adheres to the view that the decision as to the desirability of having overhead or underground transmission should be at the discretion of the Committee.

Lecturing on the development of the Paisley municipal electricity undertaking, Mr. W. Blair Smith referred to the set-back occasioned by the loss of the tramways supply. In spite of that, with the advent of a cheap bulk supply from Greenock and Kilmarnock, it was confidently expected that in the near future substantial reductions would be made in the charges to consumers.

At the last meeting of the Beckenham Urban Council, the Chairman of the Electricity Committee said the undertaking had made a profit this year of £9 628, after paying £4 000 in relief of the rates and reducing the price of energy from 8d. to 7d. per kWh. They were trying to give the smaller consumer the advantage of an economical light, and a large number of the smaller cottages were taking a supply of electricity on the fixed price principle.

Mr. J. Robert Reef, of Market Square, Bicester, has informed Bicester Urban Council of his intention to form a company with a capital of £10 000 for the purpose of establishing an electricity supply undertaking in the town. He added that he was prepared to enter into an agreement for the Council to purchase the undertaking after a number of years, to allow the Council a special flat rate for street lighting, etc., and to guarantee that the price to consumers would be at least 50 per cent. below the prevailing price of gas in the town.

The Electricity Commissioners have notified Hackney (London) Borough Council that they have sanctioned an extension of Islington Council's generating station by the installation of a 5 000 kW turbo-alternator, on condition that the Islington Council links up its system with a neighbouring undertaking. This condition has been accepted, and the Commissioners having asked Hackney Council to co-operate by laying the necessary cable to the Islington boundary, the Electricity Commissioners recommend that this be done, at an estimated cost of £12 000.

Alterations in Charges.

Belfast City Council has decided to introduce the rateable value system of charging for energy for domestic purposes.

Winchester Town Council has reduced the flat rate charges for electricity for power from 4d. to 3d. per kWh as from January 1st next.

Bradford traders are urging upon the Corporation Electricity Department the desirability of reducing their charges for electrical energy.

Richmond (Surrey) traders are complaining that the Richmond Electric Light Co. will not give special rates for outside illumination or for shop window lighting.

Croydon Town Council has decided to substitute the rateable value system of charging for electricity by charges based on the floor area of the consumer's premises.

Eastbourne Corporation has reduced its charge for electricity for lighting to 5½d. per kWh. An extensive system of rental wiring for small houses is being carried out in the borough.

The Merthyr Electric Traction and Lighting Co. has reduced its scale of charges for the supply of electricity for lighting to 8½d. per kWh for the first 40 kWh per quarter, 8d. for the next 50, and 7½d. beyond.

Burnley Corporation is not prepared to supply electrical energy to the Union authorities at a less charge than to ordinary consumers, viz., 5½d. per kWh. The Guardians are therefore recommended to continue the operation of their own generating plant, and for that purpose to instal a new 50 kW set at an estimated cost of £650.

Birkenhead Town Council has made the following reductions in the charges for electricity after the readings for the December quarter :—In the Borough : Lighting, from 5½d. to 5d. ; prepayment meters, from 6d. to 5½d. ; heating and cooking, first 1 500 kWh per quarter, from 1½d. to 1⅜d., beyond from 1¼d. to 1⅛d. ; power, first 500 kWh per quarter, from 2¼d. to 2d., next 1 000, from 1⅞d. to 1½d., beyond, from 1½d. to 1¼d. ; outside the Borough :—lighting, from 7d. to 6½d., prepayment meters, from 7½d. to 7d. ; heating and cooking, from 2½d. to 2d. ; power, first 500 kWh per quarter, from 2¾d. to 2½d., next 1 000, from 2¼d. to 2d., and beyond, from 1¾d. to 1⅝d.

Tapping New Areas.

Sligo Gas Co. is applying for powers to enable it to supply electrical energy in the borough.

Clonmel Corporation is considering a scheme for giving the town a supply of electricity.

Omagh Urban Council is considering the advisability of providing a supply of electricity for the town.

Crewkerne Urban Council is considering a proposal from a firm of electrical engineers to light the town electrically.

Belfast Corporation has decided to apply for permission to extend its area for the supply of electricity to two places in County Antrim.

Whitby Urban Council has decided to supply electrical energy to Ruswarp and High Stakesby at a cost of £6 600. Application will be made to the Unemployment Grants Committee for a loan.

Inquiries and Orders.

Middlesbrough Town Council has decided to apply for a Special Order to supply electrical energy to Marton, Ormesby and Nunthorpe.

Epping Rural Council has decided to consent to the application of the County of London Electric Supply Co. for an order to supply electricity to the parish of Chigwell.

Sandwich Town Council has decided to object to the East Kent Electricity Order on the ground that arrangements have not been made to secure a supply of electricity from the Stonar power station.

Ulverston Urban District Council has applied to the Electricity Commissioners for a Special Order to supply electricity in Ulverston urban district and in the parish of Osmotherly in the Ulverston rural district.

The Minister of Transport proposes to confirm the Ayrshire Electricity Special Order made by the Electricity Commissioners for the constitution of a Joint Board consisting of representatives of the Ayr County Council, Ayr Corporation and Kilmarnock Corporation for the joint exercise of powers under the Electricity (Supply) Acts. Objections to the Secretary, Ministry of Transport, Whitehall Gardens, London, by December 29th.

An inquiry was held at Atherton last week by Colonel Ekin, for the Electricity Commissioners, into the application of the South Lancashire Tramway Co. for sanction to extend the plant at their generating station at Atherton to meet the increasing demand for electricity in the district. It was stated that since 1902 the company had been supplying the Atherton District Council at a cheaper rate than that in any town in Lancashire, and that further agreement had been concluded with the Council to continue the supply for another 20 years. No opposition was offered.

The following notices have been given of intended applications to the Electricity Commission for Electricity Special Orders :—Barton-upon-Irwell Rural and Urmston Urban Council (to constitute a joint board of representatives of the two Councils for the joint exercise of powers under the Electricity Acts. Objections to the Secretary, Electricity Commission, by January 7th) ; Lancashire Electric Power Co., electricity supply in (1) Padiham urban district, and (2) the Borough of Clitheroe (objections by December 30th) ; Bideford and District Electric Supply Co., to generate and supply electricity in the boroughs of Bideford and Great Torrington, the urban district of Northam and parts of rural districts of Bideford, Barnstaple and Torrington (objections by January 5th) ; Birkenhead Corporation, for Bebington and Bramborough urban districts (objections by December 31st) ; Tiverton Corporation, for borough of Tiverton (objections by December 28th).

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ELECTRIC TRACTION.

The Montevideo (Uruguay) State tramways are to be electrified.

A "Morning Post" correspondent states that a new type of electric locomotive, capable of developing a speed of 120 miles an hour, will be used in the near future on the French railways.

The Ministry of Transport has reminded Accrington Corporation that the Order which authorises the Corporation to maintain fares at about 10 per cent. above pre-war rates will expire on March 31st next.

Bradford Tramways Committee has recommended that the Corporation tramcars should be run on Christmas Day as on Sundays. The service has been suspended on the Christmas Days of the last eight years.

Plymouth Corporation has authorised the issue of £250 000 4½ per cent. stock, part of which will be expended upon 20 new tramcars and other tramway equipment and electricity mains and plant.

The London County Council tramcars will be run on Christmas Day in the same way as last year. All cars are to be in depots by 4 p.m., and notices will be exhibited announcing the time of last cars from terminal points.

Liverpool Tramways Committee has decided to spend nearly £200 000 upon extending the tramways. The work will be proceeded with as soon as possible, if the requisite financial assistance is given by the Government.

The Parliamentary Bills Committee has submitted to Glasgow Corporation revised prints of a proposed Provisional Order giving authority to double the tramway lines in Coatbridge and Airdrie, and in the Paisley area from Barrhead to Paisley.

Rothesay Council has refused the renewed application of the Rothesay Tramways Co. to take a plebiscite as to the desirability of running Sunday tramcars. The Council has also decided to oppose the company's application for a Provisional Order authorising Sunday working.

It has been decided to enforce the regulation on the Bradford tramways that passengers must not leave the cars at the driver's end, in view of the danger of alighting on the "off" side. This danger may be avoided by the use of a reversible staircase similar to the one with which experiments are now being made on the Metropolitan Electric Tramways.

Glasgow Corporation last week decided by 50 votes to 38 to accept the tender of Hadfields, Ltd., the lowest of the three English tenders, for special tramway track work, thus rejecting the recommendation of the Tramways Committee that the contract be given to the United States Steel Products Co. whose tender was £1 226 lower. A sub-committee had previously recommended the division of the contract between all four tenderers.

The experimental one-man tram, which was introduced upon the London United Tramways Hanwell and Brentford Route in November last, has justified itself. The car has been running in daily service since, and it is keeping scheduled time with double deck cars on the route. Further cars of this type are now being constructed, containing additional improvements with regard to loading and unloading, operating mechanism, and added comforts for the passenger.

In a report to a sub-committee of Glasgow Corporation on Traffic Reorganisation Mr. James Dalrymple, manager of the Glasgow tramways, suggests the necessity for bridges over the Clyde at Oswald Street and opposite St. Enoch Square, and a new tramway in Buchanan Street, which would provide a new through route to relieve the present main north and south route. The Subway Sub-committee has decided to take no action in regard to the adoption of the "never-stop" system.

Fares, Receipts and Passengers.

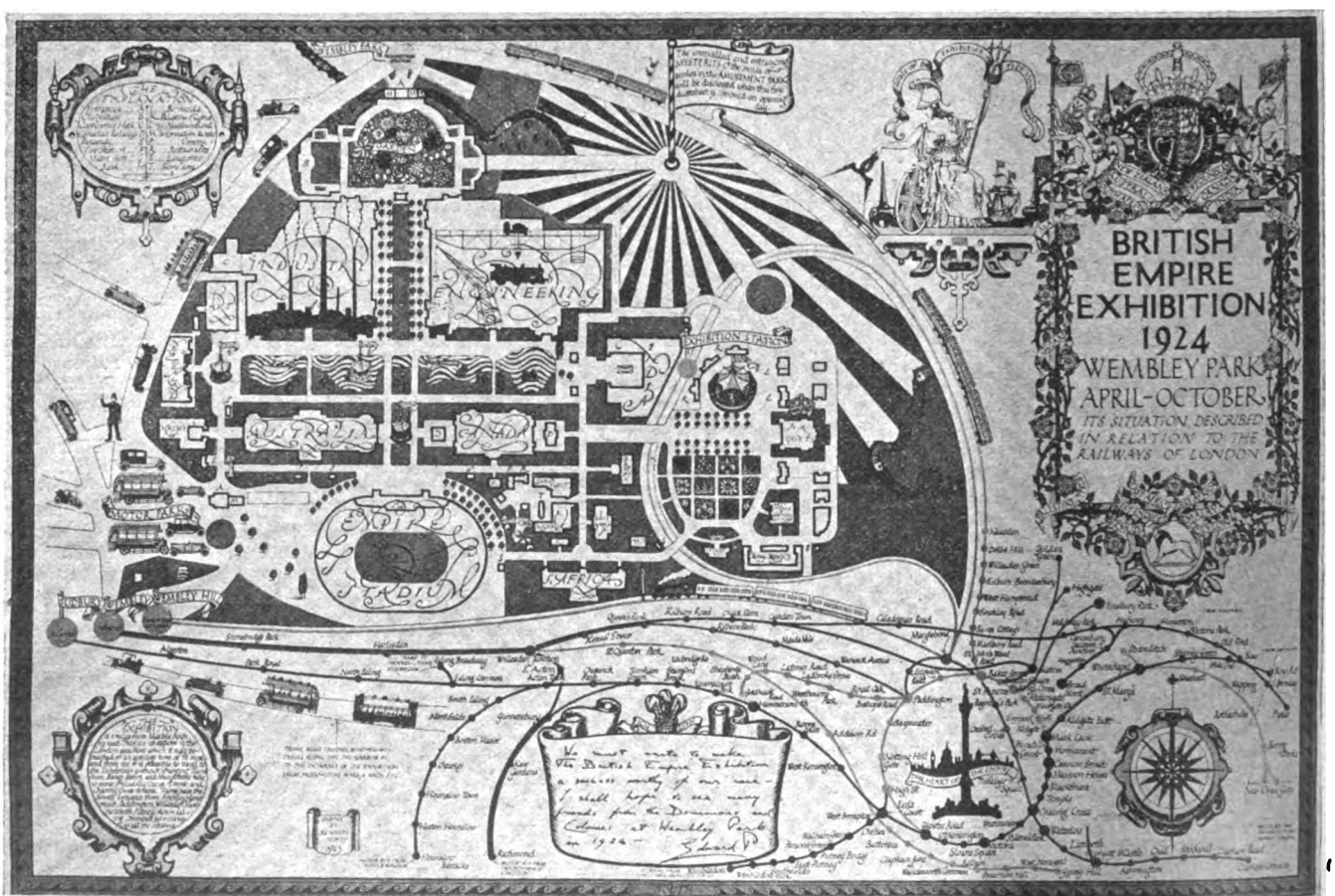
A sub-committee recommends that penny stages be reintroduced at the beginning of the New Year on all the Leicester Corporation tramway routes.

Middlesbrough Tramways Committee has decided not to introduce transfer tickets. The loss on workmen's tickets is said to have been £1 595 in the past year.

Returns of 34 of the principal tramway undertakings in the United Kingdom, as published by "The Tramway and Railway World" for the week ended December 1st, give total receipts, £320 572, or £22 946 less than in the corresponding week of last year.

Receipts on London County Council tramways were £235 000 less between April 1st and November 14th than in the same period last year. This decrease is attributed to increased omnibus competition, reduced return fares on the railways, and decreased spending power of the public. It has been decided to reduce the maximum single fare from 6d. to 5d., and that return tickets be issued at the following rates: 5d. for 3d. journey, 6d. for 4d. journey, and 8d. for 5d. journey.

The traffic receipts on the common fund companies of the Underground Electric Railways Co. of London (Metropolitan District, London Electric, City and South London, and Central London Railways and London General Omnibus Co.) for the week ended December 8th were £221 786 (decrease compared with corresponding week last year, £7 330), and the aggregate from January 1st, £11 145 382 (decrease £150 026). On the London and Surburban Traction group (Metropolitan, South Metropolitan and London United Electric Trams, and M.E.T. Omnibus Co.), the figures were £35 663 (decrease £6 605), and aggregate, £1 949 520 (decrease £209 187).



Reproduction of a large conventionalised coloured map of the British Empire Exhibition drawn by Kennedy North. On the back of the map, which is arranged to form a folder, is given the latest available information relating to the main attractions.

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BUSINESS OPPORTUNITIES AT HOME AND ABROAD.

Contracts Open.

PETERSFIELD GUARDIANS, December 24th.—Electric wiring in the Poor Law offices. Particulars from the Clerk, 16, High Street, Petersfield, Hants.

LONDON COUNTY COUNCIL, December 31st.—One 3-ton three-motor overhead travelling crane, and one 30 cwt. motor-driven portable workshop crane for the tramway central repair depot, with six months' maintenance in both cases. Specifications from the General Manager, L.C.C. Tramways, Victoria Embankment, W.C., on £2 deposit.

GRAVESEND CORPORATION, December 31st.—Electric wiring of houses, etc., under the assisted wiring scheme. Specifications from the Borough Electrical Engineer, Suffolk Road, Gravesend.

BRI CHUALANN (BRAY) URBAN COUNCIL. January 1st.—About 800 yds. of steel tape, armoured, paper insulated, 4-core cable, connecting boxes, etc. Specification from the Electrical Engineer.

COUNTY OF LONDON ELECTRIC SUPPLY CO., January 10th.—Complete electric lighting installation for Barking power station. Specification from Mr. F. C. McQuown, manager and secretary, Moorgate Court, Moorgate Place, London, E.C.2; deposit £5 5s.

CARDIFF CORPORATION, January 14th.—One 40 000 lb. water tube boiler, for the Electricity Department. Specification from the Electrical Engineer, The Hayes, Cardiff. Only manufacturers on the King's National Roll are invited to tender.

ISLINGTON (LONDON) BOROUGH COUNCIL. January 17th.—5 000 kW two-phase turbo-alternator, condensing plant, piping, etc. Particulars from the Electrical Engineer, 60, Eden Grove, Holloway, N.7.

SUNDERLAND CORPORATION, January 21st.—Plant for Hylton Road Electricity Works, including: Section A.—One 10 000 kW alternator, turbine and condensing plant; section B.—two straight tube water-tube boilers, each of 50 000 lb. evaporative capacity per hour; section C.—natural draught wooden cooling towers, and foundations. Specification from the General Manager, Electricity Offices, Dunning Street, Sunderland; deposit, £3 3s. for each section in duplicate.

Overseas.

COMMONWEALTH OF AUSTRALIA, January 3rd (London).—Telephone and telegraph apparatus (T. 415). Tender forms, etc., from the Supply Officer, Australia House, Strand, London, W.C.2.

VICTORIAN ELECTRICITY COMMISSION, January 19th.—Transformers, switchgear and accessories for sub-station B. Specification (Nos. 23/145 and 24/2) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS DEPARTMENT. February 6th.*—Equipment of two sub-stations. February 27th.*—Motor generator sets. February 27th.*—Motor-driven air compressors, and batteries for switch operating.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO, December 27th.* Electrical supplies, including cable, wrenches, insulating compound, lamp shades, also rubber belting, ironmongery, etc.

NEDERLANDSCHE HANDELMAATSCHAPPIJ, AMSTERDAM, January 3rd.—High and low voltage plant for new building. Specification from the company's offices, Heerengracht, Amsterdam, on payment of 35f.

SYDNEY CITY COUNCIL, January 7th (in Australia).*—Electrically driven coal unloading and conveying plant at Darling Island power house. February 18th.*—Armour-clad switch-gear. February 25th (extended from November 19th.)—Stepdown transformers (Contract 758).

VICTORIAN RAILWAYS COMMISSION, January 9th (in Australia).*—Spring coiling machine with electric motor, and taper rolling machine with electric motor (Contract 36 659); also two small induction motors with starting apparatus.

INDIA STORE DEPARTMENT, January 14th.—Turbo-alternator, condensing plant, cranes, boiler, economiser, pumps, steel chimney, steam and exhaust pipework, switchboard, motor converter, rotary converters, sub-station plant, e.h.t. feeder cables and auxiliaries, for new power station and sub-station at Delhi. Forms of tender from the Director-General, India Store Department, Branch No. 12, Belvedere Road, London, S.E.1.

MELBOURNE CITY COUNCIL, January 14th.—Totally enclosed armoured type 6 600 V three-phase switchgear. Specifications from the City Electrical Engineer.

CITY OF TORONTO, January 15th.*—Centrifugal sludge pump, direct connected to 2 200 V 3-phase 25 cycle variable speed induction motor, running at about 730 revs. per min. at full load. (Contract No. 58); and electrically driven air compressor, with accessories, and one separator.

ARGENTINE SANITARY WORKS DEPARTMENT. January 21st.*—Supply and erection of steam-driven electrical generating plant for the waterworks at Posadas.

JOHANNESBURG MUNICIPAL COUNCIL, January 21st.*—240 steel tramway poles with finial and centre clamps; and 5 miles 0·4 in. round section h.d. copper trolley wire.

* Particulars from the Department of Overseas Trade.

POST AND TELEGRAPH DEPARTMENT, WELLINGTON, N.Z., January 30th*.—30 000 galvanised iron earthrods.

TARANAKI (N.Z.) POWER BOARD, January 30th.*—Electric generators and switchgear.

SYDNEY HARBOUR TRUST COMMISSIONERS, February 11th.*—Supply and installation on runway tracks in wharf shed, No. 6 Berth, Darling Harbour, Sydney, of one 5-ton electrically-operated overhead travelling bridge crane. (Contract No. 23/36.)

SYDNEY HARBOUR TRUST COMMISSIONERS, February 11th.*—Two double-drum horizontal electric capstans or warping winches. (Contract 23/34.)

METROPOLITAN WATER SUPPLY AND SEWERAGE BOARD, BRISBANE. March 11th.—H.T. aerial transmission line from Breakfast Creek to Luggage Point, and electrical equipment, pumps, blowers and auxiliaries. Specifications from the Secretary, Albert Road, Brisbane, Queensland; deposit £7 7s. for the seven sections of the work.

ARGENTINE STATE OILFIELDS ADMINISTRATION, March 21st.*—Erection and equipment of 11 250 kW electric power station

PUBLIC WORKS TENDERS BOARD, WELLINGTON, N.Z. May 23rd (extended from April 30th).*—Design, manufacture, supply, erection, testing and maintenance for six months, of a hydro-electric power station at Arapuni, on the Waikato River, including machinery and plant, outdoor step-up transformer station and accessories.

Tenders Accepted.

GLASGOW CORPORATION.—Johnson and Phillips, cable, £473.

ACCRINGTON CORPORATION.—Babcock and Wilcox, two boilers, £12 200.

WORTHING CORPORATION.—H. J. Galliers (lowest tender) electric-light wiring and fitting in the ladies' slipper baths, £26. (Four tenders; highest, £33).

SCUNTHORPE AND FRODINGHAM URBAN COUNCIL.—Ferguson, Pailin Ltd., switchgear and panels, £344. Ferranti, Ltd., three 100 kVA transformers, £423.

LEICESTER CORPORATION.—Vickers-Spearing Boiler Co. Second section of extension of generating plant, consisting of four Spearing water-tube boilers.

SWINTON AND PENDLEBURY URBAN COUNCIL.—British Thomson-Houston Co., 300 kW rotary converter, with transformer, starting gear, switchgear, etc., £2 475.

PONTYPRIDD URBAN DISTRICT COUNCIL.—Crompton and Co., one 500 kW rotary converter and transformer, and e.h.t. and l.t. switch cubicles for controlling same.

HAVANT URBAN DISTRICT COUNCIL.—G. W. Bentley, supply of cable, £20; electric wiring and fitting in the Town Hall, £7 7s. 3d., and in the Council Chamber, £52 5s.

ELECTRIC SUPPLY CO. OF VICTORIA.—Brush Electrical Engineering Co., four 1 400 kW Brush-Ljungstrom turbo-generators, with condensing plant, etc., for Ballarat and Bendigo generating stations.

GLASGOW CORPORATION.—Hadfields, Ltd., rails for special tramway track work, £9 794. Also tendered: United States Steel Products Co. £8 568; Edgar Allen and Co., £9 867; and Titan Trackwork Co., £10 031.

PENINSULAR AND ORIENTAL STEAM NAVIGATION CO.—Marconi International Marine Communication Co., installation of the Marconi direction finding apparatus in the following ships:—"Khiva," "Khyber," "Kalyan," "Karmala," "Kashgar," and "Kashmir."

GLASGOW CORPORATION.—Metropolitan-Vickers Electrical Co., transformer oil, and reconditioning oil-circuit breakers, T. Bolton and Sons, trolley-wire, Scottish Tube Co., and Stewarts and Lloyds, wrought-iron tubing for cables, D. King and Sons, c.i. section pillar castings (all recommended).

MANCHESTER CORPORATION.—British Insulated and Helsby Cables, Ltd., and Callender's Cable and Construction Co., cables, Peckham Truck and Engineering Co., sample pair of Peckham maximum traction trucks with pendulum gear; Scholey Construction Co., in situ treatment of tramway track; Craven's Railway Carriage and Waggon Co., 12 pairs maximum traction trucks (all recommended).

MANCHESTER CORPORATION.—Extension of existing contract for ensuing six months, Venner Time Switches, Ltd., time switches, Aron Electricity Meters, d.c. Wh meters, Chamberlain and Hookham, d.c. Ah meters, Ferranti, Ltd., a c single-phase meters, d.c. Ah meters and current and potential transformers. Measurement, Ltd., single-phase meters, Metropolitan-Vickers Electrical Co., single-phase and polyphase meters (all recommended).

PARKES (N.S.W.) TOWN COUNCIL.—A. Leplastrier and Co., gas producers and engines, £6 848 10s.; Electric Meter Supply Co., meters, £481 5s.; Canney and Towe, insulators, £309 4s.; Australian General Electric Co., transformers, £333; C. J. Murrill, poles, £1 157 9s. 6d.; W. Adams and Co., copper cables, £1 634 18s. 1d.; Ferguson Pailin, Ltd., switchboards, £893; Australian General Electric Co., alternator, lightning arresters, etc., £1 950 8s.

BERMONDSEY (LONDON) BOROUGH COUNCIL.—Ferranti, Ltd., 12 2½ A and 12 5 A, 240 V meters, £64 7s.; Venners, Ltd., 12 time switches, £64 12s.; Chamberlain and Hookham, six 5 A and six 10 A, 240 V, two-rate meters, £55 1s.; Babcock and Wilcox, two rear drums for boilers, £11 1s. 4d.; Doulton and Co., conduits 1s. 8½d. yard and trough covers 11d. yard, less 26¼ per cent.; Sykes and Dyson, 41 joint boxes, four 3-way distribution boxes, £8, 36 service boxes £20 11s.; Siemens Bros., and Co., one 4-way distribution box, £6 15s.

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MUSEUM LIGHTING.

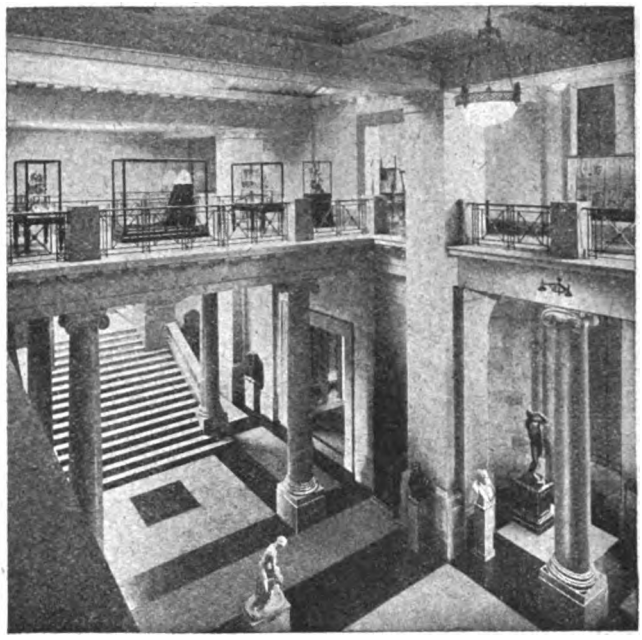
An Interesting Installation at Cardiff.

In the electric lighting installation at the Welsh National Museum at Cardiff, Moonstone glassware has been largely employed. For general illumination 47 ornamental 16 in. bowl fittings have been employed in conjunction with Siemens 300 W gasfilled lamps. In the main galleries approximately 100 bowl fittings have been used, suspended at a distance of about 5½ ft. from the ceilings and at an average height of something like 16 ft. from the floor; 200 W Siemens gasfilled lamps, spaced approximately 20 ft. apart, being installed in these to provide the required illumination. On the main entrance stairs to the upper galleries and around the lower balconies are a number of two-light fittings in which canteloupe Moonstone spheres are used to supplement the general illumination. These fittings are of the architect's own design, and the glassware is suspended in heavy bronze metal fittings harmonising with the architecture.

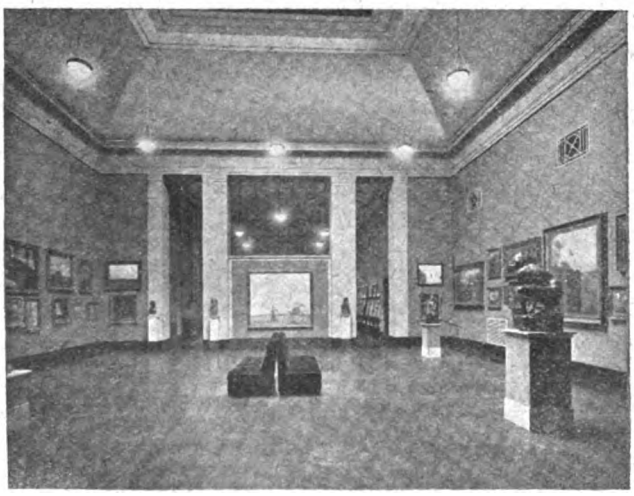
In the China and Print room lengths of "Beuttell" lighting strip, specially designed to meet the existing conditions, are concealed in the angle of the glass well-lights. In this way an adequate illumination is obtained on the display without the light source being visible to the eyes of the observer. A somewhat similar method has been employed in one of the upper galleries for general lighting. In this instance about 100 ft. of "Beuttell" strip, in four separate units of approximately 25 ft. each, is fixed in a concealed position behind a 12 in. cornice; 30 W tubular lamps are used.

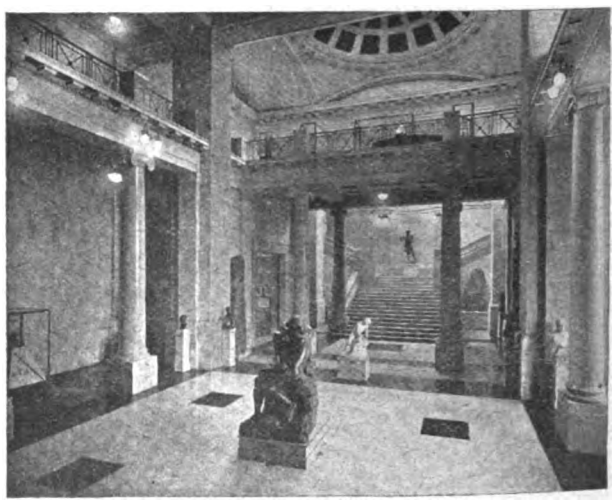
The wiring system is run in solid-drawn conduit, and C.M.A. cable and standard appliances have been installed throughout. The whole of the contracting work was under the personal supervision of Mr. W. E. Hutchison, then manager of Fred Price & Co., of Cardiff. Most of the electrical equipment and glassware and all the lamps were supplied by Siemens & English Electric Lamp Co.

The accompanying illustrations of the interior of the Welsh National Museum at Cardiff give some idea of the pleasing effects which can be obtained as the result of close co-operation between the architect and the illuminating engineer.



In the upper picture will be seen one of the bowl fittings used for general illumination and one of the supplementary two-light fittings. Light is concentrated on the glass showcases in the galleries by means of concealed lighting units.





THE NEASDEN EXPLOSION.

Essential Operating Conditions Neglected.

A report on the boiler explosion which took place at the Neasden Power Station of the Metropolitan Railway Co. on April 28th, 1923, has been issued by the Board of Trade. A leading stoker was severely scalded but has since returned to duty. The boiler was the property of the contractors, John Thompson Water-Tube Boilers, Ltd., its total heating surface, excluding the economiser, being 6 350 sq. ft., the working pressure 275 lb. per sq. in. and the final temperature 650 deg. F. The tubes were between 18 ft. 11 $\frac{11}{16}$ in. and 17 ft. 3 $\frac{11}{16}$ in. in length, 3 $\frac{1}{4}$ in. outside diameter and No. 9 S.W.G. thick. They were made by Stewarts and Lloyds.

The boiler had been working since September, 1922, for periods of 500 to 600 hours between cleaning. The explosion was caused by the overheating of a tube which caused it to rupture, and it appears that shortly before the date of the accident various alterations were made to the water circulating tubes with the object of supplying drier steam to the superheater. The boiler was put into use again on the day of the accident and had been steaming 16 hours when the explosion took place, the pressure not having exceeded 186 lb. per sq. in. during that time. The explosion seems to have been caused by the feed water supply to the front bank of tubes having been restricted. It is pointed out that the circulation was imperfect, and that in water tube boilers it is essential that each tube should act in an assigned capacity as a circulating medium with a definite and continuous direction of flow through it. The neglect of this essential caused a concentration of feed in the upper drums and water could only reach the hot tubes by flowing in a direction contrary to the steam. During heavy load the tubes were practically isolated from the feed water, and overheating of course, followed.

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STOCKS AND SHARES.

Political uncertainties have led to some weakness in the share markets during the past week, but electrical descriptions have on the whole held their ground pretty well, and in the case of supply companies have continued to be in some demand, with the result of improvement in price quotations. Charing Cross West End Ordinary have risen a further 10s., and are now quoted 14½. The directors propose to follow the example of certain other companies and subdivide the £5 into £1 shares, at the same time converting the unissued preference shares into ordinary shares and giving the company power to make a bonus issue. There is a quarter of a million sterling of both preference and ordinary share capital unissued. Westminster Preference ordinary £5 shares have put on 7s. 6d., advancing to £10 6s. 3d., and Chelsea £1 shares at 37s. 3d. are 3d. up on the week. Shropshire, Worcestershire and Staffordshire debenture stock advanced fractionally. Exceptionally, City of London ordinary shed 7½d. Several electrical manufacturing shares show small declines, but Metropolitan-Vickers ordinary shares have risen from 23s. 1½d. to 23s. 9d. Traction stocks have shared the general weakness of markets.

Last Anul. Divi.	Description.	This Week.	Last Week.	1912 to 1922. Highest.	Lowest
%	**Electricity Supp'y.**				
12	Brompton & K'sington Ord. ..	41/3	41/3	38/-	24/-
4	Cent. Elec. Sup. 4% Deb. ..	87	87	100	67
14	Charing X. W.E. & City Ord. (£5)	14½	14	7/18/9	2½
4½	,, ,, 4½% C.P. (£5)	86/3	86/3	97/6	50/-
10	Chelsea Elec. Sup. Ord. ..	37/3	37/-	21/-	10/-
15	City of Lon. Elec. L'ting Ord. ..	48/9	49/4½	46/6	20/3
6	,, ,, 6½% C.P.	24/-	24/-	40/-	15/6
10	County Lon. Elec. Sup. Ord. ..	41/3	41/3	32/3	14/6
6	,, ,, 6% C.P. ..	23/1½	23/1½	24/9	15/3
12	K'sington & K'bdge. Ord. (£5) ..	10/2/6	10	8/1/3	3/5/0
10	Lon. Elec. Sup. Ord. (£3) ..	98/9	98/9	62/6	15/-
8½	Metro. Elec. Sup. Ord.	34/4½	34/4½	26/6	8/-
4½	,, ,, 4½% C.P.	17/6	17/6	19/10½	9/6
5	N'castle & Dis. Ord. (£10) ..	7½	7½	6	3/17/6
2½	,, Elec. Sup. Ord. ..	15/7½	15/7½	23/10½	11/6
6	N. Metro. Elec. P. 6% C.P. ..	22/6	22/6	22/6	10/1½
6	Notting H. 6% C.P.	9½	9½	10⅞	6/13/9
14½	St. James' & P.M. Ord. (£5) ..	11⅛	11⅛	10½	5½
7½	Shrops. Worc. & Staff. Elec. Deb.	102½	102	105⅝	96
12	W'minster Elec. Sup. Ord. (£5)	10/6/3	10/3/9	9½	4½
4½	,, ,, 4½% C.P. (£5)	90/-	90/-	107/6	65/-
	Yorks. Elec. Power Ord. ..	28/-	28/-	23/7½	12/6
	,, ,, 6% C.P. ..	22/6	22/6	25/-	14/3
	Railways and Tramways.				
5	Brit. Elec. Trac. Ord. Stk. ..	69½	70	65	24
6	,, ,, 6% Pf. Stk. ..	98½	98½	96	53
4	Cent. Lon. Rly. Ord. Stk. (asstd.)	73	73	89½	40½
4	,, ,, 4% Deb. ..	81½	81½	103	56⅛
4	City & S. Lon. 4% Perp. Deb. ..	79½	80⅛	102⅝	50
5	Lancs. Un. Trams. 5% Deb. ..	77⅛	77⅛	88	60
4	Lon. Elec. Rly. Ord. (£10) ..	130/-	130/-	104/1½	20/-
4	,, ,, 4% Pf. Stk. ..	79½	79½	80½	43
4	,, ,, 4% Deb. ..	79½*	81½	98⅝	52
5	Lon. & Sub. Trac. A Deb. ..	87	87	86	65
4	Lon. Un. Trams. 1st Deb. ..	59½	59	82	30
4½	Met. Elec. Trams. 4½% Deb. ..	82½	82½	101½	49
5	,, ,, 5% Deb. ..	79½	79½	102/17/6	53
3	Met. Rly. Cons. Ord. Stk. ..	72	74½	75/2/6	19
3½	,, ,, 3½% Pf. Stk. ..	69½	69½	88½	40½
3½	,, ,, 3½% Deb.	72½	72½	92½	51
3	Met. Dis. Rly. Ord. Stk. ..	54	56	51½	12⅝
4½	,, ,, ,, 4½% 1st Pf. ..	85½	85½	91	45
6	,, ,, ,, 6% Perp. Deb. ..	118½*	121½	146/12/6	80
4	S. Met. Elec. Trams. 4% Deb. ..	74	74	73½	48½
Nil	Yorks (W.R.) Trams. Ord. ..	16/-	16/-	6/-	1/-
4½	,, ,, 1st Deb.	77	77	87	52
	Electrical Ma ufacturing.				
7	Brit. Elec. Transformer 7% C.P.	14/4½	14/4½	22/1½	11/6
15	Brit. Helsby Ord.	48/9	48/9	62/-	26/6
6	,, ,, 6% C.P.	23/9	23/9	25/6	14/6
6	,, Ericsson 6% C.P. ..	17/6	17/6	21/-	12/7½
7	B.T.H. 7% C.P.	22/-*	23/-	21/1½	19/7½
7	,, 7% Deb.	105	105	107	92
15	Callender's Cable Ord.	49/4½	49/4½	85/-	22/-
6½	,, 6½% C.P.	25/-	25/-	24/7½	3/-
7½	,, 7½% B. Pf.	26/3	26/3	26/1½	16/6
Nil	Edison & Swan Elec. Ord. ..	4/6	5/-	28/9	1/11
,,	,, ,, 1st Pf. ..	17/6	17/6	26/-	5/-
10	Elec. Constr. Ord.	29/4½	29/4½	30/3	6/7½
7	,, ,, 7% C.P.	23/9	23/9	22/6	16/-
5	Eng. Elec. Ord.	17/6	17/9	29/3	7/3
6	,, ,, 6% C.P.	19/6	19/6	20/9	10/6
15	W. T. Henleys Ord.	49/4½	49/4½	86/6	23/3
7½	Lon. Elec. Wire & Smith's 7½% C.P.	23/9	23/1½	24/4½	17/6
12½	Metro.-Vickers Ord.	27/-	27/-	37/-	13/1
8	,, ,, 8% C.P. (£2) ..	52/6	52/6	67/10	5/-
20	Tele. Constr. Ord. (£12) ..	24	24½	56/2/6	19½
	Telegraph.				
6	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	68½	40
4	Com. Cable 4% Deb.	77½	77½	87½	60
7	Cuba Sub. Mar. Ord. (£10) ..	7½	7½	11/12/6	5⅜
10	Direct Span. Tele. Ord. (£5) ..	8/10/-	9/2/6	9/7/6	3/7/6
10	East. Tele. Ord. Stk.	165½	167½	213½	113/2/6
3½	,, ,, 3½% Prf. Stk. ..	67½	67½	84/17/6	49
4	,, ,, 4% Deb.	81½	81½	103½	60
10	,, Exten. Tele. Ord. ..	16/15/-	16/17/6	21½	10/12/6
4	,, ,, ,, 4% Deb. ..	81½	81½	97½	60
22	Gt. Nor. Tele. (£10)	28½	28½	42/12/6	19½
7	Indo-Eur. Tel. (£25)	32½	32½	50⅜	25
15	Marconi's Wireless T. Ord. ..	40/-*	45/-	9/16/3	20/9
12½	,, Intern. Mar.	27/6	27/6	5/11/3	14/11
Nil	W. India & Pan. T. Ord. (£10)	1/-	1/-	5/11/10½	3d.
5	,, ,, 5% Deb. ..	35	35	104	50
10	West. Tel. Ord. (£10)	16*	16½	23	11/6/3
4	,, ,, 4% Deb. Stk.	81½	81½	100	60/2/6

* Ex dividend.

COMPANY MEETING.

Edison Swan Company's Improved Financial Position.

Presiding at the 40th annual meeting of the Edison Swan Electric Co., in London, on Tuesday, Mr. C. F. Spencer (the chairman) first dealt in detail with the items in the balance sheet, and mentioned that the profit for the year was £71 162. Of this sum over £11 000 would be carried forward. Referring to the policy of the board, Mr. Spencer said that having carried through a scheme of reorganisation which had effected economies, speeded up and properly regulated output, increased sales and withal maintained the high quality of the company's products, they were now engaged in reviewing the whole position so as to secure even greater efficiency in every section. It was also intended to discharge the temporary loan obligations of the company as rapidly as circumstances would admit, and to build up an adequate reserve fund.

With respect to current trading profits, their sales for the five months up to November 30th had increased appreciably over those of the corresponding period of last year, notwithstanding the average reduction—not less than 10 per cent.—in the selling prices of their products, and they had every reason to believe that the profit for the five months was as good as, and perhaps a little better than, that which resulted from trading in the corresponding period of last year. He saw no reason why this progress should not be maintained if home demands continued in anything like the same volume as during the last eighteen months—a period of undoubted trade depression. The orders which were being placed in this country to provide more employment should give an impetus to many trades for a limited time; consequently, the business of this company in the immediate future was likely to benefit indirectly from the orders distributed among other trades. It was obvious that the Government and railway companies could not continue indefinitely providing work for the relief of unemployment, and when this class of work ceased, the severe handicaps on home production would manifest themselves in a very prejudicial manner in many of this country's industries, unless a settlement of the economic conflict in Europe was secured on a firm and equitable basis. Depreciated exchanges were in effect operating as a bounty to foreign manufacturers on exports to this country and our colonies.

Moreover, in those countries which were our Allies during the war the comparative relief from the burden of unemployment, together with their freedom from payment of interest charges on loans advanced to them by this country—such interest charges falling on our taxpayers instead of theirs—gave producers in those countries a marked advantage over producers in this country when competing for trade in any market.

In conclusion, Mr. Spencer said that the company was now well equipped to deal efficiently with every branch of its business.

On the motion of the Chairman, seconded by Mr. John Cross, dividends of 7½ per cent. for the year on the preference and ordinary shares were declared.

The Chairman, in proposing the re-election of Mr. A. F. Berry and Mr. C. H. Cox as directors, paid a warm tribute to the excellent services which they had rendered to the company under exceptionally difficult circumstances. Mr. A. F. Rubin seconded the motion, which was unanimously adopted.

Mr. Glynn, in moving a vote of thanks to the Chairman and directors, and also to the staff, said his confidence in the undertaking was unabated, and he was particularly grateful to the directors and the staff for the magnificent way in which they had brought the company round. Mr. Rubin seconded the vote, remarking that the change which had come over the concern during the last 15 months was extraordinary.

COMPANY NEWS.

SHAWINIGAN WATER AND POWER CO.—A dividend of 1¾ per cent. for the quarter ending December 31st is announced.

CHILI TELEPHONE CO.—An interim dividend of 3s. per share, tax free (the same rate as last year), has been declared.

AMERICAN TELEPHONE AND TELEGRAPH CO.—A quarterly dividend of 2¼ per cent. on the capital stock is announced.

VICTORIA FALLS AND TRANSVAAL POWER CO.—A dividend at the rate of 6 per cent. per annum on the preference shares is announced.

MANILA ELECTRIC CORPORATION.—A dividend of 2 per cent. ($2 per share) on the common stock for the quarter ending December 31st is announced.

EASTERN EXTENSION, AUSTRALASIA AND CHINA TELEGRAPH CO.—The directors have declared an interim dividend for the three months ended September 30th last, of 5s. per share, payable tax free on January 15th.

AUTOMATIC TELEPHONE MANUFACTURING CO.—The transfer books are closed until December 25th, inclusive, for the purpose of preparing the dividend warrants on the 6 per cent. preference shares for the half-year ended December 31st.

EASTERN TELEGRAPH CO.—A dividend at the rate of 3½ per cent. per annum, less tax, on the preference stock for the quarter ending December 31st, 1923, and the third quarterly interim dividend of 2½ per cent. on the ordinary stock, tax free, in respect of profits for the year ending December 31st, 1923, will be payable on January 15th.

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CHARING CROSS, WEST END AND CITY ELECTRICITY SUPPLY CO.—The directors have placed before the shareholders a scheme under which it is proposed to divide the £5 into £1 shares, to convert the unissued preference into ordinary shares and to give the company power to make a bonus issue. The unissued capital is £250 000 in ordinary and £250 000 in preference shares.

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA.—For the year ended June 30th last the gross profit was £401 808. After providing for income taxes, and adding a balance of £76 593 brought in, there was an available balance of £361 999. After writing off preference share and debenture issue expenses, placing certain sums to debenture sinking fund reserve and equalisation reserve, full dividends on the preference shares to June 30th last and a dividend on the ordinary shares for the half year to June 30th at the rate of 8 per cent. per annum have been paid.

FIRST GARDEN CITY.—For the first time this company is paying the ordinary shareholders the full dividend of 5 per cent. The company was formed 20 years ago, and the first dividend (1 per cent.) was paid in 1913. Amongst its other activities, the company supplies electrical energy to the town of Baldock, and the directors now propose to apply for Parliamentary powers to supply in other urban and rural districts. Continual capital expenditure on the electricity, gas and water supply undertakings and the construction of roads and sewers has retarded the payment of dividends, but the value of the estate is much in excess of the capital expenditure.

DELAGOA BAY DEVELOPMENT CORPORATION.—At the annual meeting last week, the report, abstracted in our previous issue, was adopted. The chairman (Mr. F. R. Cunningham) said capital expenditure for the past year was £14 944, mainly on tramways. For some years the directors do not anticipate any further heavy capital expenditure beyond the normal demand for new electric light and power mains and services and for water. The manager, Mr. Main, was of opinion that the net revenue of the combined undertakings could be increased by from 40 to 50 per cent. without material increase of plant. Tramways and electric power supply had produced a net revenue of about £7 400 and electric lighting £12 500. The mileage run on the tramways was 25 per cent. more than in 1914, whereas the wages paid to motormen and conductors had increased by 120 per cent. The net revenue for the four months ended October 31st last showed a small increase on the corresponding period of last year. With a revival of trade, the business must improve automatically

New Companies.

BRENNER AND RYCE, LTD.—Cap., £1 000. Manufacturers of and dealers in electrical and mechanical devices, etc. Reg. office: 268B, Stockport Road, Manchester.

GLEBE MANUFACTURING CO., LTD.—Cap., £10 000. Mechanical and electrical engineers, etc. Reg. office: 5, Guildhall Chambers, 31, Basinghall Street, London, E.C.2.

EMPRESS COPPERSMITHS AND ENGINEERS, LTD.—Cap., £2 500. Coppersmiths, founders, mechanical and electrical engineers. Reg. office: Empress Works, Empress Street, Cornbrook, Manchester.

GEORGE CROOK AND SONS, LTD.—Cap., £8 000. To acquire and carry on the business of George Crook, contractor, gas and electric light fitter, electrical and mechanical engineer, etc. Solicitors: Greaves and Atter, 26, Wood Street, Wakefield.

PRYCE, LTD.—Cap., £1 000. Electrical engineers, etc. Reg. office: Corbiehall, Bo'ness.

RECTOSCOPE, LTD.—Cap., £100. Electrical engineers, etc. Solicitor: E. E. Bale, 83, Cannon Street, London, E.C.

SPHINX ELECTRIC SUPPLIES (IRELAND), LTD.—Cap., £100. Electrical engineers and contractors, etc. Reg. office: 6, Clanwilliam Place, Dublin.

RADIO IMPROVEMENTS, LTD.—Cap., £100. Manufacturers of and dealers in wireless and electrical apparatus, etc. Reg. office: 95, Great Portland Street, London, W.1.

FARRINGDON ELECTRICAL CO., LTD.—Cap., £21 000. Manufacturers of and dealers in electrical apparatus and appliances, etc. Reg. office: 13, Farringdon Road, London, E.C.1.

BELL'S (YORKS), LTD.—Cap., £100. Manufacturers of and dealers in dynamos, electric motors, batteries, electric lighting and starting sets, etc. Reg. office: 5, Upperhead Row, Leeds.

MIDLANDS EXHIBITION, LTD.—Cap., £2 000. To acquire the business of Midland Counties Motor Wireless and General Trades Exhibition, etc. Solicitor: J. H. Woodford Robinson, 16, Guildhall Road, Northampton.

F. B. TAYLOR AND SONS, LTD.—Cap., £4 000. Manufacturers, exporters and importers of glass and glass ware, particularly for chemical, x-ray, wireless, laboratory, and other scientific purposes. Reg. office: 131, Seven Sisters Road, London, N.7.

VICKERS AND INTERNATIONAL COMBUSTION ENGINEERING, LTD.—Cap., £500 000. Designers, manufacturers and builders of and contractors and constructional engineers for power plants of every description, etc. Solicitors: Maswell, Scriven and Batley, 29, Great St. Helens, London, E.C.

SUBMARINE SIGNAL CORPORATION.—Cap., $3 000 000. Registered in Delaware, U.S.A. To manufacture and deal in instruments, devices and equipment used in connection with transmitting or receiving messages, sounds, signals and electrical current and power and for detecting and recording the proximity or approach of objects of all kinds, etc. British address: Friars House, New Broad Street, London, E.C.

BUSINESS MEMS.

Mr. Robert Ormiston, electrical engineer, has opened new premises in Meadow Place, Bank Street, Alloa.

Premises at 133, High Street, Slough, have been opened by Mr. A. E. Peplow, electrical engineer and wireless expert.

Bruce Peebles and Co. inform us that their works will be closed from Saturday, December 29th, until Monday, January 7th, inclusive.

Bertram Day & Co., advertising service agents, of 9 and 10, Charing Cross, London, S.W.1, have removed their Service Department to No. 1, Charing Cross.

The British Thomson-Houston Co. has taken over a large factory in Alma Street, Coventry, formerly occupied by the Dunlop Rubber Co. The works will be used principally for the manufacture of wireless apparatus.

The Engineering and Lighting Equipment Co., of Sphere Works, St. Albans, Herts, inform us that they have appointed Mr. Hugh F. King, of 17, Ellers Road, Harehills, Leeds, as their agent for the West Riding of Yorkshire.

The Chloride Electrical Storage Co. announce that their works and head office at Clifton Junction, Manchester, will be closed from 12 noon on Saturday, December 22nd, until Thursday morning, December 27th, 1923, and on Tuesday, January 1st.

S. Davis and Co. (publishers of the "Electrical Engineer's Year Book" and "Where to Buy Everything Electrical") have removed their offices from 30 and 31, St. Swithin's Lane, London, E.C., to more commodious premises at Aldwych House, Aldwych, W.C.

Kent Brothers Electric Wire Co. and E. H. Phillips, Ltd., of 15, Berners Street, London, W.1, have appointed Mr. F. E. Warburton, late works manager of Marconi Scientific Instruments, Ltd., as sales representative for North, North West, West and South West London and suburbs.

In view of the interest taken in the large illuminated model of the "R.I." transformer exhibited at the Wireless Exhibition, the manufacturers are having a number of similar models built; these will be available to prominent dealers in various parts of the country for window display.

Weldrics (1922), Ltd., of Bush Lane House, Cannon Street, London, E.C.4, announce that they have purchased the business of T. Scott Anderson, electrical welding engineers and equipment manufacturers, of Royal Insurance Buildings, Church Street, Sheffield. The Sheffield premises will be retained as a branch establishment.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"What Sort of Ornament?: Labour-Saving Devices and their Influence on Furnishing"; "Industrial Design"; "Designing the Mark: Devices with Real Character."

THE CHEMICAL AGE.—"Constitution of Colophony, II," by H. M. Bunbury; "Recent Advances in Corrosion Study," by Dr. J. Newton Friend; "Chemical Engineering Conference in Liverpool."

THE EUROPEAN COMMERCIAL.—"Trade Fairs: Features of the British Empire Exhibition"; "Belgian Iron and Steel Outlook."

THE FRUIT GROWER.—"Control of Woolly Aphis"; "Publicity for British Tomatoes"; "Trade Exhibits at Smithfield Show" (illustrated).

GARDENING ILLUSTRATED.—"Hollies for the Home and Garden"; "Buds in the Garden"; "The Interesting Mistletoe."

THE GAS WORLD.—"Gas Appliances in Spain"; "Life of a Meter Reader"; "Analysis of Municipal Gas Accounts."

THE HARDWARE TRADE JOURNAL.—"The Christmas Window Display;" "Hardware Humour"; "Glass Research: Sheffield University's New Development."

Diaries and Calendars.

Christmas returns, and with it diaries, calendars, blotting pads and other gifts from many well-known firms. Among the earliest is Siemens Brothers and Co.'s well-known diary which, besides recalling the fact that the concern was founded so long ago as 1858, contains a great deal of useful technical matter and, above all, plenty of pages blank and dated, for which we shall no doubt find much use during the coming year.

Francis Polden and Co. send a most useful combined leather pocket wallet and diary. There is a great deal of handy information in the pages preceding the diary proper, which is ruled for three days to a page.

The wall calendar prepared by the Siluminite Insulator Co., for 1924, has an effective illustration of a dog sitting on a live rail suitably protected by the Siluminite live rail cover. More will probably be seen of this dog in the firm's publicity matter.

From Siemens and English Electric Lamp Co. we have received a leather combined season ticket and card case. While it remains necessary to show tickets at the beginning and end of each journey, and sometimes in the middle, too, it will remain close to our heart.

Among the calendars received are two fine examples of colour work by "Barribal," and by Stanley Davis. The former occupies the major portion of a really pleasing wall calendar issued by the Chloride Electrical Storage Co., while the latter adorns a very effective production received from Mawdsleys, Ltd.

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COMMERCIAL INFORMATION

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

CARDIFF ELECTRIC AND WIRELESS SUPPLY CO., LTD., R.O., 43, Bute Street, Cardiff. £44 10s. 11d. November 7th.

OVER, ROBERT, AND CO., 105, Water Street, Manchester, electrical engineers. £22 12s. 10d. November 1st.

SMITH AND BIRKETT, 22 and 24, Wheeler Gate, Nottingham, electrical engineers. £42 2s. 1d. October 16th.

Receivership.

CAR IGNITION AND LIGHTING CO., LTD. J. P. Cave, of 29, Martin Lane, Cannon Street, E.C., was appointed receiver on December 5th, 1923, under powers contained in debentures dated January 4th, 1923.

Private Meetings.

[*Inclusion under this heading does not necessarily imply ailure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

ELECTRICAL SERVICES, LTD., Bradford. At the statutory meeting of creditors in this voluntary winding-up the liquidator, Mr. P. Hodgkinson, C.A., 48, Sunbridge Road, Bradford, submitted a statement of affairs which showed ranking liabilities of £3 199. The claims of the trade creditors totalled £2 311, and there was a bill payable amounting to £889. The assets were estimated to realise £1 117, from which had to be deducted £107 for preferential claims, leaving net assets of £1 010, or a deficiency as regarded the unsecured creditors of £2 189. The deficiency account showed that on December 31st, 1922, there was a debit balance on the profit and loss account of £803. The deficiency of £2 189 was accounted for by that debit balance, together with the following items: loss on trading during 1923, £415; goodwill written off, £100; preliminary expenses, £18; loss on motor car, £123; depreciation of stock, £287; depreciation of fixtures, £99; book-debts written off, £153; and other items, £191. It was reported that the company was registered in the early part of 1914 with a nominal capital of £1 000. The company took over an existing business and during 1914 the turnover was £1 150, with a loss of £70. In the following year the turnover fell off and there was a loss on the trading of £100. Detailed accounts were not prepared again until 1918, when it was found that there was a debit to profit and loss account of about £80. The next accounts were prepared in December, 1920, and disclosed a net profit of rather more than £1 000. During the year to December, 1921, the turnover was £7 400, with a gross profit of £1 500 and a net profit of £320. During 1922 the sales fell to £3 670, with a gross profit of only a little more than £400, and a net loss of £1010. The loss during 1922 was attributed to the fluctuation of prices. The creditors passed a resolution confirming the voluntary liquidation of the company with Mr. Hodgkinson as liquidator, and also appointed an advisory committee of three of the principal creditors.

LUMENS, LTD., 12–14, Great Ducie Street, Manchester, electrical and wireless engineers. The statutory first meeting of creditors in this voluntary winding-up was held on December 11th at the Deansgate Hotel, Manchester, when a statement of affairs was submitted by the liquidator, Mr. T. Forster, showing liabilities of approximately £630, and assets put down at £108. The liquidator stated that the purchases of the company for the seventeen months ending November 23rd last were £1 681. The sales amounted to £2 058, and after deducting expenses, etc., there was a loss made of £997. It was further stated that the stock had been seized under a distraint. No balance sheets have ever been drawn up since the inception of the company. After some discussion it was decided to confirm the voluntary liquidation of the company with Mr. Forster as liquidator. The following are creditors: Ashdown, H., £14; Electrical Distributing Co., £38; Cable Accessories Co., £15; Electrical Supplies, Ltd., £18; General Electric Co., £37; Radio Equipment Co., £50; Hirst Bros., £32; John Moores and Co., £36; Electrical Accessories Co., £20.

SMALL, C. R., trading as the CLACTON ELECTRICAL CO., High Street, Clacton-on-Sea. In our Commercial Information of April 27th last we reported the decision of a meeting of creditors in this matter that the debtor should issue a deed of assignment to Mr. E. H. Hawkins, of Poppleton, Appleby and Hawkins, accountants and auditors, 4, Charterhouse Square, E.C. The property and stock-in-trade have been sold by auction, the bank's claim settled, and the trustee has now paid a first and final dividend to the trade creditors of 20s. in the £.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Bankruptcy Petition.

GIBB, John Purvis, trading as WATERHOUSE AND GIBB, wholesale electrical engineers, 5, Exchange Street, Dundee. An application for sequestration of estates has been presented at the instance of N. V. Telga, Ltd., dealers in electrical and general engineering supplies, Union Place, Wells Street, Oxford Street, London.

Notice of Intended Dividend.

WATKINS, Fred Arthur, 57, High Street, Hythe, electrical engineer. Last day for receiving proofs, December 31st. Trustee, E. H. Hawkins, 4, Charterhouse Square, London, E.C.1.

Partnership Dissolved.

COGENT ELECTRICAL CO. (Herbert NEVILLE, Walter Dennis JOYCE, and Albert John SINGLEHURST), electrical engineers, 54, Berry Street, Liverpool, by mutual consent as from December 10th, 1923. Debts received and paid by A. J. Singlehurst, who continues the business.

Bankruptcy Proceedings.

BILLINGTON, Raymond, 163, Walker Street, Kingston-upon-Hull, electrical contractor. This debtor's statement of affairs shows liabilities £245 and assets £17. The following are creditors: General Electric Co., Ltd., Newcastle-on-Tyne, £34; Telephone Manufacturing Co., West Dulwich, £23; Yorkshire Electric Supplies Co., Hull, £37; Pashby, T., Withernsea, £53.

CARPENTER, Charles Augustus, 4–5, Mason's Avenue, E.C., electrical engineer. The affairs of the debtor, who was adjudged a bankrupt in December, 1921, came before the London Bankruptcy Court last week on the hearing of his application for an order of discharge. The Official Receiver said that the proofs of debt and probable claims together amounted to £1 380, and there were no assets. After carrying on business at 4, Maidenhead Court, E.C., in partnership with another person as an electrical engineer from October to December, 1913, the debtor and his partner sold the business to a limited company which in the following year went into liquidation voluntarily. He afterwards conducted a similar business at the same address and in 1916 was joined in partnership by another person, who provided £200 capital. In June, 1917, the debtor surrendered the business to his partner and became managing director of a limited company formed to acquire a fire alarm which he had patented. In June, 1918, he recommenced business as an electrical engineer at 4 and 5, Mason's Avenue, and for a few months in 1919 he had two partners who retired, but the business, owing to his ill-health and to labour troubles, was unsuccessful. In March, 1921, the debtor transferred, in consideration of £1 998 payable in shares and the appointment of managing director, the whole of his business assets to C. A. Carpenter, Ltd. The company, the entire share capital of which was £2 000, did not, however, take over his trade debts. But the debtor said that before the formation of the company his brother had lent him £1 200 to pay debts of the business on the understanding that he was to receive for such advances £1 200 in shares of a company when formed. In pursuance of that arrangement 1 200 of the debtor's shares were allotted direct to his brother. The debtor attributed his insolvency to his ill-health, to labour troubles, and to lack of capital, and he admitted that he became aware of his insolvency in July, 1920, when he saw the balance sheet for June 30th, 1920. He afterwards contracted debts amounting to £751. He further admitted that the result of his having transferred all his assets to C. A. Carpenter, Ltd., for shares was that his creditors had been deprived of their power to attach any of the assets, but he contended that they received the benefit of his brother's £1 200. The whole of the unsecured indebtedness added the Official Receiver, was in respect of goods supplied and work done and money borrowed for the purpose of the business. The creditors were not informed of the transfer of the assets to the company until three weeks later. As offences against the Bankruptcy Act the Official Receiver submitted and reported that the debtor's assets were not of a value equal to 10s. in the £; that he had continued to trade after knowing himself to be insolvent; and that he had been guilty of misconduct in transferring all his assets to the company on terms beneficial to himself but most damaging to his creditors. Having heard Mr. Kingham, who appeared as counsel on behalf of the debtor, who gave evidence, the Registrar remarked that there was in fact a fairly substantial equivalent received by creditors for the transfer of the assets to the company, and that he considered minimised the effects of that offence. No doubt the debtor had suffered from ill-health, but the discharge must be suspended for two years and six months.

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PATENT RECORD.

Specifications Accepted.

199 016 Western Electric Co. Radio broadcasting equipment. (9/6/22.)
198 697 Date Laboratoriums-und Industrie Bedarf Ges. Mercury-vapour ejector or vacuum-producing apparatus. (6/3/22.) (Divided Application on 6501/23.)
204 663 L. L. R. Dean. Crystal receiver-set for wireless signalling. (26/6/23.)
204 667 W. Preston and W. Walker. Electric switches. (22/5/22.) (Divided Application on 204 357.)
182 768 V. Martinetto. Asynchronous induction electric machine. (2/7/21.)
205 540 A. H. Railing, C. C. Garrard, and W. Wilson. Control of electric motors. (13/4/23.)
205 552 J. H. Collie. Apparatus for taking up the slack flexible cable for electric-irons and the like. (15/7/22.)
191 361 H. G. C. Fairweather, (*International Radiotelegraf & Telefon Cie.*). Illuminated sign lamp with varying colours. (18/7/22.)
183 464 Felten and Guilleaume Carlswerk Akt.-Ges. Protective covering for submarine cables. (18/7/21.)
205 572 Sir C. A. Parsons, and J. Rosen Dynamo-electric machines. (19/7/22.) (Addition to 203 804.)
197 633 Western Telegraph Co. Telegraph transmitting apparatus. (13/5/22.)
205 585 N. E. North and Metropolitan-Vickers Electrical Co., Ltd. Electrical resistances. (22/7/22.)
183 835 A. H. Adams. Impulse transmitters for use in automatic telephone systems. (30/7/21.)
205 609 D. Arcani. Switch apparatus for electric and steam tramways, railways, and the like. (4/8/22.)
205 613 E. Y. Robinson. Thermionic devices. (8/8/22.)
205 627 L. J. Hunt and Sandycroft, Ltd. Alternating current dynamo-electric machines. (22/8/22.)
198 318 W. Dubilier. Connecting device for radio-receiving systems. (23/5/22.)
205 630 M. J. Railing and C. W. Saunders. Brackets and like supports for electric fans, lamps, and the like. (26/8/22.)
199 343 C. Brandes, Inc. Mounting of electric terminals, particularly applicable to telephone receivers and like electromagnetic devices. (28/8/22.)
192 359 Western Electric Co., Ltd. Systems for the telephonic distribution of news, amusement, and the like. (25/1/22.)
205 634 W. F. Grafton. Brush holders for dynamo-electric machines. (2/9/22.)
205 641 F. Shergold and Edison Swan Electric Co., Ltd. Electrical fuses. (7/9/22.)
205 651 Siemens Bros. and Co., Ltd., and D. A. Christian. Automatic and semi-automatic telephone systems. (15/9/22.)
205 655 G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. Roller bearings. (20/9/22.)
205 658 H. Tinsley. Submarine cables and telegraph lines. (23/9/22.)
205 660 J. C. White. Electric lamp holders and the like electric couplings. (26/9/22.)
205 663 British Electrical Federation, Ltd., and A. Twidle. Locking means for doors. (27/9/22.)
187 222 Akt.-Ges. Brown, Boveri, et Cie. Electric transformer oil-boxes. (15/10/21.)
205 681 H. V. M. Fell and W. F. Gaulke. Device for preventing the theft of motor-cars and the surreptitious use of electrical apparatus in general. (19/10/22.)
205 685 Johnson and Phillips, Ltd., and C. F. Street. Manufacture of telephone cables. (20/10/22.)
205 709 S. J. Brice and Callender's Cable and Construction Co., Ltd. Electrical bonding junction boxes for use with metallic sheathed wires and the like. (6/11/22.)
205 717 B. G. Calver. Wireless receiving apparatus. (10/11/22.)
189 771 R. Andersson. Automatic interrupters for electric heating apparatus (28/11/21.)
205 742 Henley's Telegraph Works Co., Ltd., and E. E. Judge. Junction boxes for use in electrical distribution systems. (21/12/22.)
205 744 C. F. Elwell, Ltd. and S. P. Wing. Wireless masts or like structures. (30/12/22.)
205 747 British Thomson-Houston Co., Ltd. (General Electric Co.). Electric incandescent lamps. (5/1/23.)
205 753 British Thomson-Houston Co., Ltd. (General Electric Co.). Circuit-breaker systems. (19/1/23.)
205 754 British Thomson-Houston Co., Ltd. (General Electric Co.). Electric switches. (22/1/23.)
205 756 I. Calvete. Suspenders for use in electric permanent hair-waving machines, and for other electrical purposes. (24/1/23.)
195 593 Metropolitan-Vickers Electrical Co., Ltd. Electrical insulators. (1/4/22.)
195 363 British Thomson-Houston Co., Ltd. Electric selective control systems. (25/3/22.)
204 038 Metropolitan-Vickers Electrical Co., Ltd. Turbine blading. (13/9/22.)
205 837 J. Scott-Taggart. Signalling system, especially radio-communication. (22/4/22.)
205 843 F. E. Pernot. Means for receiving alternating current electrical signals. (25/5/22.)
205 846 A. Huguenin. Tidal water power plant. (20/6/22.)
205 861 Relay Automatic Telephone Co., Ltd., and W. D. Edwards. Automatic or semi-automatic telephone systems. (20/7/22.)
205 864 Coventry Automatic Telephones, Ltd. (F. R. McBerty and R. C. Arter). Telephone exchange systems. (21/7/22.)
205 866 British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. Alternating current protective apparatus. (22/7/22.)
205 883 J. P. Scott. Electrode structure and method of manufacturing same. (25/7/22.)
205 884 J. P. Scott. Electrolytic cells. (25/7/22.)
187 580 Relay Automatic Telephone Co., Ltd. Means for inter-connecting electrical lines, particularly in telephone plants. (15/10/21.)
205 886 G. A. Cheetham, W. Smethurst and Metropolitan-Vickers Electrical Co., Ltd. Jewel bearings for the rotary elements of electric meters. (25/7/22.)
205 889 J. H. Bregi. Rectifying commutators for charging accumulators by alternating current. (26/7/22.)
205 891 J. Stone and Co., Ltd. and A. H. Darker. Dynamos for train-lighting and similar installations. (26/7/22.)
184 458 F. R. McBerty. Contracts for electric relays, keys, and the like. (10/8/21.)
205 897 A. F. Wood, W. Stott and Telephone Manufacturing Co., Ltd. Mechanism such as is applicable to impulse sending devices for automatic telephone systems. (27/7/22.)
205 899 A. Reyrolle and Co., Ltd. and R. W. Biles. Protective arrangements for alternating electric current circuits. (27/7/22.)
183 838 British Thomson-Houston Co., Ltd. High-frequency signalling systems. (27/7/21.)
205 921 British Thomson-Houston Co., Ltd., R. D. Given and C. J. H. Trutch. Control of electric motors driving planing and like machines. (4/8/22.)
205 928 Western Electric Co., Ltd. (Western Electric Co., Inc.). Submarine cable telegraph systems. (9/8/22.)
205 929 C. J. Baker and E. R. Ingram. Electrical joint boxes. (9/8/22.)
205 930 A. Rothschild. Terminals for electrical work. (10/5/23.)
205 939 C. C. Armstrong. Electric cooking or heating devices. (18/8/22.)
205 942 L. J. Hunt and Sandycroft, Ltd. Alternating current dynamo-electric machines adapted for synchronous working. (22/8/22.)
205 944 Crompton and Co., Ltd., and W. G. Smith. Electrical instrument cases. (25/8/22.)
205 948 A. E. L. Scanes and Metropolitan-Vickers Electrical Co., Ltd. Electric transformers. (4/9/22.)
205 961 R. Jenkins. Stands for electric irons. (23/9/22.)

Applications for Patents.

December 3rd.

30 340 A. S. Willmot. Telegraph keyboard perforator.
30 343 G. Pelletier. Variometers. (1/12/22, France.)
30 355 C. E. Mayer. Transmitting photographs, etc., by telegraphy.
30 364 G. Isenthal. Lighting emergency electric lamps on failure of main current.
30 374 F. C. R. Holland, A. E. Katz, H. G. B. Corby and S. Croneen. Rectifiers or detectors for wireless telegraphy.
30 383 Automatic Telephone Manufacturing Co. and J. E. Ostline. Telephone systems and apparatus.
30 391 Ges. fur. Drahtlose Telegraphie. High frequency telephone systems. (2/12/22, Germany.)
30 392 Metropolitan-Vickers Electrical Co. Relief valves. (23/12/22, U.S.)
30 400 Felten and Guilleaume Carlswerk Akt. Ges. Magnet cores. (5/12/22, Germany.)
30 404 Signal Ges. Arrangement for determining direction of sound. (4/12/22, Germany.)
30 411 F. L. Hollister. Wireless generators.
30 415 L. Verhaert. Electric resistances. (14/12/22, France.)
30 417 Automatic Telephone Manufacturing Co. (Automatic Electric Co.). Telephone systems.

December 4th.

30 443 A. Hippisley. Loud-speaking telephones.
30 450 H. Knowlson Contact devices for engine ignition.
30 453 J. F. Easton. Variable condensers.
30 464 E. D. Young. Telephone percussion absorber.
30 479 T. Stretton. Electro-magnets.
30 480 H. S. Budge. Contact devices for engine ignition apparatus.
30 482 Coventry Automatic Telephones, Ltd., and J. E. Collyer. Telephone systems.
30 499 Marrec, Ltd., and Y. Marrec. Receiving systems for electric currents and electromagnetic waves.
30 511 Sir F. L. Nathan and J. D. Morgan. Magneto or dynamo-electric exploders.
30 519 Felten and Guilleaume Carlswerk Akt. Ges. Balancing telephone phantom lines for reducing overhearing. (4/12/22, Germany.)
30 523 British Thomson-Houston Co. Regulators for electric discharges. (30/1/23, U.S.)
30 524 British Thomson-Houston Co. Regulating electric distribution systems (30/1/23, U.S.)
30 528 Automatic Telephone Manufacturing Co. and H. Adams. Impulse repeating arrangements for telephone systems, etc.

December 5th.

30 543 H. L. Percy. Terminal for connecting telephone wires, etc.
30 548 J. Judge. Connectors for wireless telephones.
30 561 C. Buckley. Electric ceiling roses.
30 572 Coventry Automatic Telephones, Ltd., and J. E. Collyer. Automatic telephone systems, etc.
30 573 J. Dooley and G. J. Parnell. Locking device for incandescent lamps.
30 601 R. J. Farrar. Buzzer device for audible signalling.
30 624 R. H. Barbour and J. R. Walton. Casings for electric regulators.
30 627 W. H. Gwynn. Electric advertising signs.
30 628 T. W. Simpson, C. O. Alexander and C. B. Johnson. Electric contact devices.
30 629 T. W. Simpson, C. O. Alexander and C. B. Johnson. Electric terminals.
30 636 and 30 638 Gramophone Co. and B. E. G. Mittell. Rheostats for wireless sets, etc.
30 637 Gramophone Co. and B. E. G. Mittell. Controls for wireless sets, etc.
30 639 Gramophone Co. and B. E. G. Mittell Mounting basket coils for wireless apparatus.
30 651 Cambridge and Paul Instrument Co. Vapour-pressure thermometers.

December 6th.

30 654 M. A. Robinson. Crystal detectors.
30 659 J. P. Payne. Transformers for radio frequency currents
30 683 J. B. Johnston Wireless apparatus.
30 691 British Electrical and Allied Industries Research Association. Composite materials containing inorganic fibres.
30 704 Western Electric Co. Loud-speaking telephone receivers.
30 705 Western Electric Co. and B. B. Grace. Radio receiving sets.
30 708 R. H. Winter. Coil-holder, etc.
30 709 R. H. Winter. Adaptor socket for valves of wireless sets.
30 712 J. E. Dawson. Variable condensers.
30 713 J. F. Monnot. Storage batteries.
30 723 A. Woosnam (Herkules Akt. Ges. für Fabrikation-u-Handel). Maximum current interrupter.
30 736 New Antwerp Telephone and Electrical Works Soc. Anon. Automatic calling apparatus for telephone installations. (14/12/22, Belgium.)
30 738 Sterling Telephone Co., W. M. Holbeach and J. D. Ward Miller. Mountings for thermionic valves.
30 741 S. Ruben. Electron discharge devices.
30 742 A. E. White (Sangamo Electric Co.). Electricity meters, etc.
30 746 H. F. Joel. Accumulators, etc.

December 7th.

30 764 M.-L. Magneto Syndicate and E. A. Watson. High tension magnetos.
30 772 W. Edwards. Appliance for supporting wireless aerials.
30 780 British Insulated and Helsby Cables Co., Ltd., and A. H. Selwyn. Multi-core cables.
30 787 and 30 788 A. Rogers. Electric couplers, connectors, etc.
30 791 C. B. Kersting. Loud-sounding receivers.
30 793 British Insulated and Helsby Cables, Ltd., and B. Welbourn. Lead sleeve cable joints.
30 796 C. V. Treleaven. Incandescent lamps.
30 813 E. B. Dottsio. Terminal socket and plug connector for electric circuits.
30 823 and 30 824 Metropolitan-Vickers Electrical Co., C. Ryder and T. W. Ross. Electric relays.
30 826 G. Sanders. Prepayment electricity meters.
30 827 B. and H. D. B. North. Electrolytic electricity meters.
30 843 J. Bethenod. Telephone receiving apparatus.
30 845 British Thomson-Houston Co. (General Electric Co., N.Y.). Transformers.
30 846 British Thomson-Houston Co. (General Electric Co., N.Y.). X-ray apparatus, etc.
30 849 I. Guiducci. Electric heaters.
30 851 A. L. Wykes. Electric switches.
30 859 English Electric Co. and R. H. Holbeche. Mounting electric motors, etc.

December 8th.

30 866 C. E. J. Brandt and E. A. Fouilleret. Induction meter. (20/3/23, France.)
30 881 E. Belloni. Railless roadway for electric vehicles. (9/12/22, Italy.)
30 884 Highfield Electrical Co., F. W. Highfield and H. E. Taylor. Electric testing apparatus for fluid pressure engines.
30 894 R. G. Cave. Variable inductances.
30 907 Soc. Alsacienne de Constructions Mecaniques. Electric welding, etc. (8/12/22, France.)
30 913 Ajax Electrothermic Corporation. Furnace. (13/7/23, U.S.)
30 918 J. F. Monnot. Storage batteries.
30 923 C. J. Werts. Connection for dry batteries.
30 925 T. Quinney. Wireless receiving apparatus.

Erratum.—For. No. 30 773 (S. G. Brown) in our last issue read 30 173.

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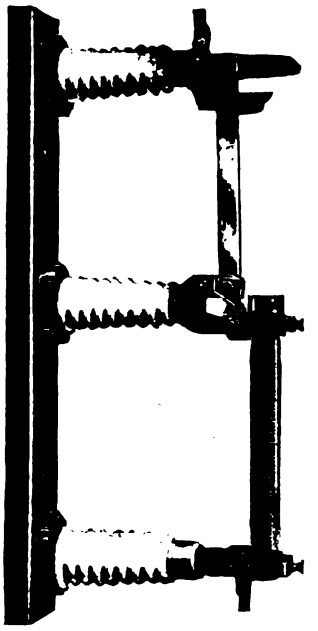

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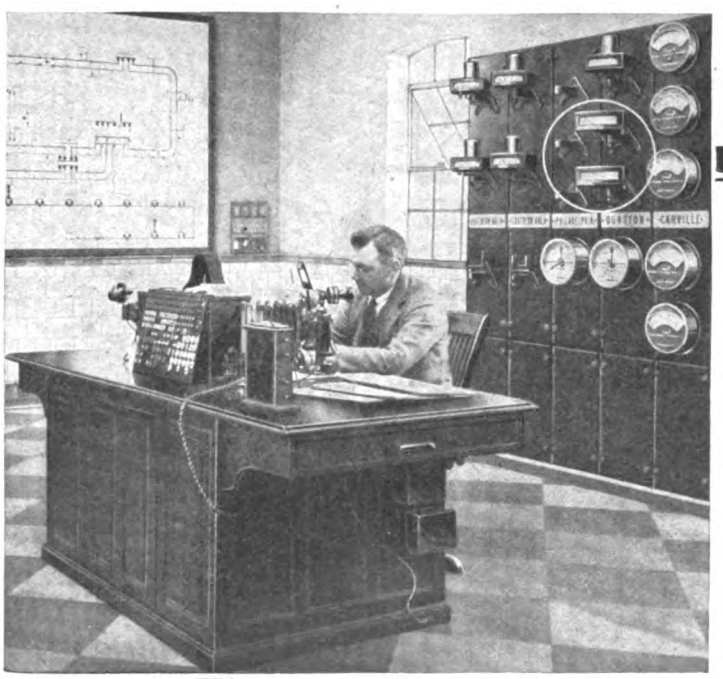

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ASH HANDLING PROBLEMS.

Ash handling is one of those operations which has to be carried on in every coal-fired generating station unless, as we have lately been informed, pulverised fuel is used. But though the proper lay-out and performance of the equipment may have a considerable effect on the fuel costs it is a matter which has not received the attention commensurate with its importance, and, as Mr. G. F. ZIMMER points out in the article which we publish on another page of this issue, long after mechanical coal handling appliances were installed ashes continued to be dealt with by hand. Nevertheless, in these economic days the ash handling problem is worth consideration, not only from the point of view of cost, but from that of improving the amenities of the station—a factor which is worth considering when the dusty nature of the material is taken into account and when it is pointed out that no less than 20 tons per hour may have to be disposed of. Under the first of these headings the problem may well be decided by the lay-out of the station; that is, if proper methods of design are employed nothing further is required. In an article which we recently published in THE ELECTRICIAN, Mr. DAVID BROWNLIE, discussing the report of the Prime Movers Committee of the American National Electric Light Association, pointed out that experience in that country showed that there are three satisfactory methods of handling ashes. One by building the station high above railway level and using gravity, the second by using telphers or locomotive cranes in conjunction with small cars run under the ash hoppers, and the third by employing the water sluice method, which has the advantage of keeping down the dust. He thought that the increasing size of generating stations and the consequent large amount of material to be handled was gradually ruling out such methods as conveyors and suction plants, though the latter especially is in use in more than one large station in this country.

It is interesting to note that the American Society of Mechanical Engineers came to a different conclusion when they recently dealt with the same matter. The general consensus of opinion of that body was that the most desirable method of handling ashes was to discharge them directly into trucks placed underneath the hoppers. This method, it was contended, was easily operated and maintained, did not require excessive head room, and was flexible in case of emergency, i.e., ashes could in case of need be dumped on the floor. It is not suggested, of course, that this last method should be common practice, but there is something to be said for methods which allow the station to be kept running when equipment gets out of order or railway strikes occur. Simplicity is, indeed, a better ideal to work for than complication. The American Society of Mechanical Engineers also called attention to the importance of having hoppers of ample size, large enough, that is, to prevent the boiler being shut down or operated at a reduced rating because of a defect in the ash handling equipment. Submerged ash-pits which prevent the emission of carbon monoxide and corrosive gases and flames were also recommended.

Criticising the steam jet and hydraulic sluice type of conveyor, which has recently been much used owing to its simplicity and the small space occupied, the report pointed out that the relative motion of ash and conduit causes abrasion. The steam economy of the pit type of conveyor is often small and may easily become smaller in course of time unless careful attention is given to its maintenance. But it is considered that with any form of fluid conveyor it is desirable, in view of the limited experience with this equipment, to provide some emergency method of ash removal in case the conduits should clog up or some other similar contingency occur. That such a warning should be necessary sufficiently indicates that American engineers consider that the advantages of the liquid conveyor can be bought too dearly. The only question, indeed, as is usual in such cases, is one of compromise. For, to quote the "Electrical World," "that ash system will be best which assures the highest reliability for the least annual expenditure and which can be readily supplemented by some expedient method in an emergency." How existing systems rank at present in this regard cannot at present be accurately determined. This means (we suppose) that there is no one best solution of the problem.

In the article to which we have referred, Mr. ZIMMER is not more definite. He points out, it is true, that coal and ash handling must usually be treated as separate problems and that the choice of the type of conveyor to use for ashes is complicated by the abrasive and corrosive nature of the material handled. He describes two types of conveyor which have been specially designed for the handling of hot ashes and also devices which make use of the hydraulic and pneumatic principle to the same end. All these systems have their advantages and all have their disadvantages, and the choice between them seems therefore to depend on local conditions and on personal predilections, two factors which often do not lead to economy, but rather the reverse.

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It remains to ask the question whether the problem cannot be dealt with in some other way—not by discovering more efficient methods of handling ash but by reducing the quantities that have to be dealt with. In his Paper on "Pulverised Fuel," which we dealt with last week, Mr. DAVID BROWNLIE pointed out that the employment of pulverised fuel would mean at least a partial solution of the fuel problem, and Dr. LESSING, speaking in the discussion, indicated that a very effective but none the less simple way would be to put less ash into the boilers. A considerable portion of so-called coal which is delivered from the collieries to the generating stations of the country has no fuel value at all and is simply waste matter. It probably reduces the efficiency of the boiler house and it certainly gives rise to a large amount of ash. If Dr. LESSING's figures are to be accepted it would seem that we have been dealing with the problem at the wrong end, and that all the ingenious and expensive machinery which Mr. ZIMMER describes has been built to do work which should not require to be done at all. We hope the question will be examined from this point of view to discover whether improvements in the present conditions cannot be realised.

Current Topics.

Eliminating Man Power—Two Examples.

THE increasing cost of labour has necessitated that more and more attention shall be given to the employment of machinery rather than men for all sorts of operations, and has also necessitated modifications in existing plant and layouts, so that the fullest advantage can be taken of the new arrangements. We give two interesting examples of this tendency in the articles by Mr. E. G. FIEGEHEW and Mr. M. JENNINGS, which appear elsewhere in this issue. The first of these deals with a crane which has been erected at the Eastbourne electricity works to handle the larger amount of coal now consumed owing to recent extensions. Part of the extension was a siding into which the coal is brought from the railway, and to take it thence to the existing conveyors it was decided for good reasons to use a locomotive crane. The crane chosen is of peculiar construction: it has a bent jib which, as our illustrations show, can be made to perform certain, almost acrobatic, feats when manœuvring in a confined space, while it is claimed its lower first cost and maintenance give it other advantages over the shunting locomotive which must not be disregarded. Its flexibility must also be taken into account, and we can readily see that it will be useful in applications, legitimate but for which it was not originally intended.

Handling Grain in Bulk.

THE second example is not so much electrical as an interesting indication of the different procedure which becomes necessary when original conditions change. Until recently the cargoes at many inland grain mills were made up in sacks, and this arrangement rendered storage arrangements usual which could not be employed when grain in bulk became the fashion. To take grain in bulk is, however, often an advantage, and Mr. JENNINGS gives an interesting example of the way in which a warehouse was adapted to this end. The storage of grain in bulk necessitates the use of mechanical handling apparatus, and the configuration of the building in question meant a peculiar arrangement of this equipment. By the employment of electrically-driven suction equipment, however, these drawbacks were overcome, and the grain can now be easily and cheaply distributed to any part of the warehouse. A discharge rate of 18 tons per hour is possible with a consumption of 180 kWh, a figure which includes driving of a certain amount of auxiliary plant. We are not surprised to learn that the owners are pleased with the installation.

Aeroplane Control by Wireless.

We have several times drawn attention to the various systems available for controlling the movements of ships in harbours and other congested places by means of leader cables. In a paper read before the Institution of Aeronautical Engineers, last Friday, Mr. WILLIAM LOTH propounded the idea of applying the same device to aeroplanes, and gave details of a system by which this could be done. Experiments that he has made show that the magnetic field in air, on whose properties any device used for this purpose must rely, is not a simple magnetic field, but is formed of three fields due to the current circulating in the leader cable, to the return current in the earth, and to the currents induced in the conducting mass surrounding the loop which is fed by high frequency alternating currents. For the navigation of aircraft it is necessary to know the direction of the route and the perpendicular to this route, by two different and independent operations, so as to control them one by the other; the inclination of the aircraft on the route to be followed determined by the guide cable (that is to say the angle formed by the great axis of the movable object, or its axis of route, with the direction of the guide cable, at the point where this movable object is located); the direction of this inclination (inclination of the aircraft towards the right or towards the left); the number of degrees of this inclination, if possible; the side of the guide cable on which the aircraft is located; the distance separating the aircraft from the guide cable; the horizontal plane of flight, and if the guide cable on land is ascending or descending.

Apparatus Used.

THE apparatus used by the author consists of three vertical coils—one parallel to the axis of the aircraft, another at right angles to this axis, and the third a horizontal coil. All these coils are embodied in the fuselage structure of an aeroplane and their ends are connected to a switching arrangement whereby various combinations of connection between the coils can be made. The current induced in these coils is detected by suitable wireless means. The direction of the guide line and the perpendicular to the direction of the guide line are obtained by observing the current in the two vertical coils, one of which is parallel to the axis of the aircraft and the other at right angles to the aircraft. The inclination and the direction of the inclination of the axis of the aircraft to the direction of the guide line are obtained by connecting these two coils successively in series, reversing the terminals at each connection. By observing the amount of the current induced in the coils in each connection, the inclination whether towards the right or the left can be ascertained. The number of degrees of this inclination may be ascertained by using the well-known radiogoniometric method of measuring the relative values of these currents, but such a device considerably interferes with the reception and can only be used on a few hundred metres for the guide line. The drift of the aircraft from left to right or from right to left of the guide line is ascertained by connecting the longitudinal vertical coil and the horizontal coil in series. The inclination of the guide line is ascertained by connecting the horizontal coil and the transverse vertical coil in series. In the trials which have been made frequencies of between 3 000 to 5 000 were used.

Equipment Equal to Pressure Increases.

IT is satisfactory to learn from an article in "La Genie Civil" that the design and manufacture of electrical equipment is keeping pace with the increasing tendency to raise the pressures. In the case of transformers especially, there is nothing to be feared and standard material can be used with every hope of success. On the other hand care is still required to ensure that automatic circuit breakers shall successfully withstand the abnormal effect brought about by short circuits on high tension lines. But

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a good deal of research is being conducted on this subject both in this country and in America and there is no doubt that a satisfactory solution will shortly be reached. It is further pointed out that the maximum transmission voltage is no longer determined by technical considerations, but by the amount of energy to be transmitted and, we might add, by the distances to be covered. For instance it is undesirable from every point of view to use 220 000 V if the power transmitted does not exceed 100 000 kW per circuit and the distance is less than 300 miles, considerations which definitely rule out the employment of such pressures in this country. It is considered that a pressure of 1 000 000 V would only be a paying proposition when the energy per circuit was more than 2 000 000 kW and the distance traversed exceeded 1 600 km. These conditions are more applicable to the Sahara or Central Asia than to this country and, unless matters change, very considerable pressures of this order are likely to remain for a long time of theoretical rather than practical interest. Quite apart from financial considerations, however, it must be pointed out that the effect of short circuits on such a line would be very considerable, while stability and good control would have to be secured by the use of synchronous condensers distributed at given intervals along the lines. In fact, the employment of such high pressures in any country that is at all populated is at present almost unthinkable.

The Effect of Heating on Impregnating Compounds.

In the construction of coils and windings for electrical equipment some form of impregnating compound is commonly employed to serve both as a mechanical support for the windings and as an insulator between them. To fulfil its purpose the material should be moisture-proof and in some cases also oil proof. It should also have good penetration, so that no air pockets will remain after impregnation. In practice the material may have to withstand considerable temperatures, the effect of which has recently been studied by Mr. D. E. Howes. In a paper recently presented before the American Electrochemical Society he describes some experiments on field coil windings impregnated with four kinds of compounds and subjected to temperatures of 105 deg. C., 125 deg. C., and 150 deg. C. for a period of 120 days. At intervals the electrical condition of the insulation was measured. An examination of the results shows that the resistance of all the materials increased with the time of heating. The bakelite impregnated coils gave a higher resistance and lower power factor than any of the gums, because they did not soften. In general, power factor decreases rapidly for the first twenty days and thereafter changes little. The resistance increases for a period, then decreases, after which a continuous increase occurs, indicating that oxidation has begun. Eventually coils tend to become carbonised, and hence their mechanical qualities are impaired. Considerable deterioration in this respect is ultimately revealed at 150 deg. C., but little at the two lower temperatures.

Electricity and the Fog Peril.

In a recent issue of "Nature," Mr. J. S. Owens gives a curve, which should be studied by all electrical engineers, showing the hourly variation in the quantity of suspended sooty matter in the air of London. This sooty matter is of course responsible for the fogs we have recently been experiencing, and it is interesting to see the increase in density which occurs when the fires are being lighted in the morning. Discussing this curve, Mr. Owens comes to the interesting conclusions that the air over London being warmer than its surroundings, water fogs will be fewer or less dense during the day than in the country, and that the "London Particular" can be entirely prevented by abolishing smoke. Mr. Owens gives good reasons for supposing that London fog does not consist of water particles dirtied by smoke, but of smoke particles alone. This is proved by the appearance of the sun seen through a fog, the small evidence of water drops, the less density though greater yellowness of London than country fog, the warmer atmosphere over London than the country, and the variation of the impurity with the time of day. It will be remembered how clear the air of London was during the coal strike of 1921, and it therefore appears that it is not naturally a foggy place but one that has been made so by human agency. The moral of all this is clear enough: the reduction of smoke-producing grates, furnaces and fires, and the substitution therefor of something that will give us an atmosphere of which even the country will be envious. In twenty years the fog peril, for peril it is, has been much reduced. Steps should be taken to remove it altogether at the earliest possible moment.

Flat Rate Disadvantages.

Paradoxical as it may seem, the very simplicity of the tariffs charged by certain electricity supply undertakings is an obstacle to the greater use of domestic equipment. There are some undertakings, especially near London, where lighting is charged on one simple flat rate and heating and cooking on another, with the result that the apparatus used on one circuit, like East and West, can never meet that used on the other. This separation is not always accompanied by high charges, and there is, at least one undertaking where a very successful cooking load has been built up on these lines. On the other hand, it possesses certain distinct disadvantages which must be placed against its simplicity. One is that two metres are required, and another is that double wiring is necessary. But the greatest disadvantage is that it prevents the proper development of that greatest of electrical advantages, flexibility. This is shown best by an example. When a two-rate tariff is used it is possible to employ in a bedroom a power plug and a lighting plug on the same circuit. With two separate tariffs this is impossible without two separate circuits. It is often convenient to supply an iron from a lighting point through an adaptor. This cannot be done with two separate tariffs unless the supply is given at a lighting rate. It is, therefore, to be hoped, for the sake of progress, not only that there will be a greater standardisation of tariffs, but that that standardisation will be towards the wider use of two-rate methods.

Carrier Currents and Power Supply.

The increasing interconnection of the power systems of the country carries with it the necessity for quick, easy and accurate communication between the power stations, substations and other points of electro-strategic importance on the network. This intercommunication is mainly effected at the present time by the telephone, the necessary wires being laid or carried near the power cable or overhead lines. The arrangement has its disadvantages, not the least of which, when the distances are great, being the cost. It is, therefore, not surprising to find that in the United States attention is being given to the possibility of using carrier current telephony for this purpose or that the operating conditions on the lines employed have a considerable effect on the telephonic results obtainable when this method is employed. In fact, it is found that the line coupling, the character of the power lines, the number of branch circuits, the condition of the insulators and any design or operating conditions that will produce transients will have their influence on the performance. An important practical point, which has caused some difficulty, is what determines the limits of the wave-bands that are desirable for carrier current communication under such conditions. If resonance or impedance conditions are absorbing or choking the carrier current these must be eliminated, while cutting in or out branch lines and so affecting the length of the transmission produce still more complications. Harmonics caused by the charging of arresters or by faulty insulators also influence the quality of the communication. So that it will be seen that plenty of research is necessary to raise the system out of the experimental stage.

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THE MECHANICAL TRANSPORT OF GOODS.

Some Factors in the Economical Operation of Road Vehicles, with Special Reference to Garages.

By RICHARD TWELVETREES. A.M.I.Mech.E., M.S.A.E., M.Soc.Ing.Civ.(France).

In some respects the factors governing the successful operation of mechanically driven road vehicles are independent of the type of machine employed, and though for various industrial purposes it may be preferable to employ either steam, petrol, petrol-electric or electrically driven machines, certain important operating factors are common in all cases. Even the most continuously worked machines

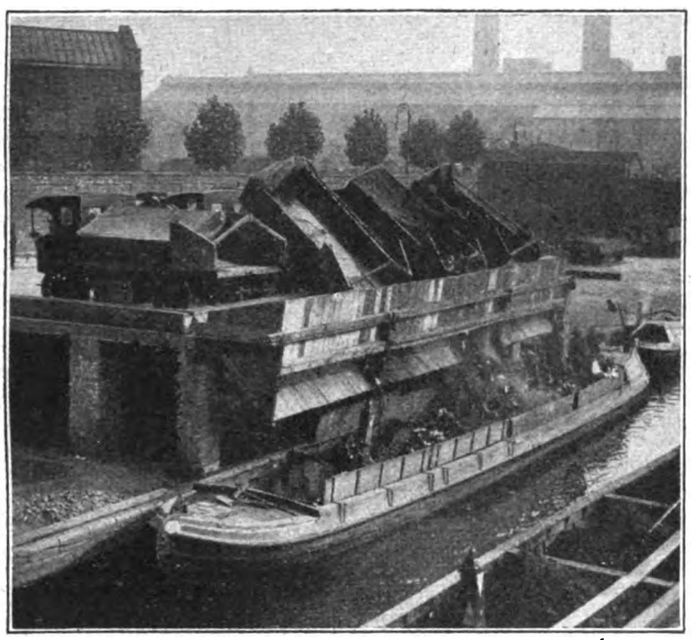

FIG. 1.—ORWELL ELECTRIC VEHICLE TIPPING REFUSE INTO BARGES.

have to spend a portion of their time off the road, and it is by reducing waste during such periods that the greatest economy is obtainable. This line of thought naturally introduces the question of garage accommodation, which is equally important for all classes of vehicles, and therefore demands close attention from the operator.

In the absence of adequate garage facilities it is altogether impossible to maintain the maximum degree of mechanical efficiency either for a single vehicle or a large fleet, and it therefore becomes necessary to consider some of the principal factors relating to this particular aspect of transport operation.

At the present time there is a lamentable scarcity of public garages specially designed for the accommodation of industrial vehicles. This in some degree is due to the fact that operators do not attach sufficient importance to this vital phase of the handling of goods by the aid of road vehicles. Even in cases where firms have erected their own garage premises, these buildings often consist of little more than a shelter for their vans or lorries, with the result that the maintenance of the machines becomes considerably neglected. As soon as a fleet of vehicles is acquired the transport manager draws up a schedule of work, under which the vehicles are worked to their utmost capacity, but in many cases the well-being of the lorries when out of service is treated as a matter of secondary consideration. Drivers are, as a rule, vested with too much responsibility in the latter respect, and as long as the machines are kept regularly at work, the real mechanical condition of the vehicles is taken as a matter of course.

Perhaps the best way of appreciating the garage problem as it really exists, is to picture what happens to a lorry after the driver has delivered his last load on a given day. Unless the operator possesses his own garage, the driver will probably have to drive the empty vehicle for a mile or so to find accommodation for the night. This naturally means so much dead mileage, which, as everyone knows, constitutes one of the most expensive items in operating vehicles, and should therefore be avoided.

After his day's work, the driver will be too tired to pay much attention to the various little adjustments which may have become necessary during the day's run, and will probably be content to park his vehicle without due consideration as to how it is to be got out of the garage in the morning. The result will be that a considerable amount of time will be wasted in disentangling his machine from others occupying the same garage, and during the course of a month the useful running time will be considerably reduced. Under such conditions, the vehicle becomes continually neglected until a serious breakdown necessitates its withdrawal from service for a lengthy period. To put it briefly, the expensive vehicle is entrusted almost entirely to the driver, whose interest in his charge is usually very limited.

Without elaborating upon further details at this point, the reader is reminded that in order to secure the best results from his vehicles, a proper amount of attention must be paid to such items as periodical inspections of the machines, arrangements for washing, the keeping of mileage and other records, the handling of running repairs and numerous other details, which cannot be performed satisfactorily in the absence of proper garage facilities.

The ideal situation for an industrial vehicle garage is in proximity to the premises where the loads are taken up,

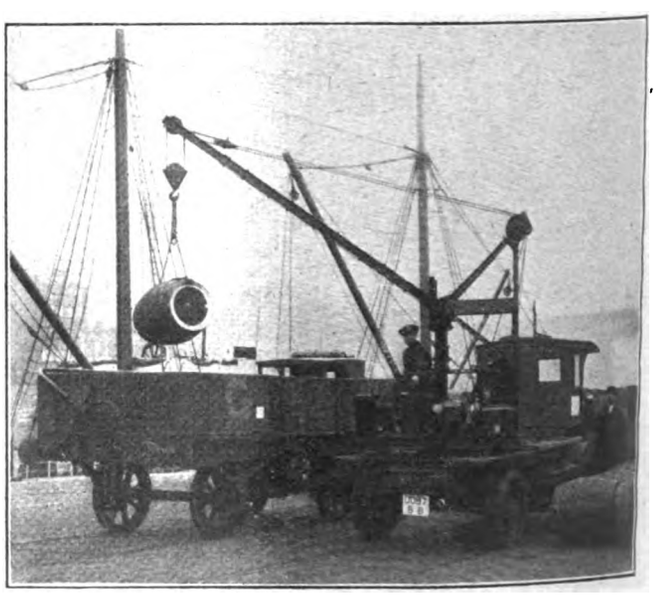

FIG. 2.—ORWELL ELECTRIC VEHICLE FITTED WITH CRANE FOR HANDLING MATERIAL.

but when such a convenience is not available, alternatives have to be considered. At this point it may be remembered that as the garage will remain long after the original fleet of vehicles has been scrapped and replaced by others, it is

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desirable to envisage future as well as present requirements. Amongst the more important matters which call for attention are the limitation of dead mileage, ease of access by good roads, convenience for future extensions of the premises, facilities for the supply of light, power and water. It is also necessary to provide for deliveries of commodities, such as fuel and lubricating oil, whilst charging arrangements will have to be made if electrically driven vehicles are contemplated. Other important matters connected with the selection of a garage site concern the nature of the foundations and character of the surrounding properties, so that it will be seen that a good deal of careful thought has to be given to this aspect of the transport problem.

Though there are difficulties in the way of suggesting a garage lay-out suitable for universal adoption by all classes of transport users, it may be useful to consider the one illustrated in Figs. 3 and 4, in relation to the matters mentioned above. Let us assume that accommodation has to be provided for twelve or sixteen vehicles of about three tons capacity, and that it is essential to avoid any congestion within the premises, which, as has been mentioned already, constitutes one of the main drawbacks to the ordinary form of building. Provision has also to be made for carrying out such operations as washing and minor repairs, so that the premises may be as self-contained as possible.

To render the garage space fully accessible, it is advisable to provide entrances from both sides. For this reason the entire space available is not covered in, the actual building occupying a central part of the site. By arranging for the vehicle parking in the staggered fashion indicated, each one can enter and leave the building unhindered by the position of any other vehicle, which is very important when several have to start work at about the same time. As far as constructional costs are concerned, the method suggested has distinct advantages, for by the use of steel columns with the rolling type door the building will be relatively inexpensive. Furthermore, by adopting the suggested methods of construction, the parking of the vehicles becomes practically automatic. It will be observed that all vehicles leave by the front exit, so that they can be replenished and booked out without delay, and their movements can be recorded in the office near the door.

Facilities for Washing Vehicles.

It is hardly necessary to emphasise the need for regularly washing all transport vehicles, though, to judge from the condition of some to be seen on the road, all operators are not agreed on this point. An ill-kept vehicle soon begins to develop mechanical troubles, which are often concealed by dirt and mud until they assume serious proportions. If washing operations are conducted in the

FIG. 3.—EXTERIOR OF AN UP-TO-DATE GARAGE.

garage, the movements of other vehicles are hindered, and if a single washing space is provided vehicles have to wait their turn until the space is free.

The arrangement indicated in the plan provides a solution of the washing problem, for by installing a drainage system for the side gangways this space can be utilised for washing the vehicles. For this purpose the gangways should be covered with a mixture of granite chippings and cement, laid on a concrete foundation, the surface being arranged so that the water runs towards the central drains shown on the plan. If so desired these areas may be covered in, when in addition to serving as a washing space they may be made use of to accommodate any vehicles temporarily thrown out of action during repairs.

A further convenience of this arrangement is that the lorries can be washed at night by a separate staff, and the

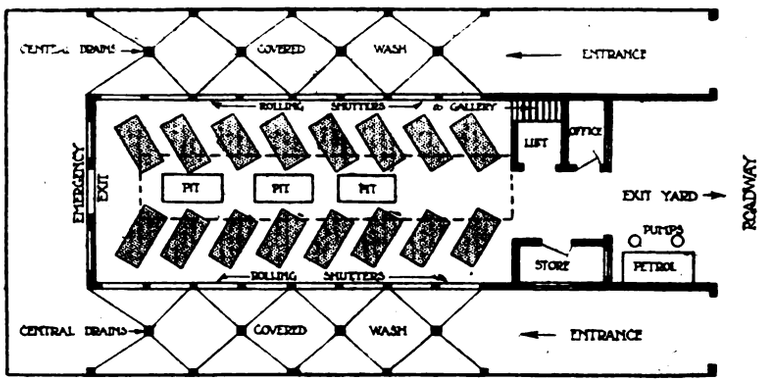

FIG. 4.—AN EFFICIENT GARAGE LAY-OUT.

men so engaged need not enter the garage premises at all. After all the vehicles have been washed they can be filled up in readiness for the next day's work under the supervision of a night foreman, and then one driver performing the duties of night shunter can run them back into the garage ready to be taken out by the drivers.

To maintain the maximum efficiency in a fleet of vehicles, whether driven by steam, petrol or electricity, it is essential that a properly organised inspection system should exist. Some operators object to instituting such a feature on account of the time usually occupied by the people who carry out the work, but the latter objection is greatly minimised if the process of inspection is split up, so that certain parts of each vehicle are examined each day. As a matter of fact, this system has other advantages besides merely saving time. If the drivers know that on certain dates an inspection is to be held they will find time to make certain little adjustments which have the effect of disguising more serious faults. But if, on the other hand, each vehicle is kept continually under the eye of the supervisor by means of daily inspections, far better control of the drivers can be exercised. The idea is that on one day of the week the power unit of each vehicle should be inspected and other parts should be subjected to similar inspection on following days, so that at the end of each week every part of each vehicle has been thoroughly examined. The system can be elaborated to include instructions to the drivers as to the preparation of the vehicles for each morning's inspection, thus saving the time of the person entrusted with this important part of the business.

It is not sufficient that each vehicle should be inspected in the manner suggested above, for proper records must be kept as to the exact condition of each machine. In this way the operators will be able to foresee the probabilities of certain machines being out of service for repair operations, and due arrangements can be made for the loads, by using reserve vehicles should such contingencies arise. The inspection reports, if properly drafted, will indicate the amount of care that is being paid to the machines by the drivers, and the recurrence of specified defects will probably indicate that the particular driver is guilty of the improper handling of his machine.

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Filed inspection reports will enable the transport manager to order up replacement parts in advance, so that when repairs become due all the necessary parts to complete the operations will be to hand in the stores. Those who have handled repair work will realise the benefits of avoiding this kind of delay.

In transport services where the vehicles are practically standardised to one type the space allocated to stores and workshops need only be small in comparison with those where several types are involved. For many reasons it is best to concentrate upon one type wherever possible, but the most important point arises in connection with repairs and the number of replacement parts to be carried in stock. The best method of organising transport stores is that of stocking complete chassis units, so that in the event of one lorry breaking down by reason of the failure of a unit, it can be put into service again with the minimum amount of delay, after the defective unit has been replaced

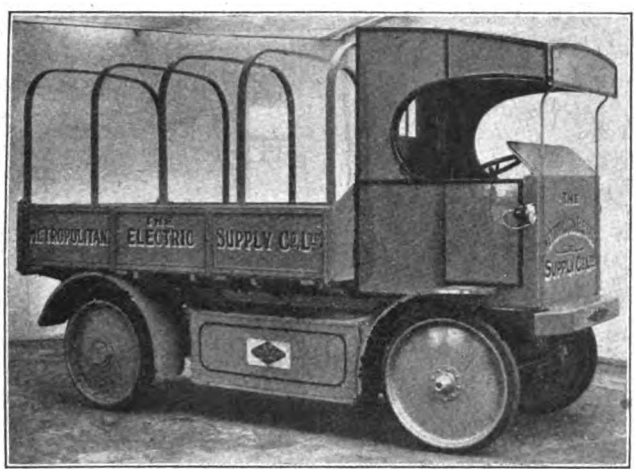

FIG. 5.—STANDARD 2-TON WALKER BALANCED DRIVE ELECTRIC VEHICLE SUPPLIED TO THE METROPOLITAN ELECTRIC SUPPLY CO.

by one from the stores. This permits the repair shop to restore the damaged unit to working condition, after which it can be returned to the store for further use.

Reference to the plan will show that only a small store is arranged on the ground floor. This is used for stocking sufficient materials and parts to keep the vehicles provided with their daily needs, the main stores being situated on an upper floor, where the workshop is also located. The upper storey is preferably arranged in the form of a gallery, so that the lighting from the roof will serve both floors, and the provision of an overhead runway will allow of units being lifted direct out of the vehicles and hauled up to the benches for attention. It will be observed that a lift is also installed to give access from one floor to the other. The above-mentioned points are the more important of those to be considered by the vehicle operator in relation to garage accommodation, and now the question of selecting vehicles with reference to loading facilities calls for some attention.

Until the last few years motor lorries appear to have been developed largely on the lines of touring car practice, with the result that the mechanism occupied far too much of the space that should have been available for carrying useful loads. Even at the present time there is a distinct tendency to produce machines of which the loading line is higher than is convenient for the majority of industrial users. In selecting vehicles for a given form of transport service it becomes necessary to consider the influence of the loading line in its correct relation to the easy handling of goods. It has to be remembered that the vast majority of loads will have to be picked up where no mechanical loading devices are available, and it is essential that there should be no great difference between the height of the discharge platforms and that of the vehicles.

Perhaps the average petrol-driven vehicle is the worst offender in this respect, but the introduction of the over-type machine has been attended by the advantage of increased platform areas with the same power of chassis.

In this country very little has been done in the development of the front wheel-driven vehicle, though examples manufactured on the Continent demonstrate the undoubted advantage of the design for general industrial purposes. By confining the whole of the mechanism to the forward part of the vehicle, any form of platform or goods container can be fitted at the rear, and the loading line can also be arranged to suit any requirements of the user.

Considerable advances have been made in the direction of mechanically-operated side and end tipping wagons, but these appear to be developed more for the use of municipal authorities than in the service of the industrial user. One of the most interesting features in the design of modern transport vehicles consists of the chassis arrangement which permits of the combination of horse and mechanical traction. The chassis is built with a special platform, upon which a goods container can be mounted, the idea being to employ horses to collect loads from short distances, which are brought to the lorry and then hauled by a mechanically-operated winch on to the platform. Furthermore, the entire platform can be tipped either endways or to either side for the convenience of unloading.

Another system, known as the D.C.C., designed by Messrs. Dalziel, Croker and Conradi, consists of employing a loose frame carrying the body, which can be twisted in any direction or moved sideways so as to bring the trailer in line with the lorry. Rollers are fitted to the loose frames, which can thus be transferred from the trailers to the lorry with the greatest of ease. This system is used by several of the railway companies and is found to possess great advantages in ease of loading. The principle can be adopted equally well either to steam, petrol or electric vehicles and involves but few structural alterations.

Semi-Trailers.

The semi-trailer is a comparatively new comer in the transport world, but has already established itself in the good opinions of transport users. In this case the tractor machine hauls the load and partly carries it, as the platform of the two-wheeled trailer is mounted directly over the rear wheels of the tractor. This arrangement permits of the transport of loads up to ten tons in weight without the use of heavy trailers, and avoids axle weight restrictions. The semi-trailer and tractor is far more compact than two vehicles with four axles and is allowed to run up to speeds of twelve miles an hour. Various improvements have been introduced recently with this class of vehicle and chiefly take the form of automatic coupling devices, the mechanism of some of the latter being so arranged that the front end of the trailer is supported on the tractor whilst it is being uncoupled, and the latter is automatically raised whilst the coupling is in progress.

For handling heavy loads over comparatively short distances the electrically-driven six-wheeler offers many advantages. The example produced by the General Vehicle Company has an approximate range of from forty to fifty miles on one charge, and is capable of dealing with loads up to ten tons weight. On this particular machine Westinghouse air brakes are adopted, and chain transmission is provided for the tractor portion, the cab arrangement of which permits of the maximum platform area. On this machine also a special form of quick release, the trailer can be readily detached from the tractor, which renders the type particularly useful for a variety of purposes.

In a brief review such as is contained in this article it is not possible to go into the various working costs with different forms of transport as the figures differ so widely according to the methods adopted by operators handling loads of varied characters, but the suggestions with regard to the general handling of road vehicles should be of some assistance to those whose experience has hitherto been confined only to mechanical details.

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ASH DISPOSAL.

Details of Appliances Now Used in Power Stations.

By GEORGE FREDERICK ZIMMER, A.M.Inst.C.E.

When but a decade ago it was the general practice to fire power house furnaces with large coal, the handling of the residual ashes was a relatively insignificant operation, and was therefore generally performed by manual labour, though the coal was handled scientifically. Since the advent of water-tube boilers with automatic stokers, low grade fuel is successfully employed, so that the ash removal has become a more important operation. In other words, while formerly, with high grade fuel, the percentage of ashes was but, say, 10 per cent., it is now, with low grade fuel, approximately double, so that the removal of the ashes—which may aggregate as much as 20 tons per hour in large power stations—by adequate handling devices has become as important as the handling of coal.

The mechanical disposal of ashes and clinkers from power houses is thus one of the latest tasks of the handling engineer, and its satisfactory solution should be almost as profitable as the use of the now well-known coal handling devices.

At a time like the present, when we are, in many respects, at the mercy of labour, mechanical handling devices should be economical in the power houses of public utility undertakings, even if the cost per ton handled thereby should exceed that of hand labour, which it certainly does not. Ash handling is, moreover, back-aching and dirty work, and most men will only take it till they can get an easier job, which means undesirable constant changes in the power house staff. Taking all circumstances into consideration, it is often cheaper, in the end, to instal a handling plant which is more costly provided it is less subject to wear and more immune from breakdowns and consequent monetary losses. The subject is of vital importance, since the delivery of the coal to the power house and the removal of the ashes therefrom constitutes, as a rule, the largest item in connection with power house expenditure.

Under these circumstances, it was only natural that, for the sake of economy, attempts should have been made to use one set of conveying plant for the dual purpose of handling both coal and ashes, and that the gravity bucket conveyor, which is recognised as the best method for handling the coal, and which, moreover, passes below the ash pits on its circular track, should be pressed into service for handling the ashes also, for which purpose it is unquestionably not suited. Coal is of a nature not unlike graphite and therefore causes little friction and consequent wear to handling devices; but ashes are just the opposite, and may, moreover, be hot or sopping wet. The former attribute will distort the parts with which they come in contact, and the latter (the moisture being of a corrosive nature) soon destroys the delicate parts of the conveyor. It is, therefore, most desirable not to use for ashes chain conveyors of any of the types usually built for coal. A further argument against so using them on a gravity bucket conveyor, for instance, is that the entire plant has to be at work, while for ash handling only a small portion is

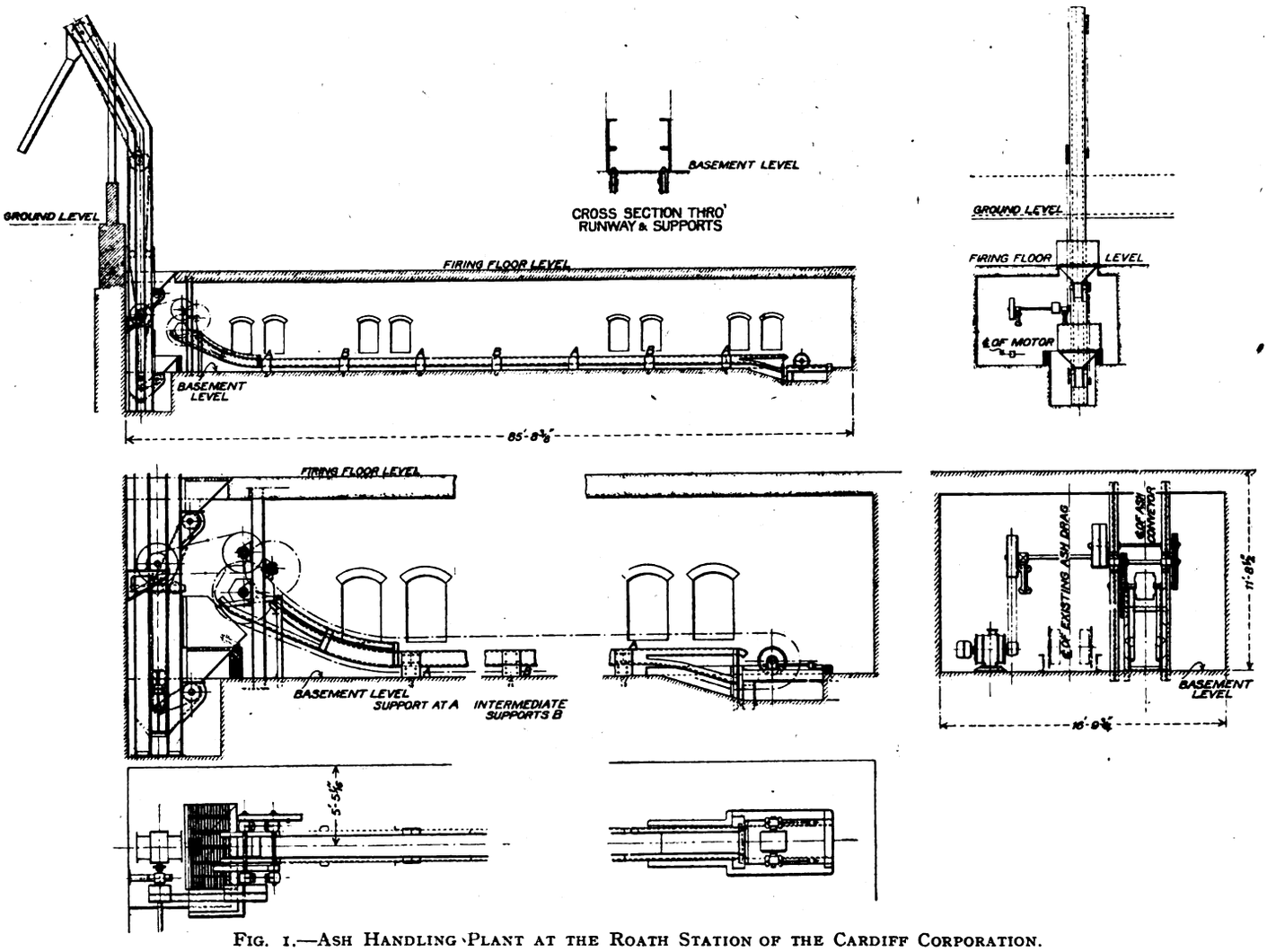

FIG. 1.—ASH HANDLING PLANT AT THE ROATH STATION OF THE CARDIFF CORPORATION.

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actually in use, and while coal is being received the conveyor is not available for ash removal and *vice versa*.

Only one conveying method is equally suitable for coal and ashes, and that is the telpher and grab, and that only for large plant where the general layout permits such an installation. Such devices can be operated for great

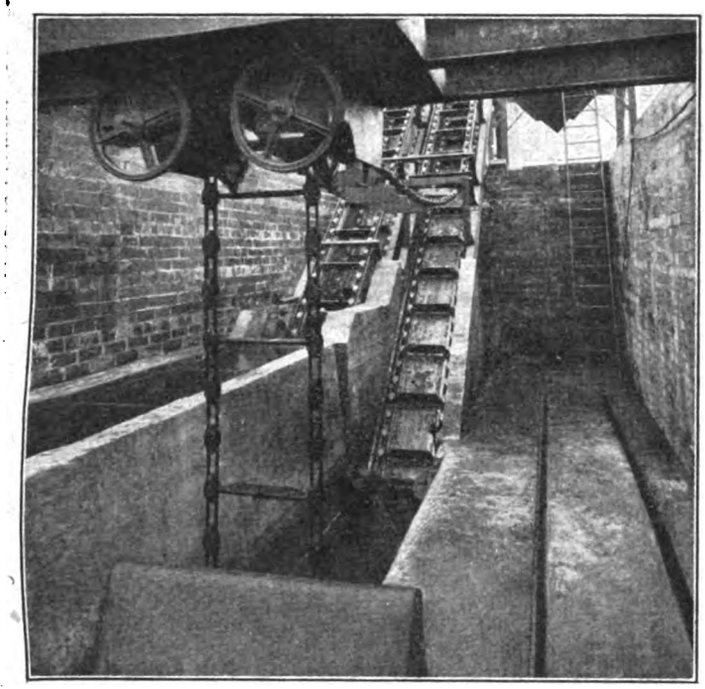

FIG. 2.—DELIVERY END OF AN UNDERFEED STOKER CO. ASH CONVEYOR.

distances and along tortuous routes, and with their use it is not necessary to break up the ashes, which is indispensable with some of the other systems; they are, therefore, most suitable where large clinkers and wet ashes are produced. The telpher track should, in such cases, pass over the ash pits and in cases of hand-fired boilers direct in front of the furnaces.

Whilst almost any conveyor can handle ashes, most types will, on account of the abrasive and corrosive nature of the material and the consequent high cost of maintenance of such plant, be economical failures. The power engineer is therefore confronted with the difficult problem of making a wise choice from the available methods.

As a general rule, it is advisable not to use a handling device of the chain type for the removal of ashes for the reasons above stated. This applies to the gravity bucket conveyor as well as to the pan and apron conveyors. Belt conveyors are quite unsuitable for handling ashes on account of their high first cost and the fact that the band will have to be replaced every six months, even if the ashes are thoroughly quenched before being fed on to the conveyor. The V-bucket elevator-conveyor has never been popular in this country; it was, at one time, in frequent use in small power houses in the United States for coal and ashes, but has of late fallen into disfavour. All disappointments in results as well as in working costs are due to the wrong application of the system and not to the principle.

Skip hoists are excellent ash handling devices because, as with telpher and grab, the ashes do not come in contact with any of the mechanical parts; these hoists generally consist of a large bucket with four wheels which runs on a steep, and more rarely on a vertical, track, and into which the ashes are fed. Steel cables and winding gear then hoist the bucket to a sufficient height for it to be automatically dumped into ash bunkers or direct into vehicles and returned for refilling. Such devices are electrically driven and controlled, and for extra large capacities they are double acting and provided with two buckets, one up and one down. Such ash hoists are fed by a system of tipping trucks, of the same capacity as the skip bucket, running on ordinary narrow gauge tracks, into which the ashes are filled from the ash hoppers.

In the foregoing, telphers and skip hoists have already been mentioned as suitable ash handling devices; both these are of the intermittent type. In the following the best continuous ash handling devices will be reviewed. These are based on the mechanical, hydraulic and pneumatic principles.

As previously observed, it is inadvisable to use such standard chain conveyors as are built for coal for the handling of ashes, but two systems have been developed in which the objections which rendered chain conveyors undesirable have been eliminated. One of these constructions is such that the ashes cannot come in contact with the conveyor chains, and the other has the chains submerged in a trough containing water, which protects the chain.

The Bennis ash conveyor belongs to the former type, and an installation of this kind has quite recently been adopted at the power house of the Roath Station of the City of Cardiff Corporation, as shown in Fig. 1. The conveyor is a modification of the U-link type, which renders it applicable to the severe duty of handling even red-hot ashes; the links of the chain, as may be seen from Fig. 4, are bent in the form of the letter U and are of mild steel. To this chain is attached a series of cast steel trays in such a manner as to form an articulated cast-steel trough 14 in. wide. The pins which join the links together are extended at each side and form trunnions on which cast iron rollers revolve, two to each tray; these rollers travel on a stationary channel steel track which extends the whole length of the conveyor and determines the path of its travel.

The driving terminal wheel, which rotates this endless trough at a speed of 27 ft. per min., is located at the delivery end and is hexagonal, measuring 20 in. across its sides. The other terminal at the tension end is cylindrical, and also 20 in. in diameter. With a conveyor of

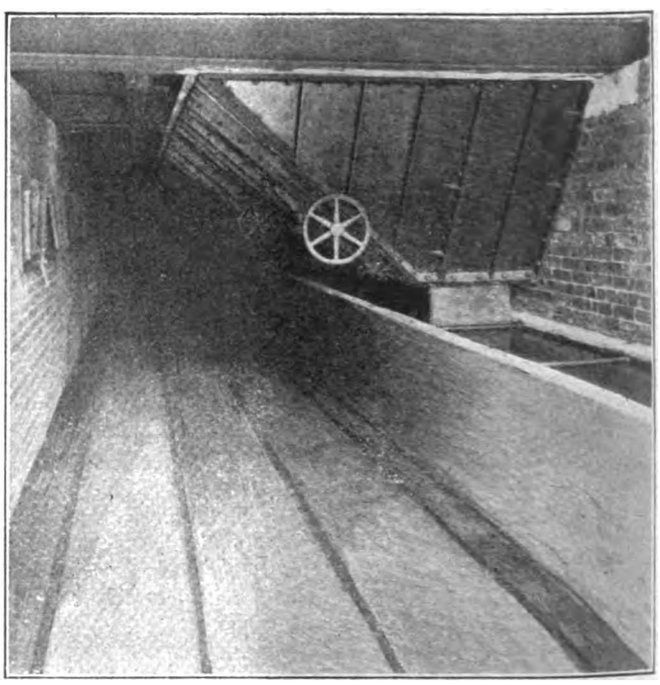

FIG. 3.—METHOD OF FEEDING AN ASH CONVEYOR. (UNDERFEED STOKER CO.).

this construction the ashes do not come in contact with the chain or the rollers supporting it, and the design of the trays is such that no ashes can be spilled where they

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are trimmed into the conveyor. It only takes an 8 H.P. motor to drive the conveyor, together with a bucket elevator, which handles the ashes at the rate of 5 tons per hour to a height of 40 ft.

The bucket elevator is of the fully enclosed type, completely of steel, and is substantially built for rough usage, and all wearing parts are easily renewable. It is provided with a screw take-up at the lower terminal. At the upper end, where the elevator passes through the boiler house wall, it has an outward bend and delivers about 18 ft. above ground level, through a hinged shoot, which can be swung out of the way when not in use. The buckets are 10 in. long, 7 in. wide and 6 in. deep. The elevator runs at a speed of 80 ft. per min.

Ash Conveyor of the Underfeed Stoker Company.

The ash conveyor of the Underfeed Stoker Co. is of the second class, in which a slow running conveyor of the push-plate type works in a trough filled with water (see Fig. 3). An important feature of this is that the conveyor is continually running and takes the ashes away as they are produced. This is always an improvement on intermittent handling, and is made possible by the water seal connection between the conveyor and the combustion chambers.

Owing to the fact that the troughs of these conveyors are deep and are kept filled with water by means of a ball cock, both runs of the chain can be accommodated therein and thus kept cool and at an approximately uniform temperature—a matter of great importance. Owing to the relatively low percentage of ashes to water, no acid is traceable in the latter. An incidental, though important, feature of this conveyor is the disintegration of hot ashes and clinkers, which is effected by dropping them from the grate and submerging them in water. By this means they are instantaneously quenched and broken up into small particles. The slow and continuous dragging of the conveyor chain along the bottom of the trough removes these small particles with less effort than would the intermittent use of such a device through an accumulation of material.

The shoot which leads the ashes into the conveyors dips into the water contained therein, forming a perfect air seal of the combustion chamber, and at the same time prevents an escape of heat or fumes into the ash tunnel. The quantity of make-up water required amounts to about 20 per cent. of the weight of the ashes handled, or say 30 gallons per ton.

The conveyor chain is composed of drop-forged links connected by steel rivets; the construction of these links is such that neither shear nor wear has to be borne by the rivets, since the bosses formed on the links take care of these, being eccentric with the rivets, and thus provide more substance for wear without undue weakening of the links. The pitch of the chain is 8½ in., and the spacing between the cast-steel scraper bars is 2 ft. 1½ in. There is thus plenty of room for the largest clinkers to pass in cases where the idle strand is uppermost in the trough. Where a portion of a conveyor is inclined for the delivery of ashes (see Fig. 2) the most suitable gradient is from 30 to 35 deg., and although a gradient of 40 deg. can be negotiated, this is not advisable, owing to the reduction in capacity, which in turn would mean greater speed of chain travel, and consequently greater wear.

The normal speed of running is from 5 to 15 ft. per min., so that the ashes arrive at their destination in a comparatively dry state.

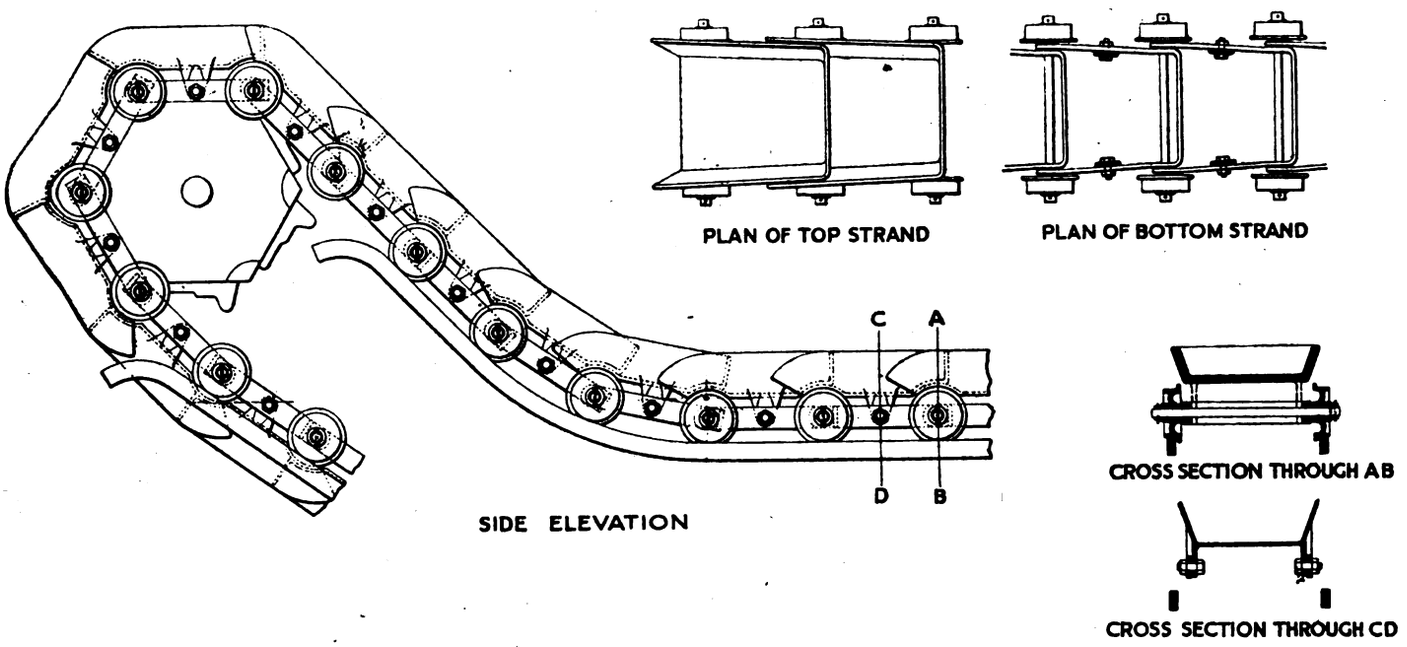

FIG. 4.—DETAILS OF THE ASH CONVEYOR AT THE ROATH STATION.

The power consumption is very low, for instance, with a conveyor of a length of 150 ft. from centre to centre, running at a speed of 10 ft. per minute, and handling ashes at the rate of 3½ tons per hour, the current consumption is 6·5 A at 220 V, or under 2 H.P.

Hydraulic ash handling plant consists of a system of flumes in which the ashes are swilled away by a rapid stream of water without the aid of mechanical devices. While this is an excellent system in all respects, it is confined to locations where the ashes can be thus swilled on to lower ground, being essentially a disposal by gravity. Unfortunately such topographical conditions are so rarely available that it cannot be of general interest to describe such plant here. This type is of the simplest nature, and where running water is available requires nothing but the provision of flumes laid at an incline of quarter of an inch per foot. Where no low lying space is available on to which the ashes can be conveyed the flume delivers into a tank from which the ashes may be pumped with a large percentage of water on to higher ground. This system is used by the Calumet and Hecla Power Station, Lake Linden, Michigan.*

* Described by C. C. Lance, in "Power," March 25th, 1922.

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The Underfeed Stoker Company have also introduced a conveying method on this principle, a typical installation of which is shown in Fig. 5. As will be seen from the illustration, the sluicing troughs pass underneath two sets of boilers and thence to one of two tanks, where the water is separated and pumped back to the sluicing troughs.

A sluicing method, pure and simple, is also in use, an inclined trough being employed, along which the water rushes, quenching and, at the same time, conveying the ashes into a concrete tank. By means of a centrifugal pump a constant flow is maintained, the water from the discharge tank passing through a strainer and being afterwards discharged in a continuous stream at the opposite end of the trough, whence it rushes, solely by gravity, back to the tank again. A grab, operated by a telpher or travelling crane, is employed for removing the ashes as they accumulate in the tank below the water. A further method might be termed the intermittent sluice, in which a trough, filled with water, which remains stationary, is employed. The ashes and clinkers fall into this trough, through which, at certain fixed intervals, water is flushed for the purpose of discharging the accumulated ashes.

Pneumatic ash handling plant is of greater importance and may be subdivided into the vacuum and the steam jet systems.

The vacuum system consists of a pipe line of hard cast-iron, which extends along the ash pits or, in the case of internally fired boilers, in front of them and under the firing floor, i.e., immediately in front of the furnaces, to an air-tight, overhead ash storage tank. A vacuum is created in the tank and a dust filter or air washer is intercepted between tank and exhauster. An air current of great velocity then passes through the pipe line and the ashes are sucked into any of the pipe inlets—one of which is in front of each boiler—and thence into the tank from which they are removed at intervals.

The advantage of the vacuum system is its great flexibility, since the pipe line can be laid in any direction. The system is, therefore, applicable to any kind of power-house, new or old. Such plant will serve the boilers for 2 500 to 3 000 H.P. for one installation, and for larger plant more units can be provided. This limitation in capacity is due to the fact that ashes can only by removed from one boiler at a time. With regard to the maintenance cost, experience shows that pipe renewals, especially at the bends, become necessary after about 7 000 tons of ashes have been removed.

Explosions have been known in the ash tank with this type of plant when ashes are not sufficiently quenched when entering the tank; these can, however, be avoided with care, though quenching water must be used sparingly to prevent blocking.

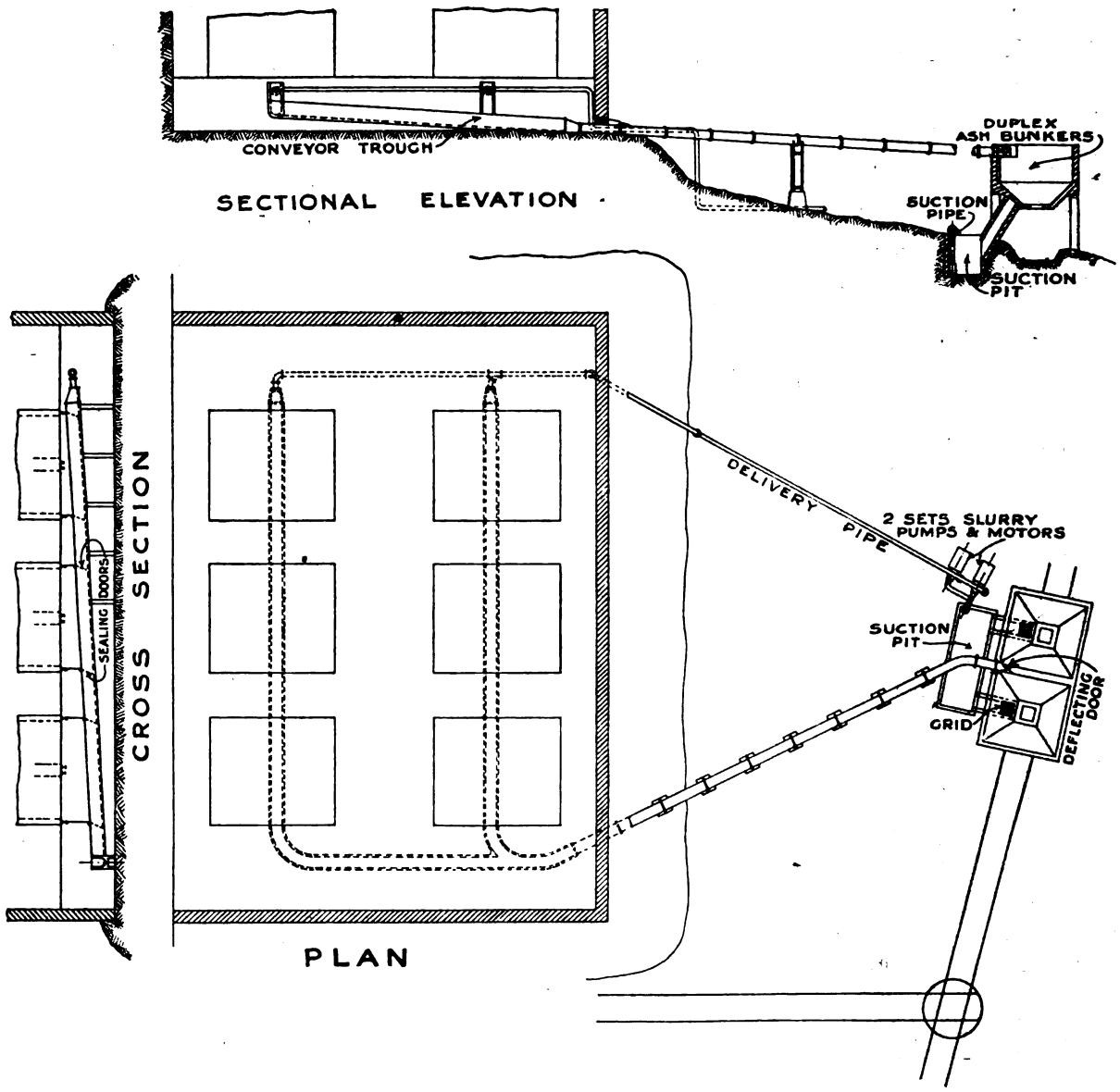

FIG. 5.—TYPICAL INSTALLATION OF HYDRAULIC ASH HANDLING PLANT.

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The steam jet system differs essentially from the vacuum system, in so far that the suction is induced by a steam jet of high velocity of not less than 80 lb. per sq. in. instead of an exhauster. An air-tight receiving tank is not necessary, and where waste space is available for an ash dump, discharge may be made direct from the end of the pipe line, and the ashes are then blown a distance of from 60 to 70 ft. If these are to be loaded into vehicles for removal an overhead open receptacle with a baffle plate is added to the equipment. It is obvious that with the jet system the effect of the jet is limited, and an additional booster jet may sometimes be necessary.

The advantages are similar to those of the vacuum system and the initial cost is less. But with the jet system some dust may escape and prove a nuisance.

An inherent disadvantage of both systems is the necessity of having to break large pieces of clinkers to enter the pipe line. This is generally met, in the former case, by a small breaker, which is mounted on rails and which runs on wheels; in the latter case the ash inlets into the pipe line are covered with a grating which excludes large pieces till broken by a hammer or rake. What has been said with regard to the capacity and maintenance of the vacuum system applies equally to the jet system. In neither case should the ashes be wetted before entering the pipe-line in order to prevent choking.

GRAIN IN BULK.

The Adaptation of a Floored Warehouse for its Reception and Storage.

By MARK JENNINGS, A.M.I.Mech.E.

Although it is true that the transportation of grain in bulk by rail and road is attractive to many mills, maltings and other users of grain who formerly relied upon river or canal craft, there are many inland mills which by virtue of their location with respect to navigable waterways can scarcely use these means of transport. Until comparatively recently canal or river traffic was made up for the most part of sack cargoes, a result of which is that the receiving warehouses of mills are, more often than otherwise, floored buildings suitable only for the storage of grain in sacks. Given the opportunity of taking the delivery of grain in bulk, it not infrequently happened that nearly all the benefit possible was lost through the absence of adequate bulk-intake and storage facilities. Sometimes, where no intake elevator existed, occasional bulk cargoes would be sacked; in other instances, bulkheads of planks or sacked grain placed from column to column upon the several floors served to convert the floors into a series of flat-bottomed bins. The disadvantages attending either method are obvious.

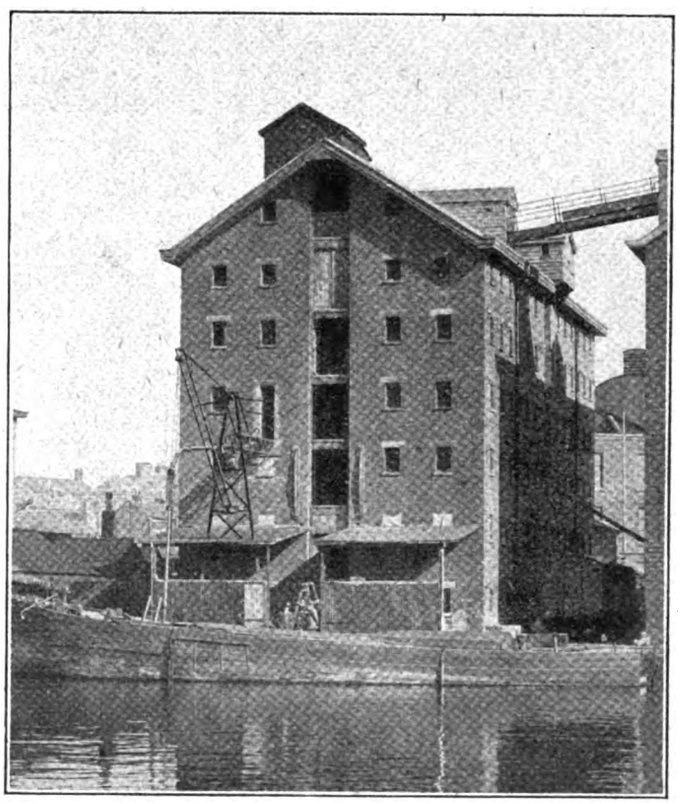

FIG. 1.—EXTERIOR VIEW OF REYNOLDS AND CO.'S GRAIN WAREHOUSE.

Two years ago J. Reynolds & Co., of Gloucester, whose warehouse accommodation was of this character, decided in favour of a change from existing methods. One of their warehouses—a substantial brick building of 3 300 sq. ft. ground area and some 50 ft. in height—was selected as being suitable for conversion. A view of this warehouse as seen from the dock is given in Fig. 1. One side only of this building has been turned into a silo and the bins—twelve in number—have been carried down to the second floor. The bins are of timber construction and as much of the existing woodwork as possible was utilised in making them. There is a total bulk capacity of about 500 tons and rather more than two-thirds of the warehouse flooring still remains intact, thus providing for such sack storage as is necessary.

Fig. 3 is a sectional elevation of the warehouse, and shows exactly how the bins are formed and the arrangement of the intake, screening and distributing machinery. The intake elevator—pneumatic system—is of twenty tons per hour capacity, a rate of working which is being closely approximated as an average. The suction pipe being only 4½ in. internal diameter is flexible and adapts itself to all classes of craft which carry grain up to the mill; all pipe adjustments being under the control of the nozzle operator.

Although the front wall of the building is of ample strength to carry a pipe boom which would span the narrow track between the building and the dock, it will be realised that the shortening of this jib makes for lightness and ease of working. There is no appreciable variation of water level so that the rise and fall of the short boom—about seven feet—gives all the vertical range of working which is ever needed. An interesting device is that by virtue of which the pipe—where it passes through the mast—can be slewed through an angle of 180 deg. in plan and an angle of about 60 deg. in elevation. This flexible portion, which is of metallic interlocked construction, is constrained to move so that it always forms a perfect arc of a circle of angular measurement corresponding to that at which the boom stands with respect to a line normal to the dockside. This condition is brought about by the compensating cradle which has a motion approximating that of an ellipse. The sliding rollers of this cradle are Hoffmann ball bearings. The foot and head brackets of the jib—the latter also ball bearing—are set so as to give a slight locking motion when the pipe is housed. The block-tackle is of enclosed geared type and is carried at the head of the jib, whose compression member is composed of two steel tubes between which the transporting pipe is free to move. Access to all these moving parts is afforded by a hand-railed bridge, the entrance to which is a door upon the third floor of the warehouse. Fig. 2 shows a close-up view of all the apparatus which has just been described, and the construction of the jib will be noticed in Fig. 1.

The series of photographs, Fig. 4, taken as nearly as possible from a common point upon the ground, first, second, third, and sixth floors, illustrates some of the receiving and distributing machinery. The grain transporting pipe will be seen sloping upwards and entering the receiving vessel, beneath which vessel there is fixed a rotatory grain discharger. In the background will be noticed the dust filters of which there are two. These are connected in parallel by horizontal air trunking at their inlets and outlets respectively. The dust-laden air entering these filters must pass through fabric sleeves before it can leave by the lower trunk and is thus purified of the dust which it contains as it leaves the receiving vessel. A full-way valve is interposed at the inlet and outlet of each

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filter and by the shutting of these valves either filter can be isolated from the vacuum circuit so that the cleansing of the sleeves of dust may be the more effectively performed than would be possible if it were attempted whilst air is passing through the fabric. This cleansing is effected by a lever which is pulled down against the resistance of a spring and released so that the sleeve-holder plate within the filter is jarred.

On the floor below will be seen the sacking-off outlets of these vessels, together with the "Avery" automatic scale, into the weighing hopper of which the grain is discharged from the receiving vessel on the floor above. The framework which carries this scale contains a hopper whence the grain flows to the warehouse separator upon the first floor. This separator removes all foreign substances and also takes out a certain quantity of heavier dust which does not get carried over to the filters of the pneumatic elevator.

The grain delivered from this screen is carried to the top floor of the warehouse by an elevator of the bucket type, the legs of which will be seen in the same position, more or less, upon the several views in the illustration. The head of this elevator commands the two bins immediately adjacent to it and delivery of grain to any of the remaining bins is effected by a belt conveyor equipped with a travelling throw-off carriage. The uppermost picture of the composite figure shows this conveyor and in the foreground the reader will notice the double-action rope hoist which formerly constituted the intake equipment.

In the bottom picture will be seen the pump which maintains the flow of air in the suction elevator: a detailed description of this machine was given by the writer in an article published in THE ELECTRICIAN, Vol. 86, p. 26, December, 1920, but the vacuum here is much in excess of that which was shown upon the indicator diagram then reproduced. An average of 31 cm.—just over twelve inches of mercury—is productive of an intake of 21 to 24 tons per hour, and the estimated power consumption at the flywheel is 23 B.H.P. The transmission facilities are such that the entire plant is driven more or less directly from a main shaft to which power is supplied by a 35 B.H.P. shunt wound motor. The electrical control gear comprises a heavy duty slow motion starter.

A test to determine the total power consumption and efficiency of the plant was made shortly after the installation had been set to work. A barge containing 110 tons was unloaded without stoppage of any kind, other than shifting of the nozzle to the fore-hold, at an average rate of almost exactly 18 tons per hour: the highest recorded capacity during the test was 22·75 tons per hour.

In addition to the screening and distributing machinery the lower band conveyor and second bucket elevator were

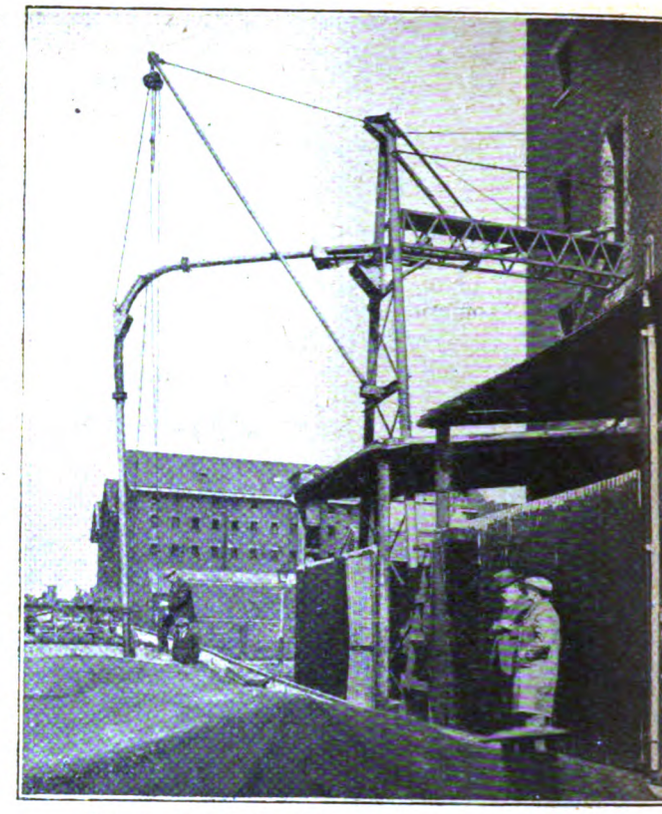

FIG. 2.—EXTERIOR VIEW OF PNEUMATIC ELEVATOR.

kept working, and the six hours odd minutes of running accounted for 180 kWh being consumed, an average input of rather less than 40 B.H.P. The stated efficiency of the motor at full load is 88 per cent., which gives an average developed power of 35 B.H.P. Of this it is estimated that the suction elevator accounts for 21 B.H.P., the remainder being absorbed by the transmission, separator and distributing machinery. The running costs—labour and power—have been carefully ascertained and upon a year's working are 4½d. per ton of grain handled.

The overhead charges are at the moment approximately 6d. per ton; this allows for complete amortization in a reasonable time. In regard both to yearly rate of intake and warehouse accommodation—for only one side of the

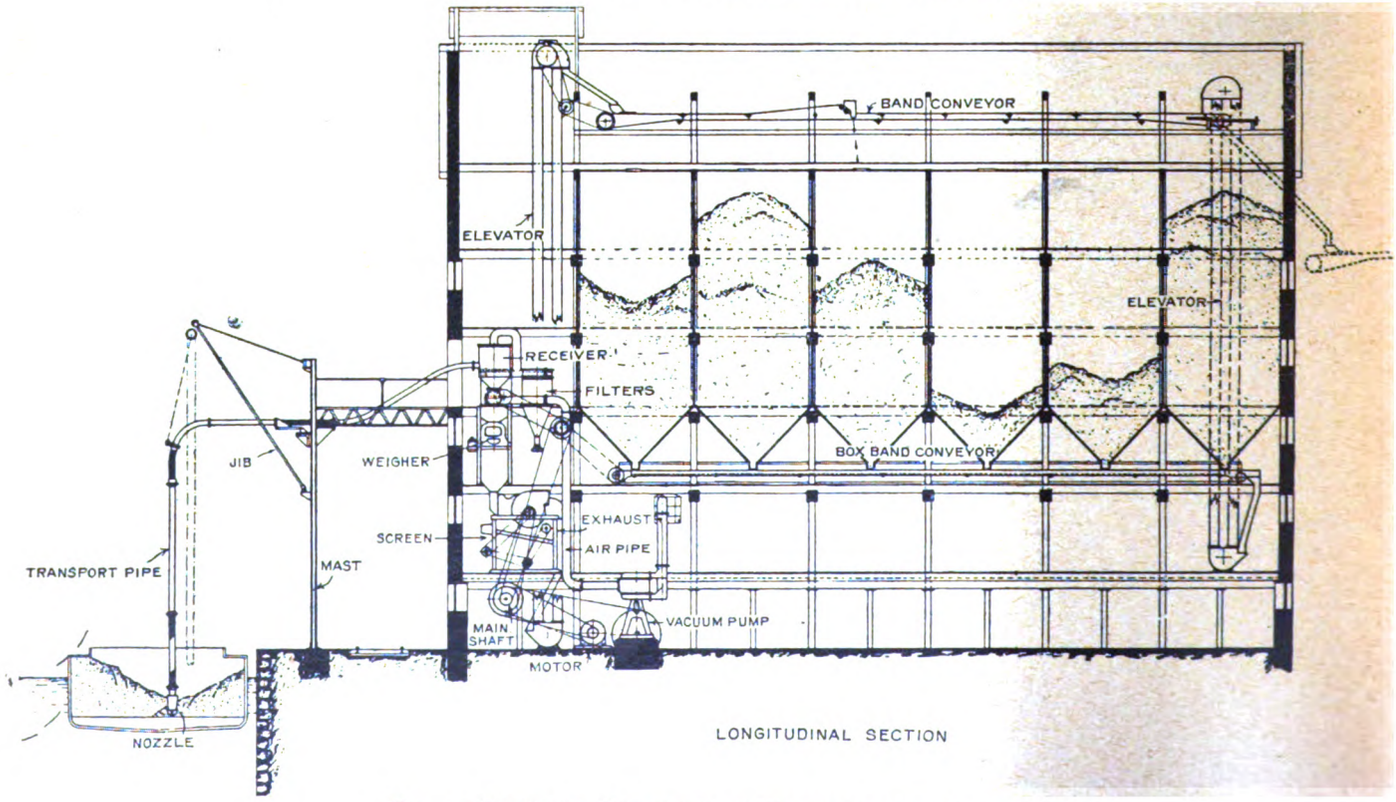

FIG. 3.—SECTIONAL ELEVATION OF WAREHOUSE AND PLANT.

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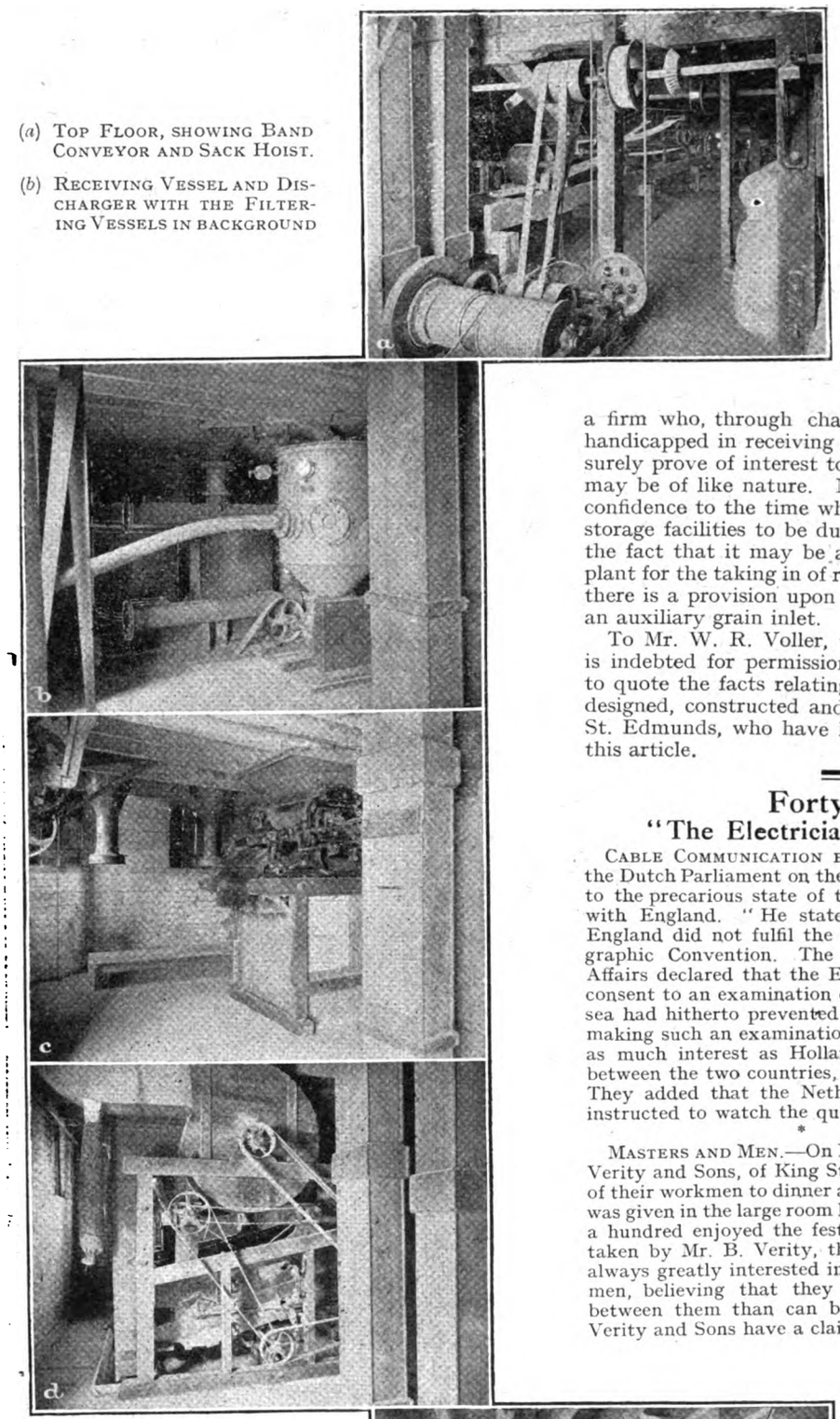

(*a*) Top Floor, showing Band Conveyor and Sack Hoist.

(*b*) Receiving Vessel and Discharger with the Filtering Vessels in background

(*c*) Automatic Scales and Dust Outlets.

(*d*) The Warehouse Separator

(*e*) View of the Pump-room, showing Motor.

Fig. 4.—Views of Several Floors in Reynolds and Co.'s Grain Warehouse.

building has been converted into bins—there is an ample reserve, so that the expansion of business will automatically bring about a reduction of this overhead charge unaccompanied by any necessity of additional capital expenditure. Furthermore, due perhaps in some degree to this low plant factor, the maintenance expenses upon two year's working are far below those which have been allowed in making up the above charge.

This brief survey of courageous enterprise on the part of a firm who, through changing conditions found themselves handicapped in receiving and storing their raw material, will surely prove of interest to those whose present circumstances may be of like nature. Messrs. Reynolds look forward with confidence to the time when it will be necessary for the bulk storage facilities to be duplicated. They are also mindful of the fact that it may be advantageous one day to adapt the plant for the taking in of road-borne grain, for which extension there is a provision upon the receiving vessel in the shape of an auxiliary grain inlet.

To Mr. W. R. Voller, their managing director, the writer is indebted for permission to make these remarks, and also to quote the facts relating to working costs. The plant was designed, constructed and erected by Robert Boby, of Bury St. Edmunds, who have kindly supplied the illustrations for this article.

Forty Years Ago.

"The Electrician," December 29th, 1883.

Cable Communication between Holland and England.—In the Dutch Parliament on the 22nd inst., M. Wintgens drew attention to the precarious state of the submarine cable connecting Holland with England. "He stated," says a Reuter's telegram, "that England did not fulfil the duties imposed upon her by the Telegraphic Convention. The Ministers of Commerce and Foreign Affairs declared that the English Government had not refused to consent to an examination of the cable, but that the state of the sea had hitherto prevented the vessel of the Submarine Company making such an examination. They stated that England had just as much interest as Holland in preserving good communication between the two countries, and would not lose sight of her duties. They added that the Netherlands Minister in London had been instructed to watch the question."

* * *

Masters and Men.—On Monday last, December 24th, the firm of Verity and Sons, of King Street, Covent Garden, invited the whole of their workmen to dinner at the Holborn Restaurant. The dinner was given in the large room known as the Venetian Room, and about a hundred enjoyed the festivities of the evening. The chair was taken by Mr. B. Verity, the senior partner of the firm. We are always greatly interested in these social gatherings of masters and men, believing that they do more to establish cordial relations between them than can be effected in any other way. Messrs. Verity and Sons have a claim upon those interested in the progress of the electric light, inasmuch as being interested in the manufacture of gas and similar fittings, they saw that the electric light, instead of diminishing the class of work in which they had embarked their capital, would increase the demand, and they did not hesitate in its very early days to throw their energies and experience into the designing and making of electric light fittings. The great success they have achieved in this new branch of work will, we hope, be fully endorsed by those who see the result at such places as the Holborn Restaurant, Gatti's, etc. The most cordial relations exist between the heads of the firm and the employees, and there is no doubt, where it is the case that such mutual confidence exists, it adds greatly to the success of the firm in whatever work it undertakes. The dinner was well served, and was a credit even to such a gigantic restaurant as the Holborn, where, we understand, on the average about 1 400 people dine daily.

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COAL HANDLING AT EASTBOURNE.

By E. G. F.

In connection with the recent large extension to the boiler plant at the Eastbourne Corporation electricity works the question of providing an economical method of handling the greater volume of coal required became of great importance. Before the extension the practice was to tip the coal from lorries and carts into the pit of an elevator, whence it was drawn by bucket and scraper conveyors and discharged into a large ferro-concrete bunker from which the boilers were supplied. It was realised that the first essential in

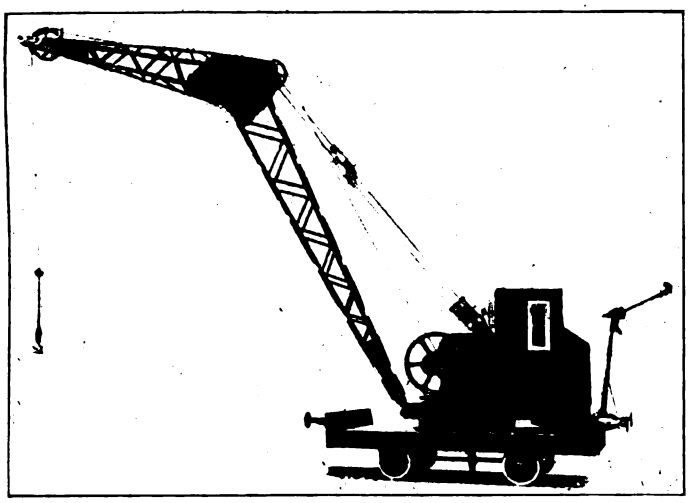

FIG. 1.—GENERAL VIEW OF THE NEW LOCOMOTIVE CRANE AT THE EASTBOURNE ELECTRICITY WORKS.

handling the increased tonnage was the provision of a railway siding into the works, and this will in due eourse be available and will simplify matters considerably.

To transfer the contents of the coal trucks to the elevated steel bunkers supplying the new boilers two methods were considered by the chief engineer, Mr. J. K. Brydges: a suction conveyor plant and an electric locomotive crane fitted with a grab.

It soon became apparent that, apart from the considerably lower prime cost of the crane outfit, it offered other advantages which ultimately led to its selection, these may be briefly stated as follows:—Its ability to shunt and marshal trucks; to transfer the coal direct from the truck to the hopper; and to handle ashes and clinker as well as coal without any modification in the machine itself; its availability when fitted with an ordinary crane hook for many lifting purposes in connection with installation and maintenance work; its high efficiency per foot-ton handled; and the possibility

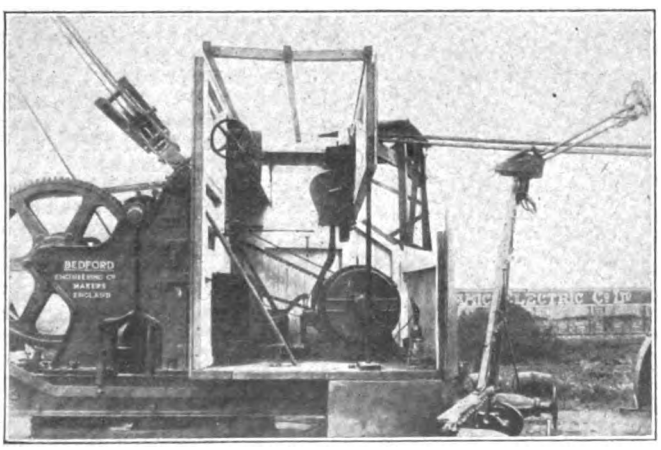

FIG. 2.—A VIEW OF THE OPERATING CABIN.

of employing it as a stand-by to the existing elevator and scraper conveyors, should these break down or require overhaul.

It will be obvious that while a suction conveyor is a fixed mechanism and confined to a single function, a crane is a mobile machine adaptable to many services. The design of the crane in this application was influenced to some extent by the small amount of space available for manœuvring, and this is the explanation of the peculiar shape of the driver's cabin and the short tail radius.

Referring to the illustrations, Fig. 1 gives a general idea of the appearance of the crane which is here shown fitted with a bent short jib, such as is used when it is employed in loading the old ferro-concrete coal bunker. Fig. 2 is a closer view of the cabin, which has been partially dismantled to obtain the photograph. This illustration shows the 25 B.H.P. "Parkinson" single-phase commutator motor fitted for driving the crane and the "Westinghouse Morse" rocker joint silent drive chain which connects the motor pinion to the clutch shaft from which all the motions of the crane are derived. Above the motor is seen the totally enclosed circuit breaker with no-volt and overload release, the latter being fitted with time lag. This panel is further fitted with a pilot lamp and hand lamp with flexible cord. Immediately facing the driver is shown the tramway-type controller with hand wheel, whilst all the controlling levers of the crane are seen to be conveniently grouped within easy reach of the driver in his working position. The main hoisting brake is operated by

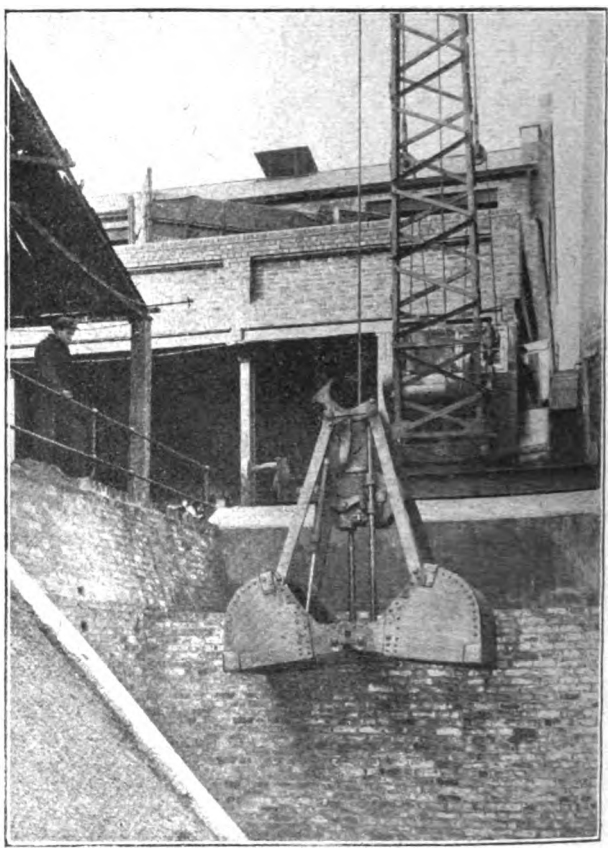

FIG. 3.—GRAB BEING LOWERED INTO ASHPIT. THE ASHES ARE DUMPED INTO LORRY, SEEN ON ELEVATED ROADWAY, TO REFUSE DESTRUCTOR WORKS.

a treadle at his left foot, whilst a light checking brake operated by a pedal is fitted to the motor and is found very convenient in use.

It will be seen from Fig. 1 that the under-carriage of the crane is extended and fitted with spring buffers and draw-hooks, and on these the crane can exert a tractive effort of about 3 000 lb. when on the straight and level track. Fixed to one of the head stocks of the carriage is a short standard supporting two trolley poles which pick up current from bare trolley wires supported on tramway ears and insulators. The nominal capacity of the crane is 2 tons lifted at 24 ft. radius whilst standing free on 4 ft. 8½ in. gauge. The working speeds with a load of 2 tons when operated upon 200 V, 50 cycle, single-phase current supply are:—Hoisting, 120 ft. per min.; slewing, 35 revs. per min.; travelling, 350 ft. per min. The crane will also hoist loads up to 3 tons at a shorter radius.

Fig. 3 gives a good view of the "Barnard" Patent No. 3

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single rope grab fitted to this crane. This grab will operate either in conjunction with a suspension ring for discharging or as a self dumping grab opened by resting, or, further, it can be opened by operating a lever. All these varied methods of working can be put into operation as required without a change of any sort in the crane or grab. The grab is fitted with a dashpot to regulate the speed of opening, and there is consequently no need to raise much dust in handling coal if the grab is intelligently worked.

Fig. 3 also shows the grab descending into a brick-lined pit alongside the boiler house into which clinkers and ashes are delivered, and the grab loads these and discharges them into motor lorries, one of which is shown on the elevated road immediately behind the crane. This road leads to the adjacent refuse destructor works of the Corporation. Later

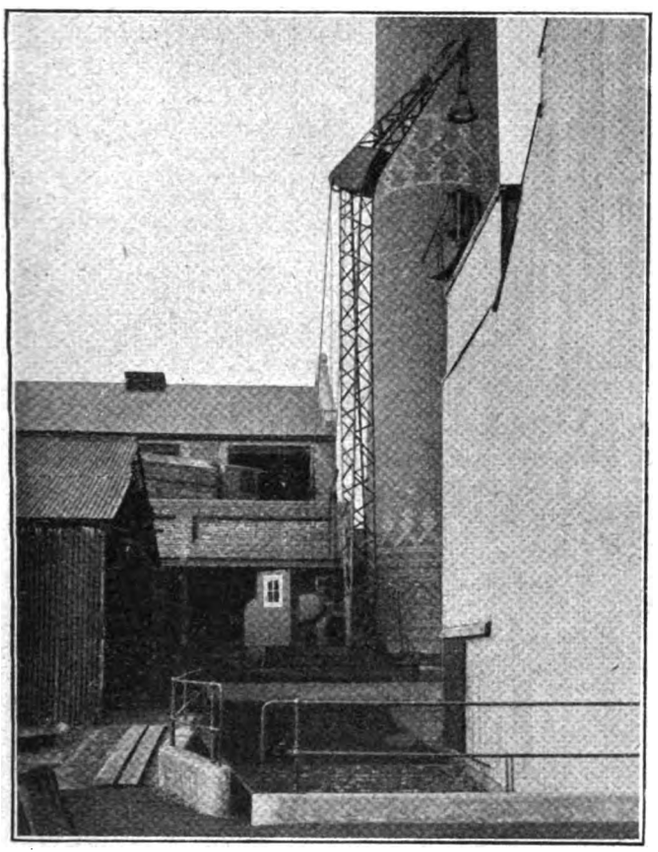


FIG. 4.—BEDFORD CRANE AND GRAB LOADING 100 TON OVERHEAD BUNKER FROM COAL PIT SEEN AT BOTTOM.

on, when the siding to the Electricity Works is completed, it will be possible to deliver clinkers direct into railway trucks if desired.

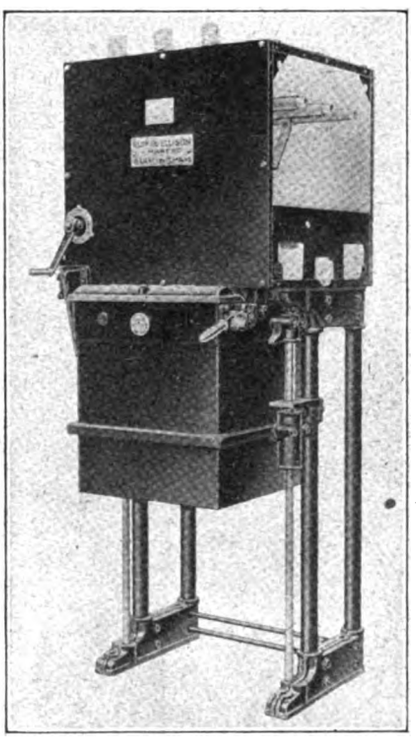
Fig. 4 shows that the grab when full is hoisted and discharges direct into the overhead steel bunkers serving the boilers shown on the right of Fig. 4. It will be noted that the small space occupied by the crane on the already restricted area has to be kept clear for other traffic. By this equipment 20 tons per hour can be bunkered by one man, with an energy consumption of 0·34 kWh per ton.

In conclusion it will be apparent that as compared with a fixed conveying plant of the mechanical or suction type the outstanding advantages of the electric locomotive crane outfit, in addition to its economy in speed of operation, are instant readiness for work, flexibility and adaptability. Further, the capital charges are lower, and there are, of course, no stand-by charges, whilst the construction of the crane itself, based upon many years' successful steam crane practice, reduces the outlay on repair and the possibility of break-down to a negligible amount. The mechanical or suction conveyors, in spite of their advantages, are of necessity single purpose machines. Should they be displaced owing to the increase in the duty demanded, or for other reasons, they have no appreciable market value, whereas the electric locomotive crane is emphatically a standard appliance, and as such finds a ready market should it be desirable at any time to replace it by a larger crane or by other methods.

A COMPACT OIL BREAKER.

Floor space being an important factor in sub-station design, it is interesting to come across a piece of switchgear whose arrangement has been definitely influenced by that requirement. For instance, in Geo. Ellison's new hand-operated 6 600 V oil breaker, which has been supplied to the Northfields sub-station of the Birmingham Corporation, and of which we give an illustration herewith, the breaker is made to be lowered instead of drawn out, the arrangement being that the first movement of the handle causes both tank and breaker to be lowered a sufficient distance for the sockets to be withdrawn from the plugs and operate the slide covering parts, after which it comes to rest on projections on the stands, the tank being then lowered alone until it rests on the floor.

The breaker, which has a maximum capacity of 250 A, is operated by a handle both in opening and closing which is interlocked with the lowering mechanism, and can be provided or not with the usual overload and trip coils depending on the purpose for which it is required. The busbar insulators are porcelain cylinders which are fitted with a grooved recess to take the fixing bolt and clamp, these latter being secured in



VIEW OF 6 600 OIL BREAKER FOR BIRMINGHAM CORPORATION SUB-STATION.

the recesses by a lead alloy. The busbars are round copper rods enclosed in reinforced synthetic resin tubes, and the clamps and strip connections are taped over to prevent flashovers, while where the bars pass from one chamber to another reinforced synthetic resin sheets are provided for the same reason. The isolating plugs consist of hollow porcelain insulators into which copper rods are fixed by synthetic resin. The upper portion of the switch containing the busbar and isolating chambers is made up of boiler plate and angle iron. To it is bolted the lowering mechanism which is interlocked by means of a rod with the breaker handle shaft.

The operating mechanism consists of a cross head carrying the contact rods, and sliding-in vertical guides is used instead of the ordinary link motion. Motion is arrested by levers in the operating mechanism entering vee-shaped buffer springs with leather pads in the base. The overload plungers act on a trip rod, releasing a similar catch. The fixed contacts are laminated copper brushes, and the moving contact is a copper bar to the other end of which the driving rod is secured.

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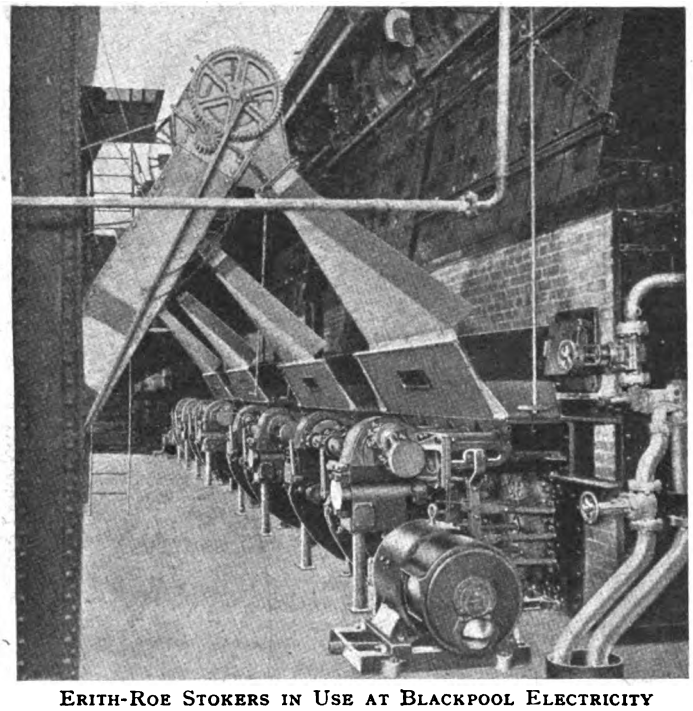
FURNACE EFFICIENCY.

The Effect of Mechanical Firing on its Attainment.

One of the chief necessities of modern power plant installations is an efficiency in firing methods which only a few years ago would have been considered impossible of attainment. Fortunately, the progress of mechanical firing is keeping pace with the demand, and amongst the developments in this direction during the last few years the Erith-Roe multiple retort underfeed stoker (manufactured by Erith's Engineering Co.), is causing widespread interest.

In our issue of October 5th, 1923, p. 368, we dealt with the latest extensions at the Blackpool Electricity Works, and referred to the pioneer work that had been accomplished at that station. Under the regime of the present borough electrical engineer, Mr. Charles Furness, it is interesting to note that Blackpool was also the first station to order Erith-Roe stokers, and two large British Niclausse water tube boilers with Erith-Roe stokers were the beginning of the extensions started and are shown in the photograph below. This installation has been in service for some time past, and a further Erith-Roe stoker was subsequently ordered for the third boiler and is now erected, while the fourth boiler recently ordered from the Vickers-Spearing Boiler Co. will be of larger capacity and will also have an Erith-Roe stoker.

Most of our readers will be aware that the London County Council now have three large Erith-Roe stokers in regular



ERITH-ROE STOKERS IN USE AT BLACKPOOL ELECTRICITY WORKS.

service under Clayton boilers at their Greenwich Power Station. This installation has created considerable comment, owing to the high efficiency attained by the combination in everyday use and to the ease and simplicity which characterise the operation of the stokers. This important station is well worth a visit by all engineers who are interested in the problems of combustion, as it affords evidence of the important progress that has been made by this latest development of the multiple retort, underfeed firing method. The results obtained in sustained commercial working at high duties with these Erith-Roe stokers have, it is claimed, proved them to be ideal for the big power plant, as high efficiency in everyday working naturally involves large annual savings.

Engineers in charge of industrial plants are undoubtedly alive to the fact that large economies can be effected in the working of their equipment by adopting water tube boilers with a firing method which, without calling for too high an order of intelligence in operation, will produce the best results with the minimum of attention. These results are possible by using the extremely simple adjustments controlling the moving parts of the furnace adopted in the Erith-Roe stoker. The stoker consists essentially of a series of retorts, the side walls of which are stationary. Superimposed on them are tuyeres through which air under pressure is evenly distributed throughout the fuel-bed. Between adjoining retorts are stepped hollow slicing bars, which are capable of being reciprocated, in the risers of which air ports are located, distributing air under pressure. Each retort contains a moving stepped pusher, by which means coal is positively fed down the retorts. Coal is fed into the retorts by reciprocating rams in the usual way. On emerging from the retorts the coal flows over moving extension grates which extend across the whole width of the furnace, so that it is finally fed on to a stationary dump, over which the ashes are continuously discharged into the ash-pit.

The combined effect of these several moving parts is not only to feed the fuel down the grate, but to give the controlled slicing and shearing movements best suited to the coal, so that it is kept open and porous in order that a suitable distribution of air may be obtained for the most efficient combustion and for thoroughly burning out the fuel. Owing to the fact that each moving part is capable of independent adjustment it is claimed that a greater control is obtained over the fuel-bed than by any other firing method, and it is interesting to note that when working at the highest efficiency each moving part has a different length of stroke.

No arches being used with the Erith-Roe stoker, full benefit is taken of the radiant heat, which, of course, forms a large proportion of the total available heat in combustion. It is instantaneously transferred to the water in the boiler tubes, and whilst ensuring the highest possible total heat transfer, keeps the furnace temperature within reasonable limits, prolonging the life of the furnace walls whilst enabling the escaping gases to be cooled to a lower temperature.

The success of the Erith-Roe design is demonstrated not only by the installations already at work but by the number of repeat orders received and orders in hand; and the further progress of this method of firing will be watched with much interest.

CORRESPONDENCE.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

INSULATION FAILURE.

[TO THE EDITOR.]

SIR,—Mr. Fernie's difficulty would be apparent even if he omitted the opening sentence of his letter published in your issue of last week. The reason for his difficulty is equally apparent. I cannot help thinking that to some extent there is a playful desire to confuse the issue for the sheer joy of argument, but in case Mr. Fernie's difficulty is genuine, may I recapitulate.

I have seen many times in the insulator which constitutes the main dielectric, the pinhole punctures to which Mr. Fernie refers, but have never discovered any trace of these having been due to the *electrical* failure of the main dielectric *itself*. These pinholes, partial punctures, or whatever Mr. Fernie may care to call them, are the physical consequences of other phenomena. To be precise, when the surrounding dielectric (either gaseous or liquid) fails, the failure takes the form of small arcs which damage the main dielectric. These failures can be eliminated even with commercial insulating materials by proper engineering and correct design.

I would assure Mr. Fernie that I have not the slightest intention of entering into the discussions which he periodically raises. It is necessary, however, to expose this pinhole fallacy, as a quotation from Shakespeare is poor recompense to those electricity users who meet with serious trouble and expense due to pinholes, irrespective of their cause.—I am, etc.

A. COLLINS.

Under the title, "The Fortieth Milestone," the Western Electric Co. has issued an extremely well-printed record of what the company has done during forty years in telephony, both manual and automatic, multiplex printing telegraphy, simultaneous telephony and telegraphy, cable development, repeaters for telephone lines and wireless reception and transmission. The publication has been prepared primarily as a souvenir for presentation to every employee in the company's service.

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THE ROPE.

Its Use in Mechanical Handling Machinery.

By T. E. DODDS, B.Sc., A.M.I.C.E.

Wire ropes are now employed under a variety of conditions and the work demanded from each differs to a wide extent. It is therefore essential that the construction of the rope be selected so that the correct flexibility and best wearing qualities are obtained for the working conditions in addition to providing an adequate factor of safety.

The factors contributing to the destruction of wire ropes are external friction on pulleys, internal friction, compression of the wires on each other, and fatigue of the steel caused by working the rope over too small pulleys. To prevent the rapid deterioration of ropes working over crane barrels and pulley blocks, the ratio of pulley, rope and individual wire diameter recommended by the rope makers must be maintained; preferably the pulley and barrel diameters should be 15 to 25 per cent. larger than the specified minimum.

Prevention of Corrosion.

The selection of the best type of wire rope for use in mechanical handling machinery to give the greatest economy under working conditions is a highly technical matter, and is largely a question of experience. The ratio of the pulley diameter to that of the wire should not be less than 1 000. The wire diameter should not vary more than 0·001 in. Ropes of medium flexibility are preferable for winding ropes; or if the ratio of pulley diameter to the rope diameter is 30, the lowest flexibility should be employed. Reverse, or S, bends should as far as possible be avoided, as the effect of these is to accelerate the deterioration of the rope due to fatigue.

The prevention of corrosion requires careful consideration and adequate lubrication should be provided. Serious accidents have been caused as a result of the internal corrosion of ropes. In wet workings or damp surroundings a rope should be inspected periodically for internal corrosion. Galvanising the individual wires is valuable in preventing internal corrosion. On the other hand, galvanising reduces the tensile strength of the wires by 8 to 10 per cent. The wires have consequently to be drawn to a correspondingly higher stress resulting in a sacrifice of ductility; the galvanising process also reduces the toughness. Galvanising reduces the torsion of a wire by about 15 per cent. and the capacity to resist bending by 20 per cent.; the elongation is doubled. All fixed ropes should be galvanised, but this does not include Blondin ropes, which are really working ropes. Ropes, whether galvanised or plain, should be frequently greased; this reduces internal and external friction as well as preventing corrosion. A lubricant, free from fatty acids, and of a consistency which will allow it to penetrate to the internal wires of the rope and at the same time to adhere firmly to its exterior surface, should be used. The condition of the external wires is no criterion of that of the internal wires; it is therefore most essential that the lubricant penetrate to the core of the rope, and to obtain this effect the lubricant should be applied frequently.

Question of Durability.

The durability of a rope depends on the correct disposition of the drums, sheaves and pulleys; if avoidable, no portion of the rope should move over more than one pulley. Loads must not be applied suddenly, or overstrain will occur. A factor of safety of 10 should be employed for hoists, elevators, etc., carrying men constantly. For large winding ropes a factor of safety of 8; for medium and small sizes a factor of safety of 10 is preferable; for crane ropes a factor of safety of 7. The gross load includes the weight of the maximum length of suspended cable; for haulage ropes due allowance for the incline and friction must be made in computing the maximum load coming on the rope.

The life of ropes working over pulleys also depends on the lay of the wires in the strands and of the strands in the rope; suitable ratios are 2·75 and 7·5 times the diameter of the rope. The lay reduces the aggregate breaking stress of the individual wires by from 5 to 15 per cent. Haulage ropes of a 6/7 construction in round strand or 6/8 construction in flattened strand have their aggregate breaking stresses reduced by 5 to 7½ per cent. A deduction of 12½ to 15 per cent. should be made from the aggregate strength of winding, crab, and crane ropes, etc., in compound constructions of either standard round or flattened strand. The grooves of pulleys should be lined with leather except for heavy ropes and high tensions. Wood pulleys increase the life of a rope. One third of the rope circumference should bear on the groove. The bending stress caused when a rope passes over a pulley is $\frac{E\,d\cos^2\alpha\cos^2\beta}{D}$, where E = Young's modulus of elasticity, d = the diameter of an individual wire, D = pulley diameter, α = angular pitch of the wires in the strand, and β = that of the strands in the rope. The bending stress is added to the tension due to the load. The bending stress causes the total stress to fluctuate. Pulleys should be as light as consistent with strength. If pulleys are too heavy, there is considerable friction on the rope during starting and stopping operations; as owing to the inertia of the pulley the rope slips on starting and the pulley overruns on stopping. Drums should be grooved spirally to receive the rope and so avoid contact of the laps. In cases where the rope rides over other layers on a drum a wire core should be used instead of one of hemp; as the compression on a rope with a hemp core, permanently destroys the shape of the section of the rope.

The modulus of elasticity of ropes should be tested periodically; if it diminishes, the rope is unsafe. Lang's lay should be used for shafts where the cage is guided; a greater area of contact and increased flexibility are thus obtained. Locked coil ropes do not spin but are practically solid and are not flexible enough for small pulleys, the wire of which has not a high tensile strength, usually 90 tons per sq. in. As the cage approaches the top of the shaft, the portion of the rope which has passed over the drum unlays; a tightening, twisting movement accumulates in the portion between the drum and the cage, and causes excessive compression on the centre core. A swivel should not be used at the end of a winding rope; it tends to produce a permanent alteration of the lay of the rope, and for this reason is detrimental. Winding ropes should be recapped at periods varying from three to six months, according to the speed and load. The portion of the rope near the cage is overstrained from the above cause and with continued working becomes fatigued; a length of at least half the circumference of the head-gear pulley should be cut off.

Value of Aerial Ropeways.

In broken and mountainous countries where the construction of railways and roads would be too costly to construct and operate, aerial ropeways are of great value for transporting almost every kind of material. An aerial ropeway has a small initial cost; and if carefully constructed and operated, the cost of maintenance and operating will also be low. There are several systems. The single or endless running rope system has a very low maintenance cost: it is suitable for a carrying capacity up to 80 tons per hour over ground involving moderately steep gradients. The double rope system is suitable for transporting heavy loads on steep gradients. The loads and skips run on heavy carrying or rail ropes and are drawn along by a light endless moving rope. The carrying or rail ropes should be of locked coil construction, as a greater external wearing surface is presented. Loads up to two tons each are carried by this system; the haulage speed of the skips along the rope varies from three to five miles per hour. Cableways, or "Blondins," are ropeways of one span; they are very useful for handling material at any point between two terminals. A strong cable spans the distance between the terminal towers which should be of the same height. A carriage fitted with hoisting and travelling gear allows of the handling of material at any point. Blondins are used extensively for quarrying, excavations, constructions of masonry, dams and viaducts, and ships. The carrying cable is anchored at each end and should be of locked coil construction.

Wire rope chutes are the most economical and expeditious form of transport; they are simple and cheap to erect and operate. A wire rope or strand is stretched from an elevated loading point to the unloading point. Chutes work by gravity, and effect a considerable economy of labour. They are particularly valuable for transporting produce across ravines and precipitous country. Chutes are constructed of a few hundred feet in length up to 1½ miles. Individual loads are usually of 100 lb. The ropes for chutes should have a higher breaking load per unit weight than for ordinary ropes. In the aerial gravitating rope, the descending loads are utilised for hauling up the empty carriers.

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"PHONOFILMS."*

Details of Dr. Lee de Forest's Talking Pictures.

By C. F. ELWELL.

The "phonofilm," developed by Dr. Lee de Forest, was made possible by the three electrode valve. Attempts to record sound vibration phtographically are not new. Ruhmer in 1906–7 obtained crude photographic records of telephonic currents superimposed on the direct current of an arc, and producing fluctuations in light that could be registered photographically. Dr. de Forest himself suggested this application of the three-electrode valve in 1911, but it was only seven years afterwards that he was able to develop the device.

A properly synchronised talking moving picture involves frequencies of 600 to 2 000 per sec. for voices and good articulation, and 27 to over 4 000 for music. It is also necessary to put both sound and picture records on the same standard film. This is done by recording sound in the blank space usually left between holes left in the film for driving it and the picture. The band record is only 2 mm. wide. The width or amplitude does not vary and sounds are produced by the alteration in density.

The first essential is the telephone transmitter, which must be sensitive and as distortionless as possible. The ideal would be a transmitter without a diaphragm. Flames have been used, and have given very good fidelity of reproduction. Platinum wires heated to dull red by a current may also serve as transmitters, the sound causing an alteration in the resistance. By means of a local battery and telephone transformer faithful reproductions at frequencies as high as 3 000 per sec. may be obtained. The resulting currents are naturally extremely small, but may be amplified by means of the 3–313c-trode valve.

Having transformed sound waves into electric current, these currents must be transformed into light. The method used by Dr. de Forest is to pass the amplified current through a gasfilled two-electrode valve—the "photion." The "photion" emits light of high actinic value and its intensity increases or decreases in exact correspondence with the changes in current. The "photion" is mounted (see Fig. 1)

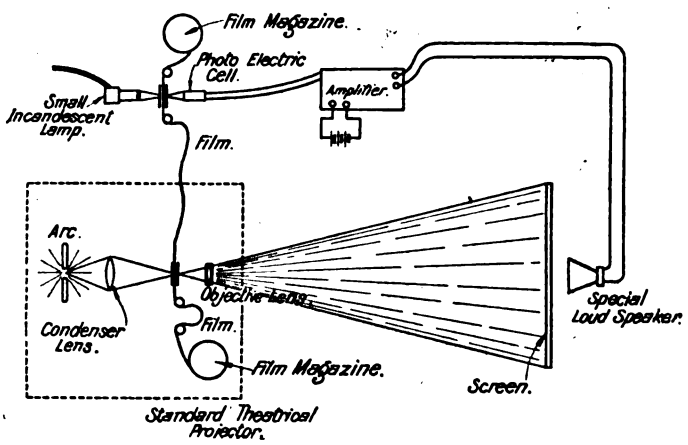

FIG. 1.—ARRANGEMENT OF THE "PHOTION" USED IN THE "PHONOFILM" SYSTEM.

near the point where the film is moving continuously in the case—i.e., about 10 in. from the window of the camera. The light from the "photion" lamp is focussed by a lens on a fine slit (which does not exceed more than 2/1 000 in. in width) directly over the emulsion side of the film. The record of the sound thus appears as a series of fine horizontal lines when the film is developed.

In the reproduction of sounds the pictures are projected in the ordinary manner by a standard motion picture projector, but there is a tubular attachment, containing a small incandescent lamp, just below the film magazine. The sound record passes immediately over a thin slit through which the light from the small lamp passes. The emergent light falls upon a photo-electric cell, the resistance of which changes with the intensity of the light falling upon it.

For talking motion picture work it is vital that the change should occur instantaneously without appreciable lag. This is effected in the cell adopted by Dr. de Forest, known as the "thalofide" cell. The constituents of the cell are thallium, oxygen and sulphur, and the material, which is fused on to a ¾ in. diameter quartz disc, is mounted in an evacuated glass bulb. The resistance is lowered by 50 per cent. when 0·25 foot-candle from a tungsten lamp falls upon the active material. A cell of this type is shown in Fig. 2.

The weak currents thus generated are amplified by means of a four or five stage amplifier, and the current is then passed

FIG. 2.—DR. DE FORREST HOLDING THE SILEMIN CELL USED IN THE "PHONOFILM" SYSTEM.

through one or more loud speakers, which complete the cycle by converting the current into sound. Of the whole chain of operations the loud speaker is the weakest link. It is doubtful whether perfection can be achieved so long as a diaphragm is used. Some better means of transforming electricity into sound is needed. There is here a good opportunity for research, as the experimental apparatus may be quite inexpensive.

When the picture is shown the sounds emitted are perfectly synchronised with the movements of the artist, and, considering the cycle of operations involved, the quality is surprisingly good. The device adds greatly to the possibilities of the kinematograph. It should be possible for a large number of people to see, simultaneously, a speaker and to hear his address. Instead of lifeless printed accounts of speeches, we shall in future be able to exchange records of speakers which would give all the gestures and inflexions necessary to supplement the actual words. Films of nature studies, travel, etc., can be accompanied by a lecture with the figure of the speaker in evidence on the screen. Tests undertaken on different groups of students have shown conclusively the great educational value of such a lecture, combined with a subject-film. The mere possibility of doing away with printed titles and explanations usually accompanying a film is an important result.

Another line of future research is the problem of supplying gramophone records of great length and purity by eliminating the scratch of the needle, which is replaced by a beam of light. It is conceivable that in the future the time may come when a central broadcasting station will radiate not only waves of sound, but pictures of the actual speakers, so that the licensee, with the necessary apparatus, will both see and hear.

*Abstract of a lecture delivered before the Students' Section of the Institution of Electrical Engineers.

Thomas Edward Gambrell has applied for the restoration of Patent No. 4862/1913, for "Improvements in electric contact-makers for use with resistance boxes, Wheatstone bridges, and the like," which expired on June 2nd, 1918, owing to non-payment of renewal fee.

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NEW DRAFT ORDER.

Commissioners Constitute East Midlands Electricity District.

As the result of the local inquiry held at Nottingham on July 10th last, the Electricity Commissioners have issued a draft Order constituting the East Midlands Electricity District and establishing the East Midlands Electricity Advisory Board. The district covered by this Order includes Burton-on-Trent, Derby, Leicester, Nottingham, Loughborough, Mansfield, Ilkeston and Newark and contiguous portions of the counties of Derby, Leicester, Nottingham and Stafford.

The members of the Advisory Board are to be elected by four groups of bodies comprising (1) authorised undertakers supplying electricity within the district, (2) County Councils, (3) large consumers and (4) railway companies owning railways in the district. The members in Group 2 are to be appointed by the County Councils after consultation with any recognised association of municipal, urban or rural district councils within their area, and any local authority not now supplying electricity which may subsequently do so, will be entitled to become a constituent body in electing members of the Advisory Board under Group 1.

Derby, Leicester and Nottingham are to appoint three members each, Burton-on-Trent two members, Loughborough, Mansfield and Long Eaton one each, the Derbyshire and Nottingham Electric Power Co. three members, the Leicestershire and Warwickshire Electric Power Co, two members, and the Melton Mowbray Electric Lighting Co. one member. The County Councils of Derby, Leicester and Nottingham are to appoint one member each, large consumers two members, and the London, Midland and Scottish Railway Co., and the London and North Eastern Railway Co., one each.

An Engineers' Committee is to be appointed, on which will sit one representative of Derby, Leicester, Nottingham, Burton-on-Trent, and the two power companies, and two members appointed by Loughborough, Mansfield, Long Eaton, and the Melton Mowbray Electric Lighting Co. jointly. This Committee will have power to co-opt as an additional member an electrical engineer of the railway company, and must do so when any question affecting the interests of the railway companies is under consideration. The remainder of the Order follows the usual lines.

Technical Scheme.

The technical scheme provides for the utilisation and extension of the Freeman's Meadow station of the Leicester Corporation, the North Wilford station of the Nottingham Corporation, the Spondon station of the Derbyshire and Nottinghamshire Electric Power Co., and of the stations at Burton and Derby. The Lero and Aylestone stations of the Leicester Corporation, the Talbot Street, St. Anne's Well Road, and the temporary station at North Wilford of the Nottingham Corporation are to be utilised until the load can be transferred to the new stations belonging to the same undertakers. The stations at Long Eaton, Loughborough, Mansfield and Melton Mowbray are to be utilised until such time as other supplies become available at rates justifying their shutting down.

A scheme of main transmission lines is to be prepared and submitted to the Commissioners within six months of the date of the commencement of the Order, for connecting the Freeman's Meadow station at Leicester, and the stations at North Wilford and Spondon with Burton, Coalville, Derby, Heanor, Long Eaton, Loughborough and Mansfield, and provision is to be made during the first stage of the development for the requirements of the Newark area as may be determined by the Commissioners. A scheme providing for the control of generating stations when interconnected is to be prepared within twelve months of the commencement of the Order, and this scheme may provide for the appointment of an officer with full powers to secure the running of the plant in the generating stations in such a manner as to ensure the maximum economy in production. Provision is to be made for the utilisation of electricity from the generating station of the Leicestershire and Warwickshire Electric Power Co., at Hinckley.

The text is given of an Agreement, dated October 19th, 1923, between the Corporation of Derby and the Derbyshire and Nottinghamshire Electric Power Co., whereby certain districts which form part of the area of supply of both the Corporation and the Power Company, shall not be supplied with electricity hy the Company without the consent of the Corporation, this consent not to be unreasonably withheld.

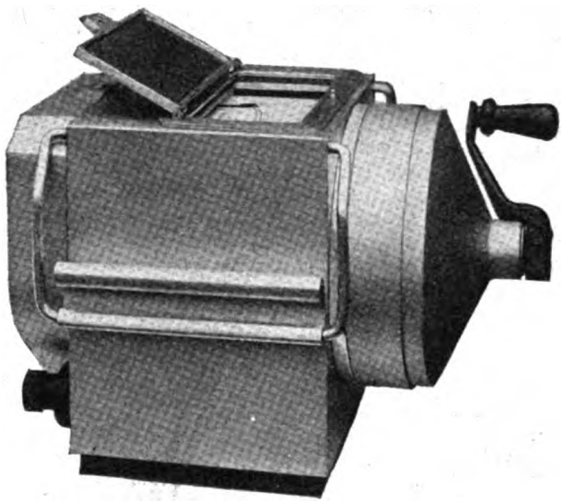
THE IMPROVED "MEG."

Now a Constant Speed Machine.

In our issue of October 13th, 1922, we described a new form of ohmmeter and generator which had been placed on the market by Evershed and Vignoles. This instrument, it will be remembered, was lighter in weight than the well-known "Megger," though it was claimed that it had all its capacity for performing the necessary insulation tests at a reasonably high pressure of 500 V. We are glad to learn that in the fifteen months this instrument has been on the market it has attained wide popularity owing to its lightness and compactness.

Nevertheless, experience has shown that a slight reversion to type is necessary. In the original "Meg," it will be remembered, the constant pressure clutch was dispensed with, since a variable pressure instrument has been found to be quite satisfactory for testing circuits of small electrostatic capacity. But it has now been recognised that the advantages of "Meg" would be increased by the incorporation of a constant pressure device such as was applied to the "Megger" twenty years ago by Mr. Sydney Evershed, and it has therefore been decided to provide a pattern in which this addition is fitted.

As is evident from our illustration, the improved "Meg" differs little in general appearance and size from the original instrument. This is not surprising, since the only change is the



VIEW OF THE LATEST TYPE OF "MEG," SHOWING NEW SANDWICH UNIT.

introduction of a "sandwich" unit between the generator and the gear casing. This unit carries the copper driving drum of the clutch and the intermediate gearing and stud, which is transferred complete from its previous position on the generator frame. The other clutch member is attached to the armature spindle and consists of a plate carrying spring controlled levers and pressure pads, so arranged that the driving elements will separate under centrifugal action when the armature speed exceeds a predetermined limit. Normally the speed at which this occurs corresponds to about 500 V. Specially made roller bearings provide for long generator life at the high speed (approximately 4 500 revs. per min.) at which the armature runs, and at the same time allow the armature clearance to be kept down to a minimum. With the addition of the constant pressure clutch the complete instrument weighs 7¼ lb. as against 6¾ lb. for the original "Meg," while the overall dimensions are 5½ in. by 6¼ in. by 8½ in.

The necessity of using a constant speed generator for certain testing operations is, of course, due to the condenser which is formed between two insulated conductors or an insulated conductor and earth. In many cases the capacity of the condenser thus formed is so small that the varying capacity current caused by the variations in the applied voltage do not prevent a steady reading on the ohmmeter being obtained. When the capacity reaches the order of 1 mf, a steady reading is difficult to obtain unless the testing voltage is kept constant, and this need for a constant voltage is becoming more evident with the increased capacity of house wiring installations using a lead covered system such as Henley's.

The instrument should therefore find an application for a wide variety of testing work.

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ELECTRICAL DEVELOPMENTS IN CHILI.

Progress of the Telephone Business—The Market for British Electrical Plant—Railway Electrification Projects—Proposed National Telephone Co.

Many people in this country regard Chili as a wild, undeveloped, and more or less uncivilised country with little beyond its tremendous nitrate fields and copper mines and earthquakes to remember it by. Nevertheless, the country has been the scene of remarkable developments within the last ten years—even to the adoption of the automatic telephone and other ultra-modern conveniences—and there seems to be every indication of still greater development during the next decade.

In an interview with Mr. William Johnston, a director of the Chili Telephone Co.—whose knowledge of Chilian affairs is based upon a sojourn of nearly twenty years in the Republic—a representative of THE ELECTRICIAN learned of some of the electrical developments completed and in contemplation, and also of the possibilities of supplying electrical plant and machinery to Chili. Generally speaking there is no doubt that Chili offers exceptional opportunities to the enterprising British manufacturer of electrical machinery and appliances.

Vast Scope of Modern Plant.

As Mr. Johnston explained, the large towns, like Santiago and Valparaiso, have their electrical needs fairly well catered for, but there are, on the other hand, many small towns whose electricity supply arrangements are inefficient, depending as they do on inferior gas engines and very inferior turbine plants. Very archaic installations are to be found at Linares, Buin, Rancagua, San Fernando, Curico, and Parral, to mention only a few examples taken at random. In some places the street lamps are lit very early in the afternoon and are left burning until late the next morning. Lamps of 50 c.p. are commonly used for street lighting, and even this rating is purely nominal, as the lamps are rarely replaced until they refuse to serve any longer. Taking the country as a whole, Mr. Johnston believes that the demand for lighting and power is a good and constant one, offering vast scope for modern plant designed on economical and efficient lines.

A large amount of British capital is invested in various enterprises in Chili and there is ample room for the employment of still more. British capital runs the nitrate railways and one of the British-owned railways with over 643 kilometres of track, is proposing to spend £1 000 000 on electrifying its lines from Iquique; this development is held up for the moment pending the grant of a concession. The port works, drainage and paving in Valparaiso have been carried out with British capital, and money from the same source has supplied Santiago (the capital) with water, drainage, paving, and one of the most extensive tramway systems of the world. The size of the system is largely due to the desire of the Chilian to dissipate as little energy as possible in pedestrianism.

Important Hydro-Electric Plant.

This undertaking now derives its power from a large hydro-electric plant on the rivers Maipo and Colorado, near Santiago. It is intended that the plant shall also supply light and power to the whole of the Central Valley between Santiago and Valparaiso. High tension lines are now being laid in this district by the Westinghouse Co., and the State Railways are being electrified between Santiago and Valparaiso. Joining the State Railways on the Pacific side to the railway running through the Argentine to the Atlantic, the British-owned Transandine Railway, which crosses the Andes at a height of 12 000 ft., will probably be electrified in the near future. Views of sections of this line given opposite, give some idea of the nature of the country through which the line runs.

Quite recently the Valparaiso electric tramway, light, and power undertaking owned by a German company, has been taken over by British capital and formed into a Chilian company. Electrical energy for this system will be obtained from the hydro-electric plant near Santiago. In the Tocopilla district there is the Anglo-Chilian Railway (British owned) and to the south-east is a large hydro-electric plant at Chuquicamata for the development of immense low-grade copper deposits; this undertaking belongs to the Guggenheim group and the Arizona Copper Co.

In spite of the depreciation of the Chilian peso to the value of 6d. against a nominal 1s. 6d., and other factors militating against stable conditions, Mr. Johnston thinks the country generally is making steady progress and the people readily accept any new device that will save labour and make for increased efficiency.

Dealing with the telephone business in Chili, Mr. Johnston pointed out that at present the constitution only permits the President to give concessions to electrical undertakings for ten years where aerial wires are concerned, and twenty years where the wires are put underground. In view of the enormous expenditure required for modern telephone supply with underground cables and automatic plant this tenure does not provide sufficient security for the capitalist.

For some time the public officials have advocated the Government control of telephone services and have brought about a spirit of discontent on the subject with the object of getting the telephone joined to the telegraph service, as has been done in so many other countries. Efforts have also been made to restrict the rates chargeable to subscribers, an arrangement which would obviously be very prejudicial to an operating company buying its material and paying its dividends abroad.

To put the telephone business in Chili on a sound basis, continued Mr. Johnston, the capitalist would require in the first place a concession based on a special law of Congress for a period of from 30 to 50 years and a guarantee that capital expenditure properly maintained would be returned. Failing the latter the rate of charge allowed should be high enough to provide for adequate amortisation of capital.

Many influential Chilian business men are opposed to State ownership on the ground that the State is not a good administrator and have suggested the formation of a national company to take over the existing telephone businesses, of which there are about 13, operating some 350 exchanges. The largest of these systems is that of the Chili Telephone Co., which operates at 260 exchanges at the present time. This company's properties are valued at over £1 500 000, and as there are 22 000 stations this works out at £68 per station, including real estate, trunk lines, etc.

Automatic Telephones in Valparaiso.

Mentioning that the Chili Telephone Co. had recently installed at Valparaiso a 6 000 line full automatic plant made by Siemens Brothers & Co., Mr. Johnston said this plant has been so successful that the public is clamouring for a similar plant in Santiago; considerable capital expenditure will be necessary to provide this, and the Government is being asked for a long-date concession. It is interesting to note that for about two years before they installed the automatic plant the company started educating the Chilians in the use of automatic telephones so as to avoid any difficulties when making the change over, which took place in May last. Illustrated booklets explaining the system were distributed; at the back of these booklets was a series of questions and answers on points connected with the working—from the public point of view—of automatic telephones, and officials of the telephone company conducted periodical examinations of the junior assistants in the various commercial houses to make quite sure that the instructions were fully understood. By this means the change-over was made with the utmost ease, to the satisfaction of all concerned. In many other ways too the public is educated and encouraged to take an intelligent interest in the operation of what it rightly regards as an important public service. It must be very largely due to the vigorous methods employed to "sell" the telephone that Chili ranks next to Japan in the number of telephones per 100 population, and is on this basis ahead of Czecho-Slovakia, Spain, Brazil, Italy, Poland, and Mexico.

Notwithstanding its failure, so far, to obtain a long-date concession, the Chili Telephone Co. is carrying out extensive underground schemes at Vina del Mar, Antofagasta, Iquique, Talca, Concepcion, Temuco and Santiago. At all of these places new switchboard plants are in contemplation and it is expected that the Chili Government will, before long, give the necessary security of tenure to enable the money to be supplied. Meanwhile, added Mr. Johnston, increased long distance trunk lines are being constructed between Santiago and Valparaiso and at various other centres; new modern buildings have been erected at Santiago, Valparaiso, Antofagasta, Temuco, Concepcion and Talca, and a modern building is in course of construction in Iquique.

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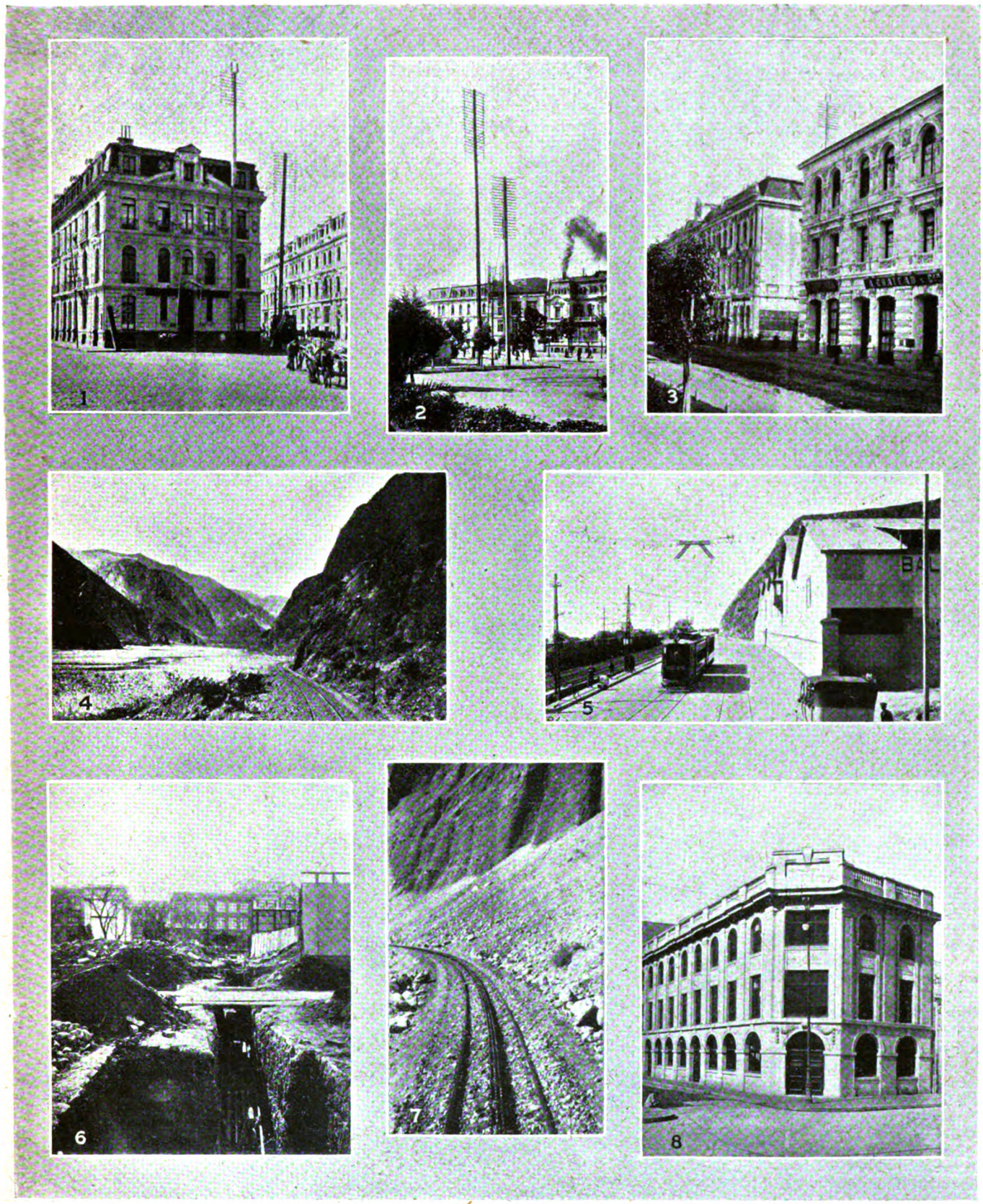

ELECTRICAL DEVELOPMENTS IN CHILI.

1.—A 100-pair telephone pole in a Valparaiso street. The line pole on the right is on the main route in Calle Blanco.

2.—Besides giving an idea of the height of telephone poles in Valparaiso, this view shows the comparative methods of construction of the National Telephone Co. (left) and of the Chili Telephone Co.

3.—Where possible, high poles are erected in narrow side streets, where they are partially hidden by the buildings.

4.—View of the Transandine Railway, a British-owned enterprise, which is to be electrified in the near future.

5.—The road between Valparaiso and Vina del Mar along the sea coast. Under this road are the ducts to carry the cables for extending the automatic telephone system. The State Railway from Valparaiso to Santiago is between the road and the sea on the left of the picture. This railway is being electrified and the concrete poles carrying the conductors can be seen in the photo.

6.—Laying conduits (fibre tubes in concrete) in the Avenida Brasil, Valparaiso, for the Chili Telephone Co.'s new exchange.

7.—A typical view on the Transandine Railway.

8.—View from Calle Huito of the new premises of the Chili Telephone Co.

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MERCHANDISE TO SELL & PROFIT BY.

Lighting Accessories.

It seems apparent from the latest catalogue of British-made electrical accessories, just to hand from Reeves and Co., Crescent Works, Birmingham, that a serious attempt is being made to meet foreign competition in these lines. The lampholders offered by the firm are of substantial design, and fitted with best English "S" interiors and well-balanced plungers with phosphor bronze springs. They are completely standardised by the introduction of a $\frac{5}{8}$ in. square cord grip, being fitted when desired with flat surface plungers. The threads are die cut, and the shade rings are turned from the solid rod, loose fitting to prevent jamming.

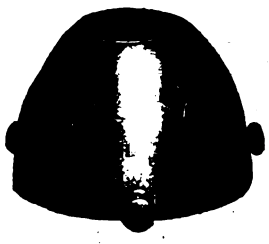

FIG. 1.

A wide range of electric galleries is offered at very competitive prices. True die stampings of pleasing design (Fig. 1), the galleries are made for either screw or spring fastening, and are finished with $1\frac{1}{8}$ in. fitting for s.c. lampholders, suitable for $2\frac{1}{4}$ in. or $3\frac{1}{4}$ in. shades. Switch plates, one to four ways, are also listed, and four very handsome designs are illustrated in the catalogue. They are available in antique copper, brass, silver, satin brass and Florentine bronze finishes. Stamped or solid cut brass fixing rings are available in various finishes.

An Efficient Shade Carrier.

Those who have experienced the difficulty of screwing up shade carrier rings on a b.c. holder when the thread will persist in running cross will welcome the "Titan" shade carrier introduced by the General Electric Co. (Fig. 2). This device provides a practical solution of the difficulty, and is so easy to manipulate that shades can be fixed on practically all existing holders, even when the electrician is working in a confined or awkward position at the top of a ladder. It is most particularly useful when fitting shades of the long narrow type, into which it is impossible to introduce the whole of the hand. The carrier consists of a ring provided with four teeth projecting inwards and split across a diameter, the two parts being kept in position by spiral springs. The two ears, when compressed between the thumb and finger, cause the two halves to gap open, hinging on the two rivets shown in the illustration. The ring can then be slipped over the barrel of the lampholder, and upon releasing the ears the teeth on the inner side of the ring grip the thread of the lamp holder, securely supporting even the heaviest of shades. An added advantage of this device is that the shape of the teeth is such that the weight of the shade causes them to grip even more firmly.

FIG. 3.

Moonstone Glassware.

The revised "Moonstone" glassware catalogue which has just been issued contains a comprehensive selection of various types of fittings made of this special glassware. Particularly suitable for every kind of interior lighting, it comprises a series of reflectors for use as pendants, ornamental bowls and hemispheres for semi-indirect fittings, together with a number of one-piece glass units—one of which is shown in Fig. 3—which can be used as pendant fittings for high candle-power gasfilled lamps. Moonstone glassware is semi-translucent, and is said to combine exceptional reflecting properties with perfect diffusion and a minimum of absorption. It is neither dense like ordinary opal glass nor transparent like crystal glass, but unites the two, and when illuminated it is uniformly luminous. Moonstone glass does not colour the light, but softens it in a pleasing manner, producing an effect which closely resembles daylight.

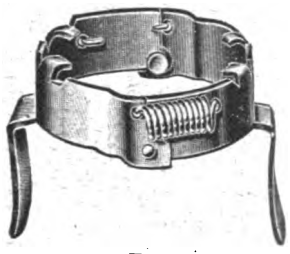

FIG. 2.

A New "Gecophone" Amplifier.

A new "Gecophone" two-stage power amplifier has now been placed on the market by the General Electric Co. Designed primarily as an addition to the "Gecophone" two-valve set, this amplifier is suitable for use with any broadcasting receiver. As the result of careful research and study of broadcasting requirements, it is claimed that with a good loud speaker and moderate skill in tuning everyone may now obtain sounds pure and free from all distortion. Completely enclosed in a polished mahogany cabinet with a flat top lid acting as a base for the receiving set, this new amplifier is among the most handsome, as well as the most efficient, it has been our pleasure to review. In accordance with "Gecophone" custom all connections are made by plugs and sockets to an ebonite panel at the back of the amplifier, rendering connections extremely simple and avoiding the eyesore of unsightly leads. Full control of the valves is obtainable, and all batteries, including those of receiving sets, can be switched off completely if desired, whilst a further switch enables headphones to be used together with, or independently of, the loud speaker. The single-stage "Gecophone" amplifier is, of course, still marketed, and at its price is probably one of the most efficient and satisfactory one-valve amplifiers available to the public. A folder, B.C.3186, descriptive of the new amplifier, may be obtained on application to Magnet House, Kingsway, London.

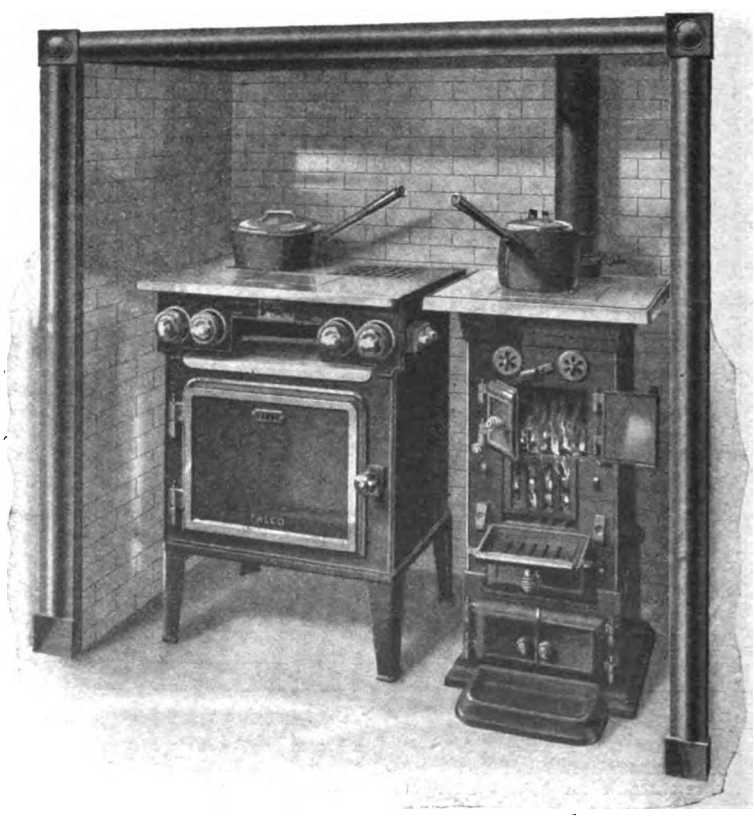

FIG. 4.

A "Falco" Combination.

Described as a "Falco" innovation, the electric cooker, with "Companion" water boiler, shown in Fig. 4, is now being placed on the market by the Falkirk Iron Co. Designed to meet the requirements of the average sized household, the cooker has ample oven accommodation, two radiant type boiling burners, and a griller, and is complete with switches and fuses, forming a compact, serviceable, and reliable cooker. The manufacturers claim that the oven is ready for roasting or baking within 25 minutes of turning the oven switch on to "high" heat, a temperature of 350 deg. F. being obtained by this time.

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NEWS IN A NUTSHELL.

Telegraph engineers are required by the Government of the Gold Coast.

The Council Chamber of the Aldershot Town Hall is now lighted electrically.

An Ideal Home Exhibition is to be held at Wolverhampton from February 13th to 28th.

Drought has interfered with the production of hydro-electric power in Wisconsin (U.S.A.).

A highly diverting "light" entertainment was given last week by members of the B.T-H. London Club.

It is understood that the Departmental Committee on the rating of machinery is to proceed with its work.

Electrical apparatus for measuring rainfall is to be installed in the Government meteorological department at Kitchener, Ontario.

The Danish staff of the Great Northern Telegraph Co. held their annual dinner in the Crown Hotel, Newcastle-on-Tyne last week.

All persons or firms having patents, designs, or trade marks registered in Japan must apply for re-registration before February 29th next.

The Austrian press reports that the electrification of the "Salzkammergut" railway will probably be completed in time for the next summer season.

Under the new Workmen's Compensation Act, clerical as well as manual workers whose salaries do not exceed £350 will be entitled to compensation.

The Greek Government is said to be pressing on with a scheme for the utilisation of waterfalls for the generation of electrical energy for Athens at an estimated cost of £600 000.

Czecho-Slovakia is developing its export trade in electrical goods. During September 600 000 crowns' worth of these goods were sent to the United Kingdom, Holland and the U.S.A.

A company known as the American and Foreign Power Co. has been formed in Maine (U.S.A.) to take over public utility undertakings in 38 communities in Cuba, Panama and Guatemala.

Electrical firms' catalogues forwarded to the Imperial Ottoman Bank (Trade Development Dept.), 26, Throgmorton Street, London, E.C.2, will be displayed at their agencies in Turkish towns.

The American people have invested $115,000,000 in radio sets and equipment this year, and will probably double this amount in 1924, according to Mr. D. Sarnoff of the Radio Corporation of America.

A correspondent of the F.B.I. reports that the underground railway in Milan is to be constructed by a Barcelona firm, but that there is a possibility of an opening for the supply of material by British firms.

It is reported that the Pope has approved the erection of a powerful wireless broadcasting station in the Vatican to permit his Holiness to say masses and send his blessing to the entire Catholic world simultaneously.

At the adjourned inquest at Sheerness on a stoker who died from injuries received in an explosion in submarine L11 during fuelling operations a witness suggested that the explosion was caused by "a spark from electric fittings."

A short report on the market for electrical porcelain in Chili has been issued by the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. Copies can be obtained from the Department if the reference No. 9113/F.L./M.C/2 is quoted.

A speaker at the annual dinner of the West of Scotland and Ayrshire branches of the Association of Mining Electrical Engineers, in referring to the adaptability of electrical equipment, pointed out that without electricity the five men who were rescued alive from the Redding pit could not have been brought out.

In connection with the erection of Wolverhampton's new Technical College, a number of local firms have offered to supply certain equipment free. The Electric Construction Co., Bushbury, is giving generators and electric motors as a mark of appreciation of the assistance the town has given to an outside area in technical education.

Poplar Electricity Committee's charges for electrical energy average 1½d. per kWh.

Miniature electric trains found more purchasers than ever during the Christmas shopping season.

The problem of erecting steam-power plants is being discussed by the Ontario Hydro-Electric Commission.

Already over 220 subscribers are receiving a supply of electrical energy from Skipton's new electricity undertaking.

Kingston market is to be lighted electrically, gas, naked flares and petrol having been ruled out as being dangerous.

Complaints were made at several London wardmotes against the charges for electrical energy for lighting in the City.

The American Society for Electrical Development is now issuing a monthly progress report dealing with electric battery vehicles.

Preston Electricity Committee intends to hold an exhibition of electrical appliances in the Public Hall, commencing on March 10th.

Engineers estimate that the complete electrification of the railways of the United States would save more than 100 000 000 tons of coal a year.

It is reported that the turbo-condensing locomotive invented by M. Ljungstrom is now running on regular express traffic between Stockholm and Hallsburg.

A trial flight was made last week with the "electric-sign aeroplane" illustrated in our picture page recently. Further flights of longer duration are in contemplation.

La Société Nationale des Chemins de Fer Vicinaux is said to be preparing plans and conditions for tenders for the electrification of its lines to the north of Antwerp.

It is estimated that the Swedish Waterfall Board will be able to hand over to the Treasury during 1924 the sum of 9 580 000 kr., suplus in respect of the State power stations.

All food on new trains being built for the London and North-Eastern Railway will be cooked electrically. New suburban rolling stock on order will be built so that it can readily be converted to electric working.

At the annual meeting of Bolckow, Vaughan and Co., Sir J. E. Johnson-Ferguson said the company had a large scheme in progress for the electrification of its collieries. This, he thought, would result in very considerable economy.

Birmingham Corporation Electricity Department has broken two records during the past month. The consumption of electrical energy exceeded the maximum in the war period, and new subscribers during the month numbered 600.

A verdict that "Death was due to heat failure caused by an electric shock accidentally received by catching hold of a live wire," was recorded at an inquest at Neath on a labourer who was electrocuted at the Neath Tinplate Works a fortnight ago.

A football match at Burnley on the evening of December 21st, between the women's teams of Dick Kerr and Co. and Messrs. Keyes, of Bradford, resulted in a win for the former by five goals to one. The ground was illuminated by a specially designed electrical installation.

The date of the British Association meeting in Toronto next year, provisionally announced for September 3rd-10th, has now been altered to August 6th–13th, and the meeting will be followed by official excursions, not preceded by them, as originally proposed. The meeting will be under the presidency of Sir David Bruce.

It is intended to make the annual general meeting of the British Electrical and Allied Industries Research Association on January 11th a public function, and a luncheon will, therefore, be given at the Connaught Rooms, at which many eminent scientific men and engineers are expected to be present. The President-elect, Sir Richard Glazebrook, will give an address.

Preliminary figures relating to the amount of electrical energy generated by American central stations and by electric railways show that during 1922 46 307 536 711 kWh were generated, as compared with 32 678 806 061 in 1917 and 17 621 808 893 in 1912. This gives an increase of 38·6 per cent. from 1917 to 1922 and of 157·1 per cent. for the ten-year period 1912 to 1922.

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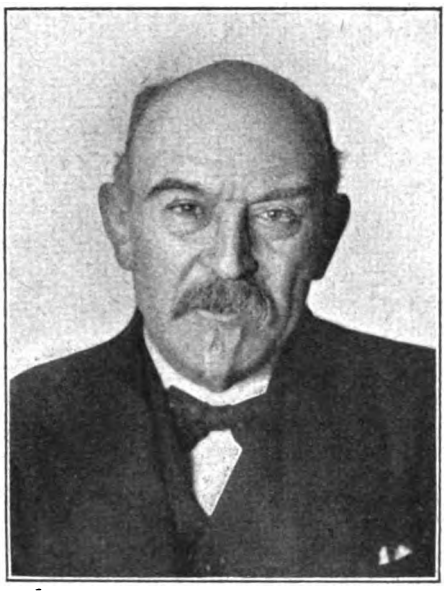
PERSONAL GOSSIP.

Councillor W. Smith has been reappointed chairman of the Worthing Electricity Committee.

Mr. E. J. Harper, who is on the staff of Siemens Brothers and Co., is to receive a prize of £1 000 from the "Daily Mail" for submitting a correct forecast of the election results.

Mr. William C. Davey, manager of Strode and Co., electric light engineers, St. Paul's Churchyard, London, who has just completed his fiftieth year of continuous service with the firm, started work at the bench in the Osnaburgh Street premises, where he later became assistant manager, a position which he occupied for some years prior to his appointment as City manager in 1912. He is a



Mr. William C. Davey.

member of the Hackney Borough Council and of its Electricity Committee. Mr. Davey, whose ligl ting experience, of course, goes back to the pre-electricity period, claims that his firm made the first outside electric lamp in this country. This lamp was exhibited outside the Osnaburgh Street premises.

Sir Vincent L. Raven, late chief mechanical engineer to the North Eastern Railway, who is retiring at the end of the year from the office of technical adviser to the London and North Eastern Railway Co., is a member of the Institution of Electrical Engineers.

We understand that Mr. W. A. Chamen, engineer and general manager of the South Wales Electrical Power Distribution Co. and this year's President of the South Wales Institute of Engineers, is now making satisfactory progress towards recovery from his illness.

Prof. M. Chatelain, the President of the Central Electrotechnical Council in Russia, President of the Russian I.E.C. Committee, and President of the recently formed Russian Engineering Standards Committee, has spent a few days in London meeting influential people in the electrical world. Before his departure for Petrograd he was entertained to lunch at the R.A.C. by the British Engineering Standards Association.

Mr. A. W. A. Chivers (of the British Electrical Federation) has been elected president of the Diesel Engine Users' Association for the year commencing January 1st, 1924. With regard to the honorary secretaryship, arrangements have now been made to relieve Mr. Percy Still of some part of the duties which he has attended to during the last ten years by appointing Mr. Still and Mr. Geoffrey Porter as joint honorary secretaries.

At Manchester's Stuart Street Generating Station, on December 18th, Mr. S. L. Pearce, chief engineer and manager of the Corporation Electricity Department, presented Mr. James Gaskell, late engine room foreman, with a wallet containing Treasury notes. The presentation was made on behalf of the staff and employees as a mark of their respect and esteem for Mr. Gaskell, who is retiring after 30 years' service. Mr. Gaskell came to the Electricity Department when it was in its infancy. He started the first engine at the Dickinson Street Station—a unit of 200 H.P.—was present at the opening of Bloom Street Station, Stuart Street Station, and the new super-station recently erected at Barton. Mr. Gaskell has had the unique experience of seeing the largest municipal electricity undertaking in the United Kingdom expand from one unit of 200 H.P. to several units of 40 000 H.P. each.

J. Springer, Ltd., cinematograph equippers, have opened new showrooms at 152-158, Wardour Street, London. They have a good range of bowl electric light fittings, electrically driven air washers and there is also shown in operation an automatic electric curtain control which opens and closes curtains in front of the usual cinema screen, while it also switches on and off in rotation electric lamps with white, red and purple bulbs fitted inside the proscenium arch.

CHEAP ELECTRICITY.

Lord Weir on Its Relation to National Prosperity.

The importance of a cheap supply of electrical energy in relation to national prosperity was urged by several of the speakers at the dinner of the Scottish Centre of the Institution of Electrical Engineers, which was held in Glasgow, on December 19th.

Lord Weir, who proposed the principal toast, expressed the view that the future progress of the country depended to a large extent on cheap power and cheap transport, and that the key to both would be found in cheap electricity. The solution of that problem lay in the creation of a main transmission system, into which nothing but cheaply generated energy would be allowed to flow, and out of which local authorities and companies would distribute.

In technical design and construction over the entire field of electrical activity we were now second to none, said Lord Weir. Given a fair field and effective freedom, he had yet to learn that British finance was lacking in enterprise. Apart from certain sections of a few other countries where hydro-electric power offered special advantages to a few specialised industries, here in Great Britain we had conditions unequalled by those of any other country of equal population and industrial importance for securing the most vital economies in power generation and distribution. But in spite of that situation, we could not ignore that we were not progressing rapidly with any far-sighted policy of reform, nor was it possible to forget the existence of much waste and inefficiency.

It was also the case that our electrical power policy was not yet linked up in its most effective way with the problems of our railway companies. It was true that the preliminary steps had been taken by the constitution of the Electricity Commissioners, and to these Commissioners a tribute of respect must be paid for the valuable work they had done within their limited powers. These powers appeared to give the Commissioners ample authority to prevent wasteful things being done, but they gave very little power to bring about the inauguration of useful things. The problem was of immediate and vital national importance, and its solution rested in a national programme which must be prepared in close consultation with electrical engineers.

London's Electricity Supply Bills.

Mr. G. W. Partridge's Views.

In conversation with a representative of The Electrician, Mr. G. W. Partridge, managing director and chief engineer of the London Electric Supply Corporation, pointed out the difference between the London Electricity Supply Bills, Nos. 1. and 2, which have been promoted for the ensuing session of Parliament. The No. 1 Bill, he explained, is promoted by the City of London, County of London, South London and South Metropolitan Companies (four companies) and No. 2 by the ten other companies comprised in the London Electricity Joint Committee, which companies believe that theirs is the Bill which gives effect to the resolutions of the London County Council and the wishes of the Electricity Commissioners. The other four companies are mentioned in the Bill because they can come in if they choose to do so.

In No. 2 Bill, Mr. Partridge continued, the idea is to form a separate company which will have entire control of the generating stations of all the companies, the old companies themselves remaining as distributors and taking energy from this new company controlling the generation. There is nothing like that in No. 1 Bill, and the ten company group considers that the technical scheme in No. 1 Bill is vague. "At the fruitless inquiry held by the Commissioners," added Mr. Partridge, "it was generally agreed that the only way to get a cheap supply of electricity was to have the entire control of the generation under one body, and to shut down any inefficient stations and make them take a supply from the cheapest source."

Electric Light Globe Dispute.

In the Mayor's and City of London Court, on December 18th, before the Common Serjeant, Sir H. F. Dickens, K.C., and a jury, a claim was made by C. Quitmann, exporters and importers of lighting glassware, 3, Cloth Street, London, against the Anglo-American Metal Co., 69, and 70, Aldersgate Street, London, for £117 14s. for glass electric light globes supplied and charges paid on their behalf. The defendants counter-claimed for £47 3s. 10d. for loss of profit. The plaintiffs' case was that they received an order from the defendants for 6 gross of clear glass dishes with flanges at 7s. 6d. per doz., and 2 500 well globes with star cut bottoms at 8s. 4d. per doz. The defendants' order specified that the globes and dishes should be "exact to drawing." The plaintiffs had since ascertained that the defendants had a contract to supply the globes and dishes in question to the London General Omnibus Co., who had rejected the goods. The defendants had refused the goods on the ground that they were not according to drawing. The plaintiffs' case was that in the glass trade there was a customary variation in measurements by which 1/32nd of an inch or 1/16th of an inch in the flange of the globe or dish was allowed. The goods they had supplied were within that allowable variation. The jury found for the plaintiffs for the full amount of the claim, and judgment was entered accordingly with costs.

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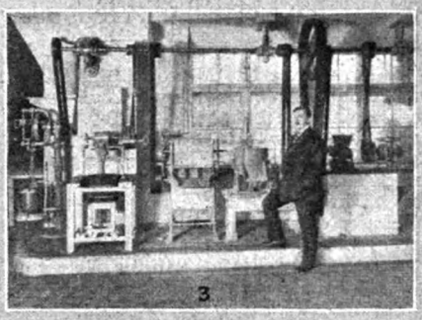

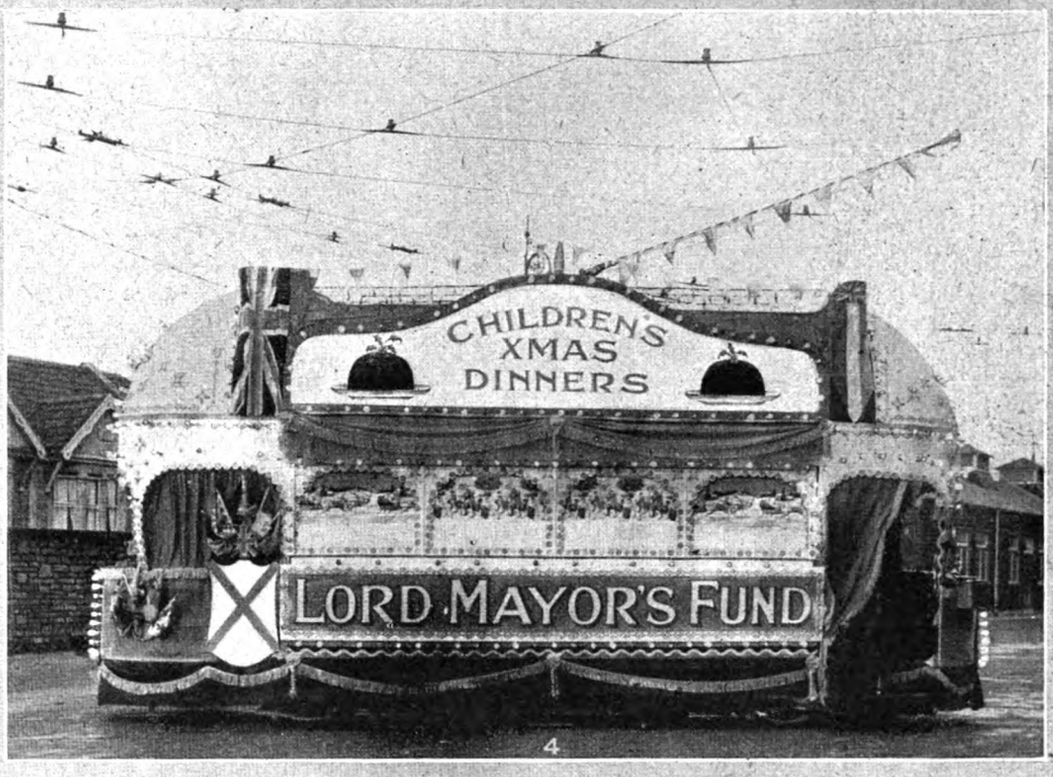

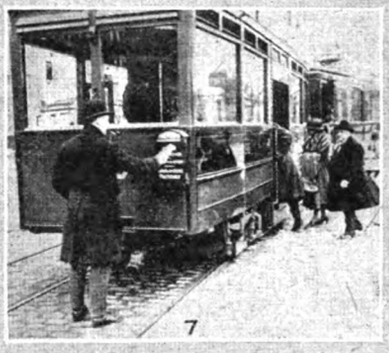

ELECTRICAL NEWS IN PICTURES.

1 and 2.—Views of the New Station at Hillingdon, between Ickenham and Uxbridge, on the Metropolitan Railway (London).

3.—Electrical mixers and other appliances in the staff kitchen of a Vienna bank ("European Commercial" photo).

4.—A seasonable note is struck by the decorations on this specially illuminated tramcar which is being used by the Bristol Tramways and Carriage Co. in connection with the company's annual collection for the Lord Mayor's Fund.

5.—An effective Christmas window display in a Cannon Street (London) dealer's showroom.

6.—This "Times" photo shows the remains of one of the power stations destroyed by the bursting of a dam in the valley of the Scalve, north of Brescia, in Italy.

7.—The practice of having letter boxes attached to tramcars is growing in this country and the idea is also finding favour abroad, as this photo—taken in Amsterdam—shows.

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WIRELESS CHAT.

An Interesting Wireless Broadcasting Experiment.

We learn that the Metropolitan-Vickers Electrical Co. has for some time past been carrying out experiments with a view to ascertaining the best methods for picking up broadcasting from long distances, and, with this end in view, has made arrangements with the Westinghouse Electric and Manufacturing Co., of Pittsburg, to conduct a series of experiments extending over the first week of the New Year. Arrangements are being made to gauge the possibility of receiving these signals with sufficient clearness and separation from interference by atmospherics or other outside influences to enable them to be relayed to a broadcasting station and re-transmitted.

With a view to testing the character of the re-radiation of these received messages, the Metropolitan-Vickers Co. will use a transmitting power of 1·5 kW on 400 metres, with the call sign "2AC." The transmissions will be carried out from the special experimental plant of the company's research laboratories at Trafford Park. The signals will be picked up from the Westinghouse Co.'s broadcasting station at Pittsburg, known to amateurs as "KDKA."

Experiments so far conducted between the two companies demonstrate that the chief trouble arises from static or atmospheric disturbances. Conditions vary enormously from day to day, and even from hour to hour, so that, while reception of the American signals may be achieved on one night with a very simple valve set, it may be impossible to receive intelligible signals on a succeeding occasion, even with the most sensitive and selective of receiving sets; consequently, it will not be a matter for surprise if sufficiently good reception for relaying is obtained on only one or two nights during the week of the tests. While the station at Manchester will re-transmit the received messages at 400 metres, the actual transmission from Pittsburg to Manchester will be carried out on a new system which this series of experiments is intended to test.

Collecting Experimental Data.

It is specially requested that between the hours given below amateurs in this country will avoid oscillation, and listen rather to the re-transmitted messages with a view to reporting to the Metropolitan-Vickers Co. the success of the experiment. The first attempt will be made on New Year's Eve, and, if reception is successful, re-transmission will probably commence shortly after midnight, but, in any case, as soon as possible after the British Broadcasting Co.'s stations have closed down. During the remainder of the week it is hoped that it will be possible to radiate a message at 11.30 each night, or immediately after the B.B.C. stations shut down (should they continue after this hour), whether or not relaying is likely to take place that night, and at what time. In all probability relaying on favourable nights will commence between 11.30 p.m. and midnight. Special messages will be sent from America at 1 a.m., and it is hoped that Mr. Sidney J. Nightingale, of the Metropolitan-Vickers staff, who is at present in America, will contribute vocal items to the programme sent out by KDKA.

For the purpose of collecting experimental data, the Metropolitan-Vickers Co. will be interested to receive reports from those who are able to listen to the re-radiation (anyone who is able to pick up the Manchester Broadcasting Station of the British Broadcasting Co. should be able to hear this re-transmission). Such reports should be addressed to Mr. A. P. M. Fleming, Manager of Research and Educational Departments, Metropolitan-Vickers Electrical Co., Trafford Park, Manchester.

Wireless Fog Signals.

According to the "Electrical World," a wireless fog signal has been installed in the new light vessel on Nantucket Shoals, one of the most important lightship stations in the world, as well as one of the most exposed, since it is anchored 41 miles from land. This signal will be operated by an automatic apparatus sending, during fog, a group of four dashes every 30 sec. and thus enabling vessels equipped with radio direction finders to obtain an accurate bearing from a distance of 30 miles, or more, in any weather conditions, and to steer for the lightship. In addition, a powerful electrically-operated signal is to be substituted for a submarine bell hitherto employed. This signal will be of 3 000 c.p., and will show at the mast-head four occultations a minute. The Nantucket Shoals installation is the eighth wireless fog signal thus far put into commission and five more are being established in the United States. Ten of the thirteen are on lightships. Nine are on the Atlantic Coast and four on the Pacific.

Wireless News in Brief.

It has been decided to hold a National Radio Week next year.

Edinburgh Town Council has agreed to request the Postmaster-General and the British Broadcasting Co. to instal in Edinburgh a relay broadcasting station with direct land line communication to London.

According to a "Times" correspondent, a new German machine for the transmission of wireless messages in cipher has been tested successfully. It is claimed that no unauthorised receiver can decipher messages sent by this method, and that there is no loss of time in transmission.

Users of the British Broadcasting Co.'s wireless receiving sets received notice on Saturday calling for the renewal of their receiving licences.

GOVERNMENT CONTRACTS.

Electrical Goods Ordered During November.

The following are among the contracts placed by the British Government Departments during November:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.—Manganese Bronze and Brass Co., high tension busbars. Babcock and Wilcox, electric travelling crane. Small Electric Motors, Ltd., motor-generators and spares. General Electric Co., Ltd., 100 kW motor-generator, switchgear, etc. Cooke, Troughton and Sims, stress recorders.

ADMIRALTY ENGINEER-IN-CHIEF'S DEPARTMENT.—Leeds Engineering and Hydraulic Co., electrically driven winches.

WAR OFFICE.—Barton and Sons, conduits and conduit fittings. H. Gardner & Co., copper ingot. British Metal Corporation, electrolytic copper ingot. British Insulated and Helsby Cables, Ltd., copper sheets. Cable Accessories Co., exterior electric light fittings. General Electric Co., Ltd., interior electric light fittings. Ferranti, Ltd., electric meters. Grindlay, Ross and Co., electric light installation at Maryhill Barracks.

AIR MINISTRY.—Evershed and Vignoles, insulation tester. British Thomson-Houston Co., magnetos. Premier Accumulator Co., storage battery. Ernest Turner, voltmeters. Mullard Radio Valve Co. and General Electric Co., Ltd., wireless telegraph valves.

POST OFFICE.—British L. M. Ericsson Mfg. Co., telegraph and telephone apparatus. Siemens Bros. and Co., telegraph and telephone apparatus, protective testing apparatus, telephone cords; and submarine cables from Turk's Island to Barbados, Barbados to Trinidad and Barbados to Georgetown (British Guiana). General Electric Co., Ltd., telephone apparatus, protective testing apparatus, conduits and fittings, and thermionic valves. International Electric Co., telephone apparatus, protective testing apparatus and enamelled and cotton lapped wire. Western Electric Co., telephone apparatus, loading coils and telephone cords. Evershed and Vignoles, protective testing apparatus. Callenders' Cable and Construction Co., Connollys (Blackley), Enfield Cable Works, Ltd., W. T. Glover and Co., and W. T. Henley's Telegraph Works Co. and Union Cable Co., telegraph and telephone cable. Macintosh Cable Co., telegraph and telephone cable and flameproof wire. Pirelli-General Cable Works, Ltd., telegraph and telephone cable and copper wire. Barton and Sons, conduits and fittings. British Insulated and Helsby Cables, Ltd., condensers and telephone cords. Telegraph Condenser Co., condensers. T. De La Rue and Co., and Taylor, Tunnicliff and Co., insulators. Waterlow and Sons, telegraph paper. Bullers, Ltd., earth plates and spindles. Armstrong, Addison and Co., Burt, Boulton and Haywood, Gabriel, Wade and English, and F. Sime, telegraph poles. J. W. Thompson, wallboards for telephones. R. Johnson and Nephew and J. Wilkes, Sons and Mapplebeck, copper wire. London Electric Wire Co. and Smiths, enamelled copper wire. Head, Wrightson and Co., steel masts for Rugby Imperial Wireless Station. Automatic Telephone Manufacturing Co., telephone exchange equipment at Gloucester. (Sub-contractors: Chloride Electrical Storage Co., batteries. Newton Bros., charging machine. Crompton and Co., ringing machine.) Ferranti, Ltd., telephone exchange equipment at Gosport. (Sub-Contractors: Chloride Electrical Storage Co., Manchester, batteries; Newton Bros., charging machine; Scottish Oils, Ltd., Ward and Goldstone, British Xylonite Co., Rowntree and Sons, Relay Automatic Telephone Co.) Western Electric Co., telephone exchange equipment at Hammersmith (Sub-Contractor: Chloride Electrical Storage Co., batteries) and at Edgbaston (Birmingham), and Dudley; and telephonic repeater station at Fenny Stratford.

H.M. OFFICE OF WORKS.—Devereux, Moodie and Co., electric light wiring Chester-le-Street (Bertley and Pelton sites). Mather and Platt, additional plant for H.M. Office of Works Generating Station, South Kensington.

CROWN AGENTS FOR THE COLONIES.—Callenders' Cable and Construction Co., insulated cable. Mather and Platt, electric light fittings. General Electric Co., Ltd., electrical materials. Pritchett and Gold, train-lighting cells. Chloride Electrical Storage Co., Lux cells. Bullers, Ltd., telegraph material. W. T. Henley's Telegraph Works Co., telephone cable. J. Wilkes, Sons and Mapplebeck, copper wire, etc. Rylands Bros., g.i. wire. Shropshire Iron Co., h.d. copper wire, etc.

Ironclad Switchgear.

We have received from Wm. Sanders and Co., of Wednesbury, an attractive forty-page catalogue which deals with their "Superior" ironclad switch and fuse gear. The catalogue is divided into sections, ranging from large unit type lighting and distribution boards down to such items as cable glands. Many of the items have been entirely redesigned, and numerous improvements made, while the "mica-metal" principle of insulation has been substituted for slates and composition.

The fuse elements described have been arranged so that when wired up the wire forms a loop and so induces a magnetic field. In this way explosions and arcing are, it is claimed, rendered impossible. We understand that drastic tests have been made on this new type of fuse with highly satisfactory results.

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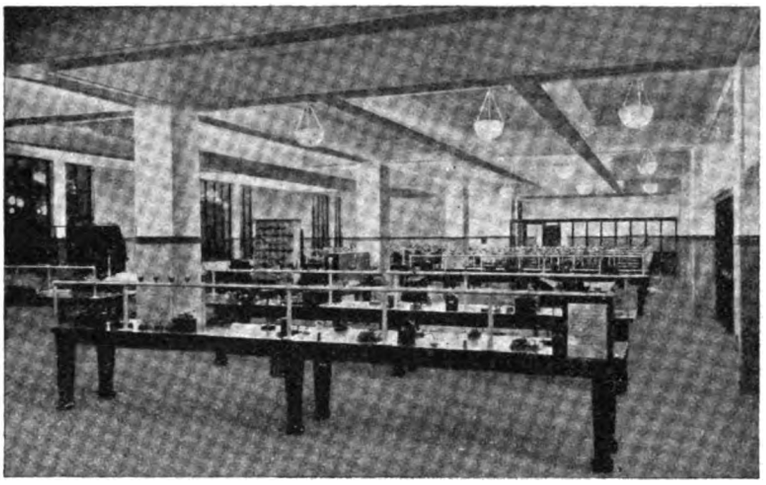
OVERSEAS NOTES.

A Large Lighting Installation.

It is interesting to note that the New General Post Office in Perth, Western Australia, which comprises nine floors, including the basement, is claimed to have the largest individual installation of electric lighting in the State of Western Australia, and one of the largest in the whole Commonwealth. The electrical equipment work was carried out by the Electrical Engineers' Branch of the Public Works Department, and the installation is remarkably complete. In all, some 8 miles of steel conduit were employed, and 42 miles of insulated wires and cable. Not only is electricity used for lighting throughout, but there are 335 power points for vacuum cleaners, radiators, fans, etc., four passenger, and three goods lifts, and a complete electric cooking and hot water installation for the kitchen. There is a power installation for telegraph operating, a very complete system of fire alarms and watchmen's clocks, and of course, a number of lightning arresters. The illustration shows a typical room, the photograph being taken at night by the light of the artificial illumination alone. In all some 780 electric lighting points have been installed, of which 495 are semi-indirect fittings equipped with "Equiluxo" glassware. "Osram" electric lamps, both of the vacuum and gasfilled types are used exclusively throughout.



VIEW IN THE NEW G.P.O. AT PERTH, WESTERN AUSTRALIA, SAID TO BE THE LARGEST INDIVIDUAL ELECTRIC LIGHTING INSTALLATION IN WESTERN AUSTRALIA.

Canadian Hydro-Electric Schemes.

The British Columbia Electric Railway Co., which, since its absorption of the Western Power Co. of Canada, has become one of the largest Canadian concerns in the production and distribution of hydro-electric power, is, a "Manchester Guardian" correspondent states, about to begin construction work on the first of three new projects which will ultimately add 160 000 H.P. to the capacity of the existing system. The complete scheme will probably be ready in 1933. The plans provide for the construction of a fifth unit adjacent to the existing Stave Falls plant, the utilisation of Alouette Lake water for another plant, and the construction of a third station on the Stave River. The Alouette Lake project consists in the diversion of its water to Stave Lake by a tunnel at the lower end of which will be constructed a plant to develop 9 000 kVA on a load factor of 85 per cent.

Owing to the necessity of obtaining additional plant capacity before the winter of 1924, it is probable that the fifth unit of the present Stave Falls plant will be constructed first, but it is the intention of the company to begin the work on Alouette Lake immediately. The fifth unit will be of 18 000 kVA capacity, and when completed the Stave Falls undertaking will be capable of generating 285 000 000 kWh per annum. The total dependable capacity of the entire system on the completion of the entire scheme will be 813 000 000 kWh.

Swedish Railways and Foreign Tenders.

Although foreign tenders were cheaper the Swedish State Railways have decided, it is reported, to place the contracts for the electrical equipment required for the Stockholm Gothenburg line, to Swedish firms. Similar action has been taken over tenders for five transformers for which the German A.E.G. and the Siemens-Schuckertwerke had made offers; the Swedish General Electric Co., whose tender was about 8 per cent. above the lowest offer submitted by the Siemens-Schuckert Co., has been given the contract.

Exporting Electrical Energy.

In some statistics relating to the exportation of electrical energy from Switzerland, issued by the Federal Council recently, it is stated that the power available in the country is 3 000 000 kW, of which 800 000 kW are already utilised. Export permits have been granted for 360 000 kW, from which 200 000 kW may be deducted, as arrangements for dealing with it have not yet been completed. It is expected that the revenue from this exportation will be approximately 10 000 000 fr.

The Toronto Hydro-Electric System.

In their 12th annual report on the operations of the Toronto Hydro-Electrci System, the Toronto Electric Commissioners state that the most important feature of the business of the Toronto Hydro-Electric System in the year 1922 was the completion of the negotiations leading to the purchase by the Hydro-Electric Power Commission of Ontario of the local distribution plant of the Toronto and Niagara Power Co., and the transfer of this plant to the City of Toronto to be operated by the Toronto Hydro-Electric System. Electrical energy purchased from the Hydro-Electric Power Commission of Ontario during the year cost $1 854 269.16 or 42·2 per cent. of the gross income, against $1 111 019.01 for the preceding year, or 30·7 per cent. of the gross income of that year. The number of consumers increased by over 11 100, and the total energy consumption was 44 198 482 kWh in excess of the consumption in 1921. These figures are exclusive of the figures for the local distribution plant of the Toronto and Niagara Power Co., which were not added to the System's figures until the end of the year.

Water Power in Bavaria.

Since 1919 construction work on a large scale to develop the natural water-power resources of Bavaria has been in progress. The project includes the laying of 1 154 miles of 110 000 V transmission lines and the building of 43 power stations and 11 large transformer stations. One section alone is expected to generate 986 000 000 kWh annually.

At Lake Walchen, one of the three main sections, the power is to be transmitted, a "Times" correspondent states, by a double 110 000 V transmission line to the transformer station at Munich, and the transformer stations at Munich and at Meitingen, Nuremberg, Amberg, Ratisbon and Landshut, which are joined by a transmission ring. The two main transmission lines branch off from this ring, one to Nuremberg and the other over Arzborg to Hof. The Middle Isar project, or second main section, has necessitated the construction of an artificial canal 50 miles long, along the banks of which four power stations are now being built.

The main object of the Rhine-Main-Danube works, the third section, is to improve these waterways. The work, when completed, will include 33 power stations with an estimated capacity of 350 000 H.P.

Pulverised Lignite as Fuel.

A communication has been received from the office of His Majesty's Trade Commissioner at Winnipeg, to the effect that there is a proposal at present under consideration by the city of Winnipeg to instal a central steam heating plant for the business area. According to a pamphlet issued by the Winnipeg Hydro-Electric System on this subject the proposal is to build a central steam heating plant in conjunction with the hydro-electric standby plant which is now being installed. The area to be heated will be on the west side of the Red River with a radius of about one mile from the plant. At the present time the standby plant is designed to run on oil. If the present proposal materialises, it will be adapted to the use of pulverised lignite from Saskatchewan which, it is estimated, can be laid down in Winnipeg for about $4.50 per ton. Firms desirous of offering plant or materials of British manufacture in connection with these proposals, in the event of the scheme being adopted, should communicate with the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1 (quoting Reference No. 12595/E.D/E.P.).

South African Electricity Supply.

At a meeting of ratepayers at Beaufort West, South Africa, it was decided according to the "Cape Times" to raise a loan of £14 000 for a new electricity supply scheme. Mr. Adendorff, the municipal consulting engineer, is understood to have prepared a scheme, the main points of which are that the present plant, which cannot cope with the demand, and is being worked at a heavy loss, should be scrapped, and that a new power station should be erected to supply the requirements of the town and also to give a bulk supply to the Railway Administration. At the present time the Council is taking a supply from the Railway Administration during certain hours of the day.

Developments in Esthonia.

It is announced by the Esthonian Legation in London that the construction of a large central station at Ellamaa has been completed and will supply electrical energy to the State railways between Tallinn, Hapsal, Baltiski, the wireless station at Hapsal, the cities of Tallinn and Hapsal, and various other places. The power station is situated about 60 kilometres from Tallinn (Reval) on peat bogs, from which it obtains its fuel. The cost of construction of the station, and the necessary machinery for excavating the peat, such as peat dredges, presses, etc., has cost about 32 000 000 Esthonian marks.

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BUSINESS OPPORTUNITIES AT HOME AND ABROAD.

Contracts Open.

LONDON COUNTY COUNCIL, December 31st.—One 3-ton three-motor overhead travelling crane, and one 30 cwt. motor-driven portable workshop crane for the tramway central repair depot, with six months' maintenance in both cases. Specifications from the General Manager, L.C.C. Tramways, Victoria Embankment, W.C., on £2 deposit.

GRAVESEND CORPORATION, December 31st.—Electric wiring of houses, etc., under the assisted wiring scheme. Specifications from the Borough Electrical Engineer, Suffolk Road, Gravesend.

ALDERSHOT BOROUGH COUNCIL.—January 1st.—Supply of 500 yards four-core paper insulated, armoured cable. Specification and form of tender from the Engineer, Electricity Works, Laburnum Road, Aldershot.

BRI CHUALANN (BRAY) URBAN COUNCIL, January 1st.—About 800 yds. of steel tape, armoured, paper insulated, 4-core cable, connecting boxes, etc. Specification from the Electrical Engineer.

PORTHCAWL URBAN DISTRICT COUNCIL, January 7th.—Schemes for installation and operation of an electricity supply undertaking in the district. Particulars from the Clerk, Council Offices, Porthcawl.

MANCHESTER CORPORATION, January 8th.—One 2 500 kW motor converter (lighting and power service) and six 1 050/1 270 kW motor converters (lighting, power and traction services). Specification from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall, Manchester; deposit £2 2s.

COUNTY OF LONDON ELECTRIC SUPPLY CO., January 10th.—Complete electric lighting installation for Barking power station. Specification from Mr. F. C. McQuown, manager and secretary, Moorgate Court, Moorgate Place, London, E.C.2; deposit £5 5s.

CARDIFF CORPORATION, January 14th.—One 40 000 lb. water tube boiler, for the Electricity Department. Specification from the Electrical Engineer, The Hayes, Cardiff. Only manufacturers on the King's National Roll are invited to tender.

ISLINGTON (LONDON) BOROUGH COUNCIL, January 17th.—5 000 kW two-phase turbo-alternator, condensing plant, piping, etc. Particulars from the Electrical Engineer, 60, Eden Grove, Holloway, N.7.

SUNDERLAND CORPORATION, January 21st.—Plant for Hylton Road Electricity Works, including: Section A.—One 10 000 kW alternator, turbine and condensing plant; section B.—two straight tube water-tube boilers, each of 50 000 lb. evaporative capacity per hour; section C.—natural draught wooden cooling towers, and foundations. Specification from the General Manager, Electricity Offices, Dunning Street, Sunderland; deposit, £3 3s. for each section, in duplicate.

Overseas.

COMMONWEALTH OF AUSTRALIA, January 3rd (London).—Telephone and telegraph apparatus (T. 415). Tender forms, etc., from the Supply Officer, Australia House, Strand, London, W.C.2.

NEDERLANDSCHE HANDELMAATSCHAPPIJ, AMSTERDAM, January 3rd.—High and low voltage plant for new building. Specification from the company's offices, Heerengracht, Amsterdam, on payment of 35f.

SYDNEY CITY COUNCIL, January 7th (in Australia).*—Electrically driven coal unloading and conveying plant at Darling Island power house. February 18th.*—Armour-clad switch-gear. February 25th (extended from November 19th.)—Stepdown transformers (Contract 758).

VICTORIAN RAILWAYS COMMISSION, January 9th (in Australia).*—Spring coiling machine with electric motor, and taper rolling machine with electric motor (Contract 36 659); also two small induction motors with starting apparatus.

INDIA STORE DEPARTMENT, January 14th.—Turbo-alternator, condensing plant, cranes, boiler, economiser, pumps, steel chimney, steam and exhaust pipework, switchboard, motor converter, rotary converters, sub-station plant, e.h.t. feeder cables and auxiliaries, for new power station and sub-station at Delhi. Forms of tender from the Director-General, India Store Department, Branch No. 12, Belvedere Road, London, S.E.1.

MELBOURNE CITY COUNCIL, January 14th.—Totally enclosed armoured type 6 600 V three-phase switchgear. Specifications from the City Electrical Engineer.

CITY OF TORONTO, January 15th.*—Centrifugal sludge pump, direct connected to 2 200 V 3-phase 25 cycle variable speed induction motor, running at about 730 revs. per min. at full load (Contract No. 58); and electrically driven air compressor, with accessories, and one separator.

POST AND TELEGRAPH DEPARTMENT, WELLINGTON, N.Z., January 16th.*—Galvanised iron arm bolts and nuts.

VICTORIAN ELECTRICITY COMMISSION, January 19th.—Transformers, switchgear and accessories for sub-station B. Specification (Nos. 23/145 and 24/2) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

ARGENTINE SANITARY WORKS DEPARTMENT. January 21st.*—Supply and erection of steam-driven electrical generating plant for the waterworks at Posadas.

JOHANNESBURG MUNICIPAL COUNCIL, January 21st.*—240 steel tramway poles with finial and centre clamps; and 5 miles 0·4 in. round section h.d. copper trolley wire.

EGYPTIAN PORTS AND LIGHTS ADMINISTRATION, January 21st.*—Stores for 1924-5, including electrical articles, asbestos goods, belting, etc.

POST AND TELEGRAPH DEPARTMENT, WELLINGTON, N.Z., January 30th*.—30 000 galvanised iron earthrods.

TARANAKI (N.Z.) POWER BOARD, January 30th.*—Electric generators and switchgear.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS DEPARTMENT, February 6th.*—Equipment of two sub-stations. February 27th.*—Motor generator sets. February 27th.*—Motor-driven air compressors, and batteries for switch operating.

SYDNEY HARBOUR TRUST COMMISSIONERS, February 11th.*—Supply and installation on runway tracks in wharf shed, No. 6 Berth, Darling Harbour, Sydney, of one 5-ton electrically-operated overhead travelling bridge crane.. (Contract No. 23/36.)

SYDNEY HARBOUR TRUST COMMISSIONERS, February 11th.*—Two double-drum horizontal electric capstans or warping winches. (Contract 23/34.)

VICTORIAN ELECTRICITY COMMISSION.—February 11th (in Melbourne).—Four 100 kVA 25 400–6 600 V transformers and spares (specification No. 24/4). Specification, etc., from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2. Deposit 10s.

METROPOLITAN WATER SUPPLY AND SEWERAGE BOARD, BRISBANE. March 11th.—H.T. aerial transmission line from Breakfast Creek to Luggage Point, and electrical equipment, pumps, blowers and auxiliaries. Specifications from the Secretary, Albert Road, Brisbane, Queensland; deposit £7 7s. for the seven sections of the work.

ARGENTINE STATE OILFIELDS ADMINISTRATION, March 21st*—Erection and equipment of 11 250 kW electric power station.

PUBLIC WORKS TENDERS BOARD, WELLINGTON, N.Z. May 23rd (extended from April 30th).*—Design, manufacture, supply, erection, testing and maintenance for six months, of a hydro-electric power station at Arapuni, on the Waikato River, including machinery and plant, outdoor step-up transformer station and accessories.

GREEK GOVERNMENT.—Schemes for utilising the waterfalls at Peloponesus for electric power and lighting in Athens. The estimated cost is 15 million gold francs.

Tenders Accepted.

PORTSMOUTH GUARDIANS.—H. A. Evans, electric fittings, £31 0s.

DUMFRIES CORPORATION.—Premier Cooling and Engineering Co., cooling tower tank, £386.

WALTHAMSTOW.—Empson Centrifugals, Ltd., oil purifier for the electricity works, £231 10s.

TELEGRAFIA COMPANY, PRAGUE.—Ten years' licence to use the patents of the Relay Automatic Telephone Co.

BELFAST CORPORATION.—John Graham, laying tramway line in Chichester Street and the extension to Dundonald Cemetery.

BRITISH POSTMASTER-GENERAL.—Siemens Bros. and Co., new submarine telephone cable, to be laid between England and Holland.

MONTREAL.—Daniel Adamson and Co., automatic sewage ejector plant driven by automatic electro-pneumatic air compressing plant.

LLANDUDNO.—Daniel Adamson and Co., automatic sewage ejector plant driven by automatic electro-pneumatic air compressing plant.

HAMMERSMITH (LONDON) BOROUGH COUNCIL.—Wm. Boby and Co., water softening plant for the electricity works, £257 (recommended).

LAMBETH (LONDON) BOROUGH COUNCIL.—Higgs and Hill, electric light installation at the Coroner's Court and mortuary, £119 4s. 3d. (recommended).

STEPNEY (LONDON) BOROUGH COUNCIL.—B. Thomas (lowest), power circuit board for Limehouse generating station, £151. Three tenders received, highest £332.

BATTERSEA (LONDON) BOROUGH COUNCIL.—Park Royal Engineering Co. (£564) and Metropolitan-Vickers Electrical Co. (£419) for switchgear (both recommended).

ST. PANCRAS (LONDON) BOROUGH COUNCIL.—De Laval, Chadburn and Co., portable oil-purifying installation for the electricity department, £352 10s. (recommended).

BARKING URBAN DISTRICT COUNCIL.—Bolckow, Vaughan and Co., rails and fishplates required for reconstruction of light railway from Abbey Road to the carsheds, £1 898 4s. 7d.

LONDON COUNTY COUNCIL.—Bolckow, Vaughan and Co. (lowest tender), 5 100 tons of track rails and fastenings, £57 080. Three tenders were received; highest £58 850. Three alternative tenders for 3 400 tons also received: Bolckow, Vaughan and Co., the lowest, being £37 805, and the highest £38 540. J. Keith and Blackman (lowest), ventilating fans, motors, etc., for Rotherhithe tunnel, £1 600. Five tenders received; highest £2 206. Industrial Constructions, Ltd., coal bunker for Greenwich power station £34 876 (recommended). The original alternative tenders of Industrial Constructions were £32 015 and £32 859. The latter, after amendment, became £34,243, and a further £633 was added by way of substituting a fixed price for an "up and down" clause according to the price of steel.

* Particulars from the Department of Overseas Trade.

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ELECTRICITY SUPPLY.

Extensions and Developments.

Lanarkshire County Council has decided to expend over £6 000 on extensions to the Cambuslang electricity works.

Dumfries Town Council has agreed to the principle that electric lighting should be introduced into all municipal houses.

Steps are being taken at Billericay (Essex) to form a company for the purpose of supplying electrical energy to the parish and district.

Bath Town Council has applied to the Electricity Commissioners for a loan of £80 000 for extensions to the electricity works and the purchase of additional plant.

Wigton Board of Guardians has appointed a Committee to consider the advisability of having electric lighting installed at the Institution, which is at present served by gas.

The application of the Douglas (Isle of Man) Town Council for a further loan of £45 000 for electricity purposes has been held up for the time being owing to opposition at the inquiry.

Burnley Electricity Committee is contemplating mains extensions for a distance of 1 080 yards down Barden Lane, and along Mizpah Street and Manchester Road for a distance of nearly 700 yards.

Luton Town Council has applied to the Electricity Commissioners for a loan of £42 327 for extensions to the plant at the electricity works, this sum including £5 000 for mains, substation and rectifier.

Burnley Electricity Committee has just elected representatives on the Interim Advisory Board which it is proposed to set up, pending the formation of the Mid-Lancashire Electricity Area Committee.

Carlisle Board of Guardians has decided to approach the city electrical engineer with a view to a report being prepared by him as to the best method of utilising electricity for lighting and power at the Fusehill Institution.

Bexley Urban Council has decided to proceed with negotiations with the Woolwich Borough Council for a supply of electricity in bulk, the terms from Woolwich being the most favourable received. In anticipation of the supply being secured, the Council has selected a site for the erection of a sub-station.

Rayleigh (Essex) Parish Council has decided to confer with the representative of the Wickford and District Electricity Supply Co., with reference to a supply of electricity to the parish. The Southend-on-Sea Corporation had informed the Council that it was not prepared to lay mains in Rayleigh at present.

Kettering Urban Council has received sanction to a loan of £2 893 for the provision of a new showroom, offices, etc., in connection with the electricity undertaking. The Commissioners have approved of the special extension order applied for, but the order will not be operative until the approval of Parliament has been received.

Inquiries and Orders.

Adwick-Le-Street Urban Council has applied to the Electricity Commissioners for a Special Order authorising the Town Council to generate and distribute electricity in its area.

An application has been made to the Electricity Commissioners by Major W. J. King, architect and surveyor, of 5, Great James Street, Bedford Row, London, W.C.1, for a Special Order to supply electricity in the parishes of North and South Mimms. The electrical engineer to the scheme is Mr. Terence G. Bacon, of The Lighting, Heating and Traction Supplies Co.

Municipal Electrical "Old Stagers."

Last year all those known to come within the definition of a "Municipal Electrical Old Stager" (see below) were communicated with and all replies were in favour of holding a further reunion similar to the one arranged in 1922. The majority were in favour of the function being held every two years rather than annually or triennially. It was also the general opinion that the qualifications for an "Old Stager" should remain as before, viz., all those who before December 31st, 1900, were chief engineers in municipal electrical undertakings or who were assistant engineers (electrical or mechanical) before that date and who at any subsequent time became chief engineers.

The Committee, consisting of Messrs. S. W. Baynes, J. Christie, R. S. Downe, E. T. Ruthven Murray, H. Faraday Proctor, G. Scott Ram, and C. H. Wordingham has arranged to hold the dinner at the Hotel Cecil on January 17th, 1924, at 7 p.m. As before, there will be only one toast in addition to the loyal ones, one speaker proposing and two responding. At the close of the speeches the party will adjourn to another room to talk over old times and to inspect objects of interest lent by "Old Stagers."

It is proposed to invite the following guests: Mr. S. E. Britton, President of the I.M.E.A., Mr. H. Booth and Sir Harry Haward, the only two Commissioners not eligible to attend as "Old Stagers," Mr. W. L. Madgen, first hon. secretary of the I.M.E.A., Dr. S. Z. de Ferranti, and Mr. Spencer Hawes. In order to retain the distinctive character of the gathering, namely, the meeting together of old friends, all of whom practically know each other, no private or other official guests are invited. Tickets, price 25s. each, inclusive of wines, can be obtained from Mr. C. H. Wordingham.

Articles of historical interest, including examples of early apparatus, relics of faults, photographs of early stations, etc., which "Old Stagers" are willing to lend for the evening will be greatly appreciated.

ELECTRIC TRACTION.

Hull City Council has approved the promotion of a Bill in Parliament to sanction tramway extensions and other works.

A motion to forbid the taking of dogs on the Corporation tramcars was rejected by 81 votes to 3 at a Glasgow Corporation meeting.

Belfast Council is employing over 200 extra men in tramcar cleaning and renovation. The Ministry of Labour will pay 60 per cent. of the cost.

The extension of the Belfast Corporation Tramways to the Ulster Parliament Buildings at Stormont was officially inspected last week, preparatory to its opening for public service.

A town's meeting will shortly be held in Leicester to consider a scheme for new roads running round, and not through, the centre of the city, and in which tramcars and heavy traffic will be accommodated.

A new section of tramway between Seven Sisters Road, London, and Stamford Hill, makes it possible for a passenger to take a circular, or rather a "horseshoe" journey of 11 miles in length between Tottenham Court Road and Aldgate.

The Bill promoted by Manchester Corporation in the next Session of Parliament proposes the expenditure of £560 000 on tramways and £100 000 on car depots, garages, etc. Amongst other provisions there is one to compel drivers of vehicles, before passing tramcars on the left or near side, to stop until the road is clear of persons entering or leaving such tramcars.

London County Council Highways Committee recommends that an estimate of £46 500 for new plant to supersede the existing rotary converter plant in the Elephant and Castle sub-station be approved. At the meeting of the Council last week Mr. C. W. Matthews, chairman of the Highways Committee, in reply to questions, stated that the Committee did not think the present time opportune to proceed with the electric heating of the tramcars. It was not practicable to increase the number of cars to meet the alleged "dead set" by the omnibuses. The City Corporation had been asked to communicate its decision as to consent to the Council's Southwark Bridge tramway proposal by January 17th. The Council would not proceed with the project if a definite refusal were received.

Fares, Receipts and Passengers.

Birkenhead Corporation is extending the penny stages on the various tramway routes, and further extensions will be made if the receipts warrant such action.

Mr. R. S. Pilcher, manager of the Edinburgh Corporation Tramways, has suggested that season tickets for travelling on the Corporation's tramcars and omnibuses should be issued for six months on certain routes, as an experiment. The Tramways Committee has decided not to take any action in the matter at present.

Receipts on the tramways and the omnibuses (M.E.T. Omnibus Co.) controlled by the Underground Electric Railways Co. of London, during the week ended December 15th were £38 434, a decrease of £4 941 compared with the corresponding week last year. The aggregate from January 1st to December 15th was £1 987 954, a decrease of £214 128.

Electric Railway Items.

The Mersey Railway Co.'s traffic receipts during the week ended December 15th were £4 301, and the total receipts from January 1st to December 15th were £225 246.

Change-giving machines have been installed at the Liverpool Street, Earl's Court, Brent, Hendon, Victoria and Paddington stations of the London Electric Railway Co. It is stated that a passenger can be given a ticket and change in four seconds.

Fifteenth Electrical Engineers' Ball.

The fifteenth annual Electrical Engineers' Ball will be held at the Hotel Cecil, London, on February 22nd next, when it is hoped that last year's record attendance of 530 will be exceeded. The General Committee and officers for the Ball are:—GENERAL COMMITTEE.—Sir T. O. Callender, Sir James L. Devonshire, Dr. S. Z. de Ferranti, Sir Arnold Gridley, Sir James Kemnal, Lieut.-Col. F. A. Cortez Leigh, Sir Philip Nash, Sir. Wm. Noble, Col. H. E. O'Brien, Col. W. A. J. O'Meara, Col. T. F. Purves, Sir John Snell, Sir George Sutton, Capt. G. Taylor, Capt. R. J. Wallis-Jones, Messrs. G. L. Addenbrook, H. Alabaster, Leonard Andrews, Ll. B. Atkinson, O. H. Baldwin, George Balfour, M.P., J. H. Bowden, E. C. Byng, R. A. Chattock, A. C. Cramb, A. J. Cridge, H. W. Couzens, T. C. Elder, H. W. Fairman, E. J. Fox, E. Gatehouse, Kenneth Geipel, Frank Gill, M. M. Gillespie, James Gray, J. P. Gregory, A. E. Hadley, J. S. Highfield, C. W. Hill, Hugo Hirst, P. V. Hunter, R. W. Hughman, Douglas Kerr, J. E. Kingsbury, H. M. Leaf, W. Stanley Lonsdale, J. J. McGregor, A. E. McKinstry, H. T. S. McKay, P. V. McMahon, W. Lee Matthews, W. M. Mordey, E. W. Moss, F. H. Nalder, E. S. New, G. W. Partridge, T. Petersen, F. Pooley, P. J. Pybus, M. J. Railing, L. L. Robinson, F. M. Rogers, P. F. Rowell, W. Rutherford, C. E. Sayer, H. Scholey, H. C. Siddeley, A. M. Sillar, C. P. Sparks, C. D. Taite, James Taylor, J.P., A. H. Walton, David Wilson and C. H. Wordingham. EXECUTIVE COMMITTEE.—O. H. Baldwin, W. S. Lonsdale, A. M. Sillar, R. J. Wallis-Jones, J. E. Kingsbury, P. V. McMahon, C. H. Wordingham and A. H. Walton. HON. SECRETARIES.—A. M. Sillar, W. S. Lonsdale. HON. TREASURER.—J. E. Kingsbury.

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COMPANY NEWS.

Meetings, Reports and Dividends.

BENN BROTHERS.—The usual interim dividend of 5 per cent. will be payable on January 1st.

TUCUMAN TRAMWAYS, LIGHT AND POWER CO.—The net profit for the year ended June 30th was £4 470, and the adverse balance brought forward was reduced to £63 562.

MARCONI INTERNATIONAL MARINE COMMUNICATION CO.—An interim dividend of 5 per cent. (1s. per share), less tax, on shares Nos. 1 to 1 192 726 on account of the year ending December 31, 1923, will be payable on January 14th.

EDMUNDSON'S ELECTRICITY CORPORATION.—Dividends on the preference shares for the past half year at the rate of 6 per cent. per annum, less tax, and an interim dividend at the rate of 6 per cent. per annum, less tax, on the ordinary shares are announced.

CLAUD HAMILTON, LTD.—The directors recommend a dividend of 2½ per cent. for the past year, and it is proposed to place £5 000 to general reserve, leaving £8 342 to carry forward; £10 000 is to be transferred from general reserve for writing down goodwill.

CHARING CROSS, WEST END AND CITY ELECTRICITY SUPPLY CORPORATION.—The directors' proposals to divide of the £5 shares into £1 shares, to convert the unissued preference into ordinary shares and authority to make a bonus issue were approved by the shareholders last week.

OFFICIAL QUOTATIONS.—The Stock Exchange Committee has ordered £1 303 192 6 per cent. convertible debenture stock of the English Electric Co. and £128 318 6 per cent. income debenture stock (in lieu of preference shares now quoted) of the Kalgoorlie Electric and Lighting Corporation to be quoted in the Official List.

AMERICAN AND FOREIGN POWER CO.—The formal public offering of 400 000 shares of preferred stock of the American and Foreign Power Co. at $96 per share was made in New York last week, but it was announced that the entire issue had been subscribed for in advance. With each share of preferred stock one share of common stock was given as a bonus. The remainder of the 520 000 shares of common stock and the whole of the second preferred stock (120 000 shares) are owned by the Electric Bond and Share Co., which is said to be controlled by the General Electric Co. of New York.

DURELCO, LTD.—After writing off one-fourteenth of the debenture expenses, the accounts for the year to September 30th show a loss of £1 973, which reduces the credit balance brought in to £8 125. No dividends have been declared during the past year by the subsidiary companies. The stoppage of work necessitated by the installation of new machinery at Bedford reduced production to a large extent, and the directors have thought it wiser to conserve the cash resources. They look forward with complete confidence to the trading results of manufacturing companies during the ensuing year. At the meeting on Friday last, the chairman, the Earl of Kintore, stated that their electric lamp company, Cryselco, Ltd., had secured a licence to operate under the patents controlling half-watt type lamps. The production of molybdenum wire, hitherto handled by Metal Manufacturers, Ltd., would in future be dealt with by Duram, Ltd. The business of the latter company was steadily increasing, and it had produced 20 million metres of tungsten wire during the year under review.

BURMAH ELECTRIC TRAMWAYS AND LIGHTING CO.—At the annual meeting last week the chairman, Mr. C. O. Webb, stated that the working profit for the year ended July 31st last was £21 866, compared with £16 546 for the previous year, the increase being due chiefly to the increase in the receipts for the sale of energy for light and power and the reduction in the cost of upkeep of the power-house plant. Interest on investments and the balance brought forward made the total sum available £23 946. It was proposed to place £7 500 to depreciation fund and £645 to employees' gratuity fund. Loss on exchange amounted to £203, dividend at 11 per cent. on £100 000 preference capital required £11 000, and the balance carried forward would be £4 098. In the early part of the year it was agreed that the preference capital should be increased by 50 000 shares of £1 each, and the preference shareholders agreed to accept 20 000 shares and a payment of 11 per cent. in cash in satisfaction of dividend and arrears on the old preference capital. He (Mr. Webb) thought the shareholders might congratulate themselves on the earning power of their undertaking and the soundness of the balance-sheet. The company's success was due to a very large extent to light and power, but the tramway business was also improving.

New Companies.

ART LIGHTS, LTD.—Cap., £5 000. To acquire business of C. G. Smith, electrical engineer, Cheltenham. Reg. office: 115, Colmore Row, Birmingham.

BEN THOMAS AND CO., LTD.—Cap., £1 000. Electrical, mechanical and general engineers, tramway proprietors, etc. Reg. office: Lon Fach, Rhiwbina, Cardiff.

PORTARLINGTON ELECTRICITY SUPPLY CO., LTD.—Cap., £3 000. To acquire business of Portarlington Electric Light and Power Co., Ltd., at Portarlington. (Public company.)

RADIO CORPORATION (SCOTLAND), LTD.—Cap., £1,000. Dealers in and manufacturers of wireless transmitting and receiving sets, etc. Reg. office: 68, Brandon Street, Motherwell.

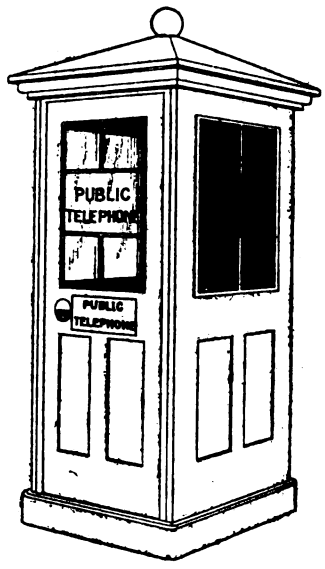
TELEGRAPH & TELEPHONE.

Manchester is to have an automatic telephone exchange.

The Western Union Telegraph Co. announces a special service of New Year cable messages of greeting to places in Newfoundland, Canada and the United States at special rates.

Speaking at the annual meeting of the Colombian Northern Railway, the chairman (Mr. P. C. Matts) said the company had its own telephone and telegraph system. The wood poles on the last seven kilometres had recently been replaced by poles made from old rails removed from the track. These provided a very permanent support for the wires and at the same time effected very considerable economies.

A new type of street telephone kiosk will shortly be introduced in London streets. Made up in sections of reinforced concrete, and fitted with a wooden door, the kiosks will, as shown in the accompanying illustration, be provided with glazed panels on the two sides and front. The three concrete sections fit into the base and top, all joints being filled in with cement to lock the whole together.



All parts of the Empire will be connected by telephone at the British Empire Exhibition at Wembley next year. A system of internal communication is being installed by the Relay Automatic Telephone Co., to connect all the Dominions and Colonies with each other and with the Exhibition Headquarters. The company is arranging for over two hundred lines. The switchboard, which will be accommodated on Stand S.778 in the Building Section will be open to inspection. The company is at present working on the switchboard for the Exhibition. Work in installing the lines was begun on December 1st, and the whole system will be ready for use on January 1st. In addition to the exchange in the Building Section, the Relay Co. is occupying a site of 500 sq. ft. in the Engineering Section, where latest models of public exchange, private automatic exchange and private automatic branch exchange apparatus will be shown in operation. A private automatic branch exchange is also being exhibited in the British Government Pavilion.

Reporting on the trade of Kashgar, Mr. C. P. Shrine, H.M. Consul-General for that province, says the telegraph service is unsatisfactory, chiefly owing to the insufficiency of the pay allowed to the staff and to the low power employed at the stations. So low is the power used along the line, at any rate, in Hsinkiang, that messages have to be re-signalled thirteen times between Kashgar and Urumchi. The result is that telegrams in code or in English between Peking and Kashgar usually arrive in a hopelessly corrupt state after a delay of a week or more. For some reason the telegraph line stops at Kashgar, the important commercial and agricultural centres of Yarkand, Khotan, Karghalik, and Yangi Hissar not being served. This is the more surprising, states Mr. Shrine, in that a line connecting Yarkand with Kashgar, Urumchi, and Inner China could not fail to be an exceedingly paying proposition.

According to the Milan correspondent of the Federation of British Industries, the handing over of the Italian telephone system to private companies has been the subject of considerable correspondence between British and Italian firms in the hope that an arrangement might be arrived at whereby a certain amount of British capital would be invested in this particular project and British material used in the new systems, but nothing definite has been decided. In the meantime a German company has come forward with lire 20 000 000 for the establishing of such a company in Milan. It is proposed to raise capital for the new company, and it is said that it will not be necessary to use any of the original capital. Arrangements have still to be made regarding the telephone systems in Tuscany (including Florence), Piedmont (including Turin), and Liguria (including Genoa). "It is also understood," the report concludes, "that German firms do not manufacture automatic switchboards, which, when put into operation, will come from England or the United States."

At a meeting of the Hull Corporation Telephones Committee last week, the Chairman suggested that, before considering further the question of substituting an automatic switch-board at the Wincolmlee Exchange for the present manual board, the Committee should inquire as to the intentions of the Bridges Committee with regard to the construction of a new North Bridge. It might be that the construction of the bridge, with its approach road, would necessitate the removal of the present exchange. In that case, it would not be advisable to proceed with the installation of a new automatic switchboard.

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COMMERCIAL INFORMATION

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ALLISON, Mr. W., 97, Leigh Road, Leigh-on-Sea, electrical contractor. £19 6s. 7d. November 6th.

CUNNINGHAM SLATER, LTD., 146, Kensington High Street, W., electrical engineers. £12 17s. 10d. November 12th.

GREENER, O., AND CO., Rosemount Garage, Salcombe, electrical engineers. £10 8s. 6d. November 9th.

LUMENS, LTD., 12–14, Great Ducie Street, Manchester, electrical fitters. £12 18s. 6d. November 8th.

McCARTHY, B., 166B, New Kings Road, Fulham, electrical engineer. £19 11s. November 15th.

NEAL WOOD AND CO., Beccles, electrical engineers. £23 1s. 4d. November 13th.

STENFORTH, Mr. G., 78A, High Street, Margate, electrical engineer. £16 3s. November 8th.

Receiverships.

BIRMINGHAM CENTRAL SUPPLY CO., LTD. W. Lloyd, of 19, Priory Street, Dudley, ceased to act as receiver or manager on December 15th, 1923.

HATCHAM MANUFACTURING CO., LTD. A. L. Leonard, of 8, Layer Gardens, Acton, W., was appointed receiver and manager on November 15th, 1923, under powers contained in debenture dated August 27th, 1923.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

B. N. B. WIRELESS, LTD., Liverpool. Registered December 4th. £500 2nd debentures; general charge (subject to 1st debenture), *£300. November 19th, 1923.

ELECTROLUX, LTD., London, W., electricians. Registered December 5th, debenture, to bank; general charge. *——. October 5th, 1923.

Satisfactions.

GENERAL ELECTRIC CO., LTD., London, W.C. Satisfaction registered December 10th, £37,400, part of amount registered July 26th, 1921.

LEATHERHEAD AND DISTRICT ELECTRICITY CO., LTD. Satisfaction registered December 10th, £9,150, registered February 24th, 1921.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Companies Winding-up Voluntarily.

ANGLO-POLISH ELECTRICAL DEVELOPMENT CORPORATION, LTD. E. Noel Humphreys appointed liquidator.

CAR IGNITION AND LIGHTING CO., LTD. J. P. Cave, 29, Martin Lane, Cannon Street, London, E.C.4, appointed liquidator.

SHORROCK (H.N.) (MORECAMBE) LIMITED.—Meeting of creditors, Kings Arms Hotel, Morecambe on Friday, January 4th, 1924 at 2.30 p.m. Creditors claims by January 31st.

Bankruptcy Information.

GALT, Henry Pickford, 56, Norbury Road, Thornton Heath, Surrey, electrical engineer. Receiving order, December 19th. Debtor's petition.

HALSON, Bertie Niven, 29, Mayfield Road, Northfleet, Kent, electrician. Receiving order, December 14th. Debtor's petition.

SIDWELL, Stanley, 51, Islington Row, Birmingham, electrical engineer. First meeting, December 31st, 11.30 a.m., Official Receiver's Office, Ruskin Chambers, 191, Corporation Street, Birmingham. Public examination, January 30th, 1924, 2.30 p.m., Court House, Corporation Street, Birmingham.

SMITH, Frank, 6, Imperial Buildings, Dale End, Birmingham, wholesale electrical accessories factor. Receiving order, December 13th. Debtor's petition.

Notices of Dividends.

DUFFIN, Albert Harold, trading as A. H. DUFFIN AND CO., Provincial Buildings, Conway Road, Colwyn Bay, electrical engineers and contractors. First dividend of 5s. per £, payable January 16th, 1924, Mostyn Chambers, Colwyn Bay.

WEST, Harry Bernard, 3, Clyde Street, Canterbury, electrician. First and final dividend of 4s. 7½d. per £, payable December 24th, Official Receiver's Office, 10, Burgate Street, Canterbury.

Notice of Intended Dividend.

HOLMAN, Leonard, 11, Camden Road, Bridgwater, Somerset. electrician. Last day for receiving proofs, January 1st, 1924, Trustee, F. W. Darley, 26, Baldwin Street, Bristol, Official Receiver.

Order on Application to Approve Composition.

THORPE, Francis Bertram, electrical engineer, 1A, West Laithe Gate, Doncaster. Composition 12s. 6d. in the £ sanctioned by Court, December 13th, an amount sufficient for this purpose to be paid by three instalments, namely:—5s. in the £ forthwith on acceptance, 5s. in the £ in three months, and the balance of 2s. 6d. in the £ within six months of acceptance. Receiving order discharged and order of adjudication annulled.

Bankruptcy Proceedings.

MITCHELLS' ELECTRICAL AND WIRELESS, LTD., 188, Rye Lane, Peckham, S.E. Under a winding-up order made against this company on October 16th on a creditor's petition the statutory meetings of the creditors and of the shareholders were held on December 19th at the Board of Trade Offices, 33, Carey Street, W.C. The Official Receiver said that the company was registered as a private company in July, 1920, with a nominal capital of £5 000, to acquire the retail business of F. L. Mitchell and Co., Ltd. The first directors, who were also the promoters, were Frederick Lewis Mitchell and Alfred William Knight. No accounts relating to the trading of the vendor company were produced, but Mitchell admitted that no profit was being made. In May, 1922, the company took over from Mitchell and Co., Ltd., the wholesale branch of the business which was being conducted from premises in McDermott Road, Peckham, and later in the same year premises were acquired in Gerrard Street, W., which were used as show rooms. According to the company's accounts, so continued the chairman, the trading until July, 1921, showed a gross profit of £3 171 and a net loss of £165 after charging the profit and loss account a sum of £1 064 in respect of advertising and catalogues. The accounts for the following year disclosed a gross profit of £2 586 and a net profit of £234 on sales amounting to £7 371, while the accounts which covered the period to July last showed a gross profit of £5 395 and net loss of £2 719, but they included £2 971 in respect of salaries and wages. On July 6th last Knight appointed E. S. Thorn, C.A., 68, Coleman Street, E.C., as receiver. He took possession of the assets and he had since disposed of the lease for £650 and part of the stock (£850) to Knight. The receiver was still realising the remainder of the stock and a small surplus was possible. The statement of the company's affairs which showed the position as at the date of the appointment of the receiver for the debenture holders, disclosed liabilities £8 218, of which £5 489 were expected to rank, and assets £4 657, of which £107 were required to meet the claims of preferential creditors and £2 600 to the debenture holder, leaving the creditors with a deficiency of £3 540. A total deficiency of £6 540 was shown in relation to the shareholders. A resolution was passed for the appointment of Mr. W. A. J. Osborne, accountant, Balfour House, Finsbury Pavement, as liquidator. The following are creditors: Brotschi Bros. and Co., Ltd., Grenchen, Switzerland, £481; British Insulated and Helsby Cables, Ltd., Prescot, £65; British Thomson-Houston Co., Ltd., Rugby, £39; Brown, S. G., Ltd., North Acton, £237; British Broadcasting Co., Ltd., £250; Concentric Manufacturing Co., Ltd., Birmingham, £101; Electric and Ordnance Accessories Co., Ltd., Hanley, £161; Evans, G. W., and Co., Hornsey, £776; Gaskell and Grocott, Longport, £67; Gledhill, G. H., and Sons, Ltd., Halifax, £55; Graham, Alfred, and Co., Crofton Park, £80; Hart Accumulator Co., Ltd., London, £85; Hill, Fredk. A., and C., London, £23; Hughes, F. A., and Co., Ltd., London, £30; Hunt, A. H., Ltd., Croydon, £61; Igranic Electric Co., Ltd., Bedford, £22; Leach, S. G., and Co., Ltd., London, £130; London Electric Wire Co. and Smiths, Ltd., London, £345; Mason, A., Sutton, £30; Metropolitan-Vickers Electrical Co., Ltd., Manchester, £113; Mitchell, F. L., and Co., Ltd., London, £221; Mullard Radio Valve Co., Ltd., Balham, £33; Miller, Jno. R. C., Portsmouth, £40; Radio Instruments, Ltd., London, £317; Radio Equipment Co., Ltd., London, £22; Radiophones, Ltd., London, £58;

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PATENT RECORD.

Specifications Accepted.

205 963 A. Chalmers and W. F. Mitchell. Fuse boxes and connections. (23/9/22.)
205 975 H. M. Butler. Axles for electrically driven road vehicles. (3/10/22.)
205 997 K. Baumann and Metropolitan-Vickers Electrical Co., Ltd. Steam turbines. (19/10/22.)
206 007 A. Stubbs and Metropolitan-Vickers Electrical Co., Ltd. Fluid pressure turbines. (2[illegible]/10/22.)
189 446 Metropolitan-Vickers Elfctrical Co., Ltd. Shaft couplings. (23/11/21.)
206 021 F. Jacobacci. Lead storage batteries. (16/11/22.)
206 031 J. N. Collins and W. Grimshaw. Torquemeters. (24/11/22.)
202 262 Western Electric Co., Ltd. Electric transformers and circuits therefor. (8/8/22.)
206 041 C. G. Nobbs and W. W. Nobbs. Electric heating devices. (13/12/22.)
206 042 British Thomson-Houston Co., Ltd. (General Electric Co.). Automatic reclosing electric circuit-breaker systems. (21/12/22.)
192 388 C. and W. Bohnert [Firm of]. Electric table, wall, or like lamps. (26/1/22.)
206 070 Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). Electric circuit controlling devices. (14/2/23.)
206 074 W. Dornig. Antennæ for wireless signalling. (30/11/22.)
206 078 D. Harvie and D. Harvie. Electrical junction boxes. (1/3/23.)
206 081 Western Electric Co., Ltd. (Western Electric Co., Inc.). Electric discharge devices. (3/3/23.)
206 094 F. J. West. Storage batteries. (16/4/23.)
206 098 A. E. Watkins. High resistances for grid leaks, as used in wireless telegraphy and telephony apparatus and the like. (11/6/23.)
191 695 Aeronautical Instrument Co. Earth inductor direction-finding devices. (11/1/22.)
184 733 Aeronautical Instrument Co. Earth inductor direction-finding devices. (13/8/21.)
204 732 Telegraph Condenser Co., W. J. Cole, and S. G. Brown. Electrical condensers. (8/4/22.)
204 734 T. G. P. Healey. Electrically-operated warning-horns of the diaphragm type. (15/1/23.)
195 579 Fahrzeugfabrik Eisenach Zweigniederlassung der Gothaer Waggonfabrik Akt.-Ges. Gotha. Magneto-electrical systems for igniting and illuminating motor vehicles. (31/3/22.)
183 431 Automatic Telephone Manufacturing Co. Telephone systems. (22/7/21.) (Addition to 15 460/21.)
204 764 J. Mirrey and H. W. Clothier. Oil-immersed electric switch fuses. (3/7/22.)
204 769 G. O. Donovan and W. Donovan. Electric lamp holders. (4/7/22.)
204 773 Siemens Bros. and Co. and A. Gordon. Printing telegraph system and apparatus with multiple transmission. (5/7/22.)
204 774 H. Workman. Electric incandescent lamps and lamp-holders therefor. (5/7/22.)
204 778 C. F. Rainsford. Bayonet holders for electric incandescent lamps. (6/7/22.)
204 781 A. S. Gush. Electrolytic means for preventing corrosion in boilers, condensers, supply tanks, and the like. (6/7/22.) (Cognate Application, 24 908/22.)
204 782 C. D. G. Franklin. Device or apparatus for use when setting or examining the contact points of magnetos and like machines. (7/7/22.)
204 792 British Thomson-Houston Co. (General Electric Co., N.Y.). Electric switches. (11/7/22.)
204 798 K. Edgcumbe and E. I. Everett. Electrical measuring instruments. (14/7/22.)
204 805 W. A. Scott. Electrically operated mining plant. (19/7/22.)
204 809 Electric Heating and Hardware, Ltd., and F. J. Wineberg. Electric immersion elements for kettles and other utensils. (21/7/22.)
204 810 J. A. Kuyser and Metropolitan-Vickers Electrical Co. Ventilating systems for dynamo-electric machinery. (21/7/22.)
184 459 A. W. Clement. Ringing control arrangements for telephone exchange systems. (10/8/21.)
198 636 Capitol Phonolier Corporation. Radio-receiving devices. (2/6/22.)
204 827 N. E. North and Metropolitan-Vickers Electrical Co. Electrical couplings. (11/8/22.)
204 843 L. J. Hunt and Sandycroft, Ltd. Alternating-current dynamo-electric machines adapted for synchronous working. (22/8/22.) (Cognate Application, 4 792/23.)
204 848 G. H. Scholes. Junction boxes for electric cables. (28/8/22.)
185 415 Philips' Gloeilampenfabrieken. Discharge tubes with enclosed arc-discharge for alternating current. (30/8/21.)
186 052 C. F. Buffard. Recuperable electric cell. (15/9/21.)
199 691 Handelsvennootschap onder de Firma Vogels & Co. (in liquidation). Manufacture of electric incandescent lamps. (26/6/22.)
186 902 C. D. J. Jamin, Jun. Electrically driven periodically moving mechanisms. (4/10/21.)
204 871 G. Motte. Electrodes for electric arc welding. (14/9/22.)
204 873 H. M. M. Colebrook and L. A. Neale. (Executrices of W. Colebrook (deceased). Electric water-heater. (Patent of Addition not granted.) (15/9/22.)
204 875 British Thomson-Houston Co. (General Electric Co., N.Y.). Electrical apparatus. (18/9/22.)
190 699 Ges. fur Drahtlose Telegraphie. High-frequency telephony. (20/9/21.)
204 910 General Electric Co., Ltd., and C. G. Eden. Electric discharge tubes and the like. (11/10/22.)
190 452 Akt.-Ges. Brown, Boveri et Cie. Electric switches. (14/12/21.)
187 989 L. S. Vello. Moulds for the manufacture of glass caps for electric incandescent lamps and similar apparatus. (29/10/21.)
187 991 L. S. Vello. Incandescent electric lamps and other similar apparatus. (29/10/21.)
204 933 General Electric Co., Ltd., and J. W. Ryde. Electric luminous discharge tubes. (31/10/22.)
190 178 Dr. N. Zonder. Electrical resistance heating-apparatus. (12/12/21.)
204 978 A. B. Ballance and W. T. Anderson. Time-switch for electric circuits. (22/12/22.)
191 391 Western Electric Co. Telephone systems. (5/1/22.)
205 000 B. W. Hurd. Electric-driven pump and blower sets. (25/1/23.)
205 002 British Thomson-Houston Co. (General Electric Co., N.Y.). Automatic reclosing circuit-breaker systems. (26/1/23.)
205 010 C. L. Arnold and C. R. Belling. Pins for electrical plug connectors. (8/2/23.)
195 942 Aktiebolaget Birka Regulator. Electric thermostatic time switches. (10/4/22.)
205 013 Igranic Electric Co., A. H. Curtis, S. R. Wright and E. J. Brunning. Electrical transformers. (27/2/23.)
205 018 B. E. D. Kilburn (Nederlandsche Thermo-Telephoon Maatschappij). Multi-core cables for long distance telephony. (7/3/23.)
195 066 C. Chilowsky. Interruption of electric circuits. (10/3/22.)
205 021 H. Wight, W. Park and Sunderland Forge and Engineering Co. Electric light fittings or lanterns. (16/3/23.)
199 361 Scintilla. High-voltage connection device, more particularly for the sparking-plug cables of internal combustion engines. (16/6/22.)
205 034 H. W. Clothier and J. Mirrey. Oil-immersed electric switch fuses. (3/7/22.) (Divided Application on 204 764.)
202 294 Western Electric Co. Radio-broadcasting systems. (14/8/22.)
202 308 Automatic Telephone Co. Circuit arrangements for automatic switches of the type used in telephone systems. (22/7/21.) (Divided Application on 183 431.)

Applications for Patents.

December 10th.

30 937 D. Smith, Ltd., and D. Smith. Presses for compressing armature cores or spindles.
30 939 S. W. Wilding. Non-metallic resistance for electric heating, etc.
30 969 R. D. Ball. Variable speed induction motor.
30 974 H. W. Cox. Electric switches.
30 975 H. O. Wallis. Variable condensers.
30 994 V. Primett. Current collectors for electric power distribution.
31 006 F. J. Cripwell. Loud speakers for radio telephone apparatus.
31 015 J. P. Scott. Electrolytic apparatus.
31 020 J. M. E. de Beaufort and G. Claude. Means for supplying current to rare gas tubes. (22/1/23, France.)
31 030 Soc. des Etab. Gaumont. Loud-speaking telephone station. (27/1/23, Belgium.)
31 031 P. S. O'Donnell. Disinfecting telephone mouthpieces.
31 032 Tyer and Co. and F. W. Leake. Electromagnets.
31 035 J. Scott-Taggart. Wireless receiving systems.
31 036 J. Scott-Taggart. Wireless receivers, etc.
31 038 Vickers, Ltd. and J. Etchells. Detachable electric couplings, etc.

December 11th.

31 055 J. W. and M. R. Cathles. Electric bell push.
31 079 E. E. Makinson. Wires or cables for wireless aerials, etc.
31 085, 31 086 and 31 087 P. A. H. Mossay and J. B. White. Electrically driven spindle for textile machines.
31 091 Falkirk Iron Co. and A. R. Wood. Luminous electric heaters.
31 106 A. Reyrolle and Co. and J. Piquet. Electric relays.
31 107 A. Reyrolle and Co. and W. A. Harriman. Electric plug and socket connections.
31 111 Muirhead and Co., B. Davies and E. S. Heurtley. Balancing of telegraph cables or lines.
31 116 H. J. Garnett and W. S. Smith. Magnetic alloys and their application for the manufacture of telegraphic cables, etc.
31 117 Soc. Belge Radio-Electrique. Variable resistances. (18/12/22, Belgium.)
31 119 Belling and Lee, C. R. Belling and E. M. Lee. Illuminated sign.
31 120 Hewittic Electric Co. (Westinghouse Cooper Hewitt Ges.). Mercury vapour lamps.
31 130 Metropolitan-Vickers Electrical Co. and C. Ryder. Electric relays.
31 131 Metropolitan-Vickers Electrical Co. and A. F. Thompson. Electric synchronising apparatus.
31 140 J. Hettinger and C. A. Vandervell. Reception of wireless signals.
31 141 Cambridge and Paul Instrument Co. and W. H. Lawes. Electric condensers. (2/11/23, France.)
31 154 Soc. des Condenseurs Delas. Surface condensers.
31 165 A. G. Westmoreland and S. Wiseman. Electric lamps.
31 166 E. Hayward. Telephone receiver supports.

December 12th.

31 174 W. E. Miller. Wireless receiving circuit.
31 175 W. E. Miller. Thermionic valve, etc.
31 180 H. Ingham. Inductance coils.
31 181 Cooke and Whitfield Wireless, Ltd., and H. S. Cooke. Wireless receiving apparatus.
31 207 W. Barclay. Commutators for engine ignition systems.
31 223 W. T. Glover and Co. and F. C. Raphael. Electric connectors.
31 224 W. T. Glover and Co. and F. C. Raphael. Binding metal covered cables to electric junction boxes.
31 238 J. Mersing. Electric lamp shades.
31 244 Embe-Fahrzeng-Uhren Ges. Self-winding electric clocks. (14/12/22, Germany.)
31 248 Edison Swan Electric Co. and T. W. Price. Thermionic valves.
31 254 Reiniger, Gebbert and Schall Akt.-Ges. Röntgen tubes, etc. (20/6/23, Germany.)
31 260 Automatic Telephone Manufacturing Co. Telephone systems and apparatus.
31 272 A. M. Cox. Electrically operated speedometers.
31 275 U. Modigliana. Protective arrangements for electrical installations. (13/12/22, Germany.)
31 279 Vickers, Ltd. Firing gear of submarine mines.

December 13th.

31 292 E. G. Phillips, C. E. Thompson and A. H. Walker. Grid leaks for valves of wireless apparatus, etc.
31 304 A. P. C. Collier. Wireless apparatus.
31 309 J. S. and L. S. Elder. Crystal detector.
31 326 A. Reyrolle and Co. and H. F. Secretan. Electric plug and socket connections.
31 332 B. and E. Thomas. Multi-contact switches.
31 334 J. R. Coltman. Electric temperature indicators.
31 337 K. N. Arnold. Socket connector for electric circuits.
31 358 Forges et Ateliers de Constructions Electriques de Gaumont. System of traction by heat motor and electric transmission. (8/1/23, France.)
31 366 Wilbarton and Co. and H. W. Bullock. Aerials for wireless telegraphy, etc.
31 371 R. Woods. Holders for valves of wireless apparatus.
31 388 A. Massey-Allen and R. B. North. Magneto-electric machines.
31 392 B. M. S. Kalling. Electric furnace.

December 14th.

31 408 C. M. Hutton. Wireless telephones.
31 445 Metropolitan-Vickers Electrical Co. Gas or oil power plant.
31 449 A. M. Cox. Electrically operated speed indicators.
31 463 Normand Garage, Ltd., and H. D. Smith. Magneto mounting
31 465 G. H. M. Rocour. Electric ignition devices for explosion engines.
31 468 British Thomson-Houston Co. Measuring devices. (18/12/22.)

December 15th.

31 483 X-Rays, Ltd. Use of vacuum tubes.
31 486 E. V. Mackintosh. Telephone receivers, etc.
31 490 D. R. and E. A. Poyser. Terminals for telephone receivers.
31 496 A. Hopkinson. Ear-piece for telephones, etc.
31 497 W. H. Gaskell and A. F. Holliday. Electric condensers.
31 503 E. P. and S. A. Chapman. Electric switch.
31 509 S. Crosby and F. W. Durrant. Detectors for wireless telegraphy, etc.
31 519 M. Semple. Electric switch.
31 544 Nederlandsche Gist en Spiritusfabriek. Electromagnetically actuated valves. (20/12/22, Holland.)
e31 549 C. R. Lown. Method of connecting wireless components.
31 553 J. F. Monnot. Preparation of active material for storage batteries.

Arrangements for the Week.

Wednesday, January 2nd.

The Institution of Electrical Engineers.

6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.2. Wireless Section Meeting. Paper by R. H. Barfield on "Some Experiments on the Screening of Radio Receiving Apparatus."

Thursday, January 3rd.

The Institution of Electrical Engineers.

6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.2. Lecture on "Railway Electrification in Foreign Countries," by Dr. S. P. Smith.

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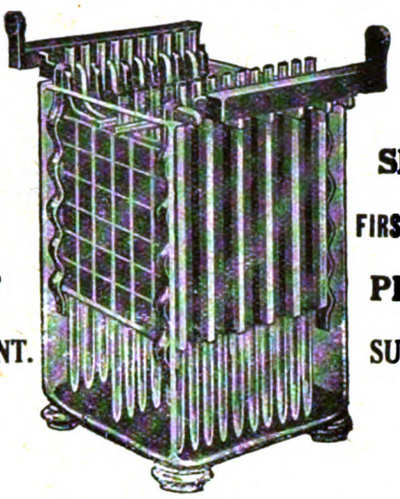

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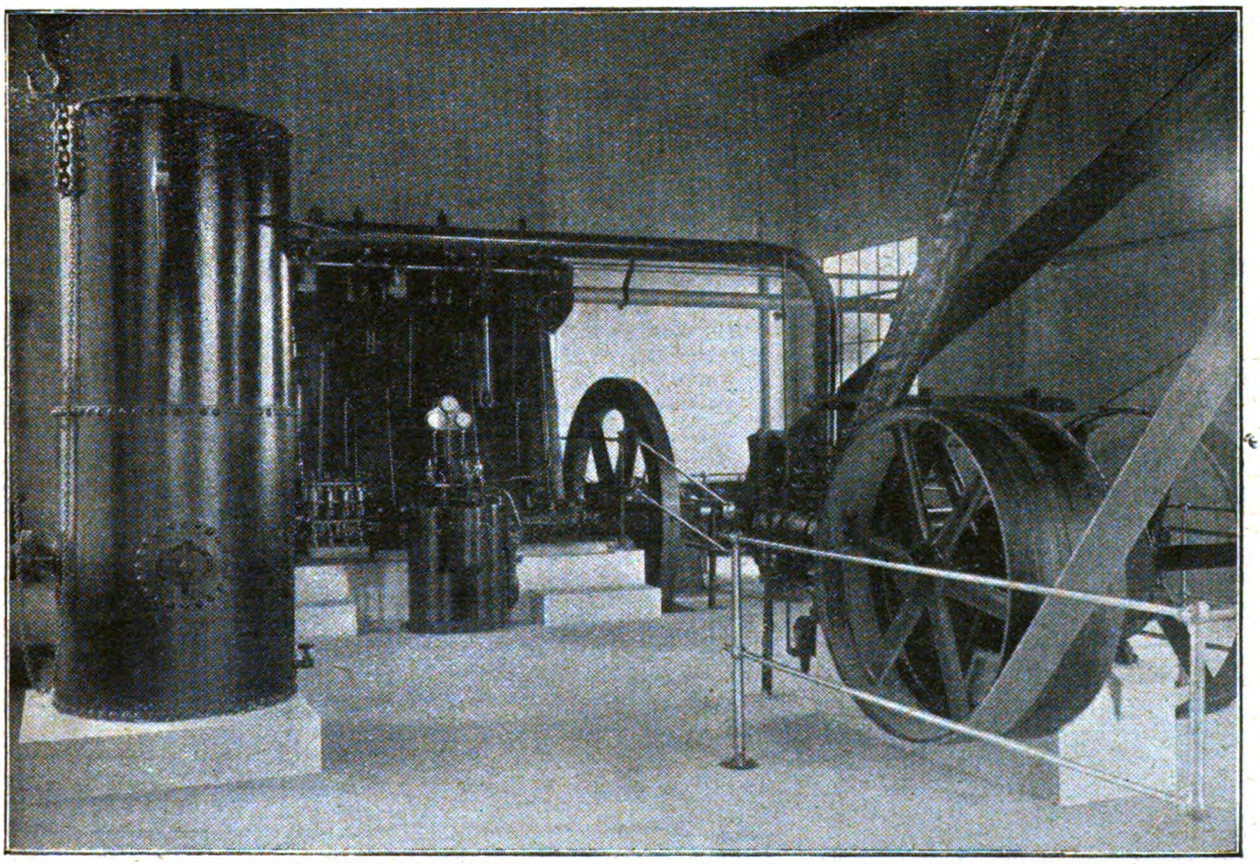

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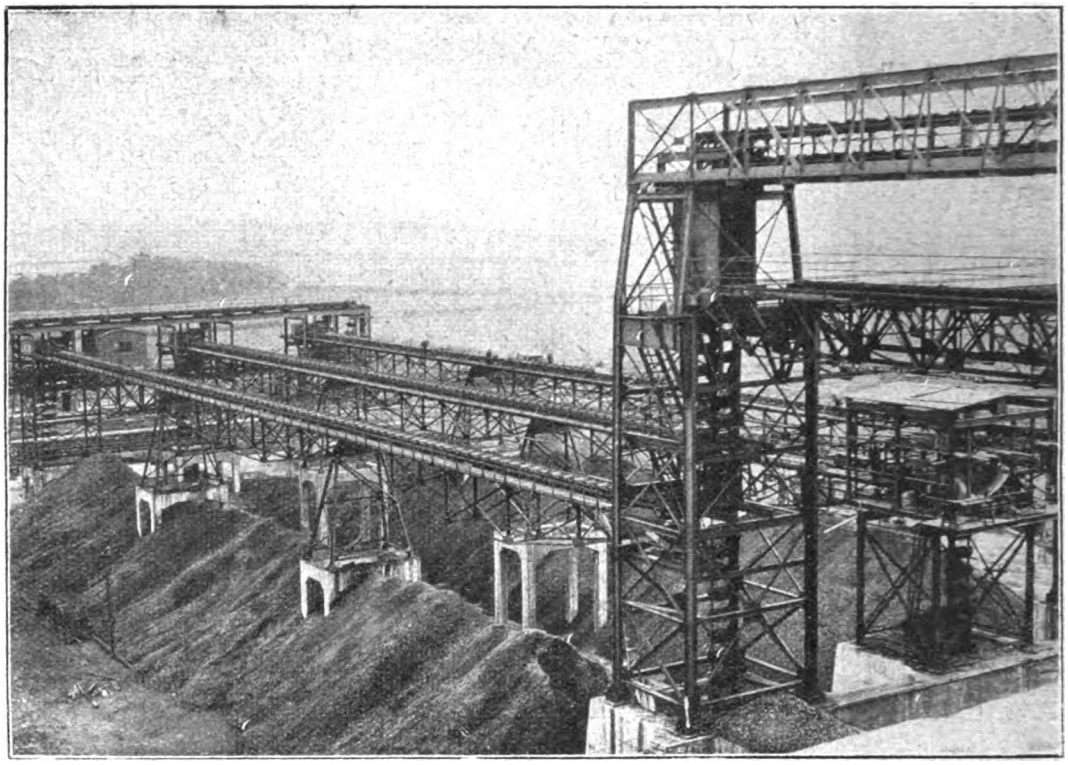

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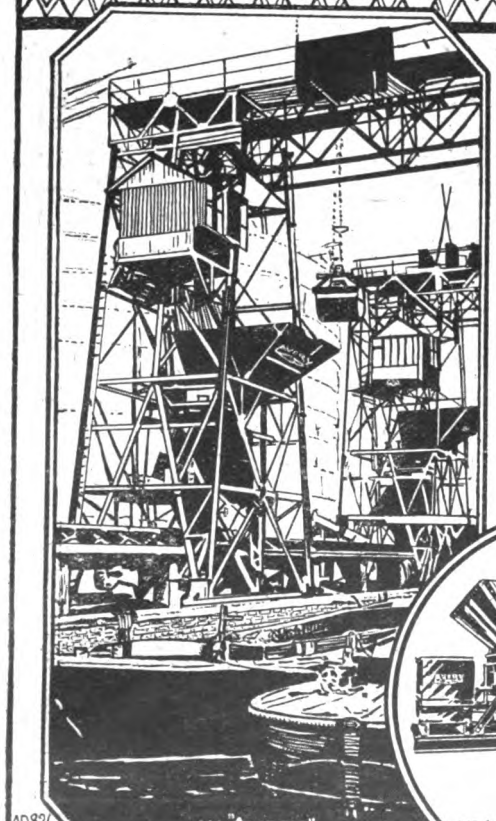

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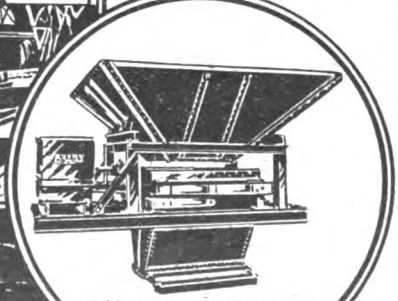

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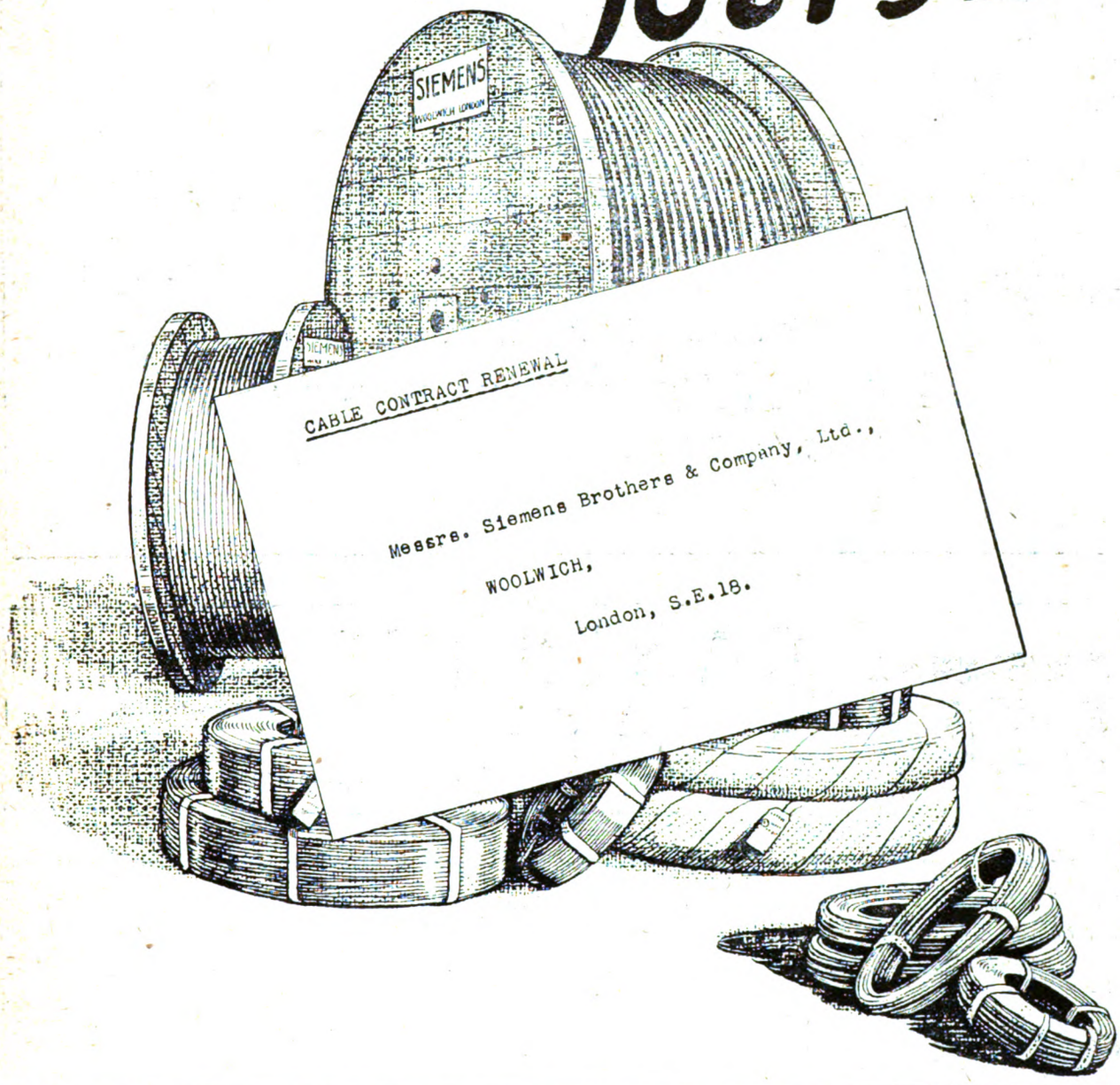

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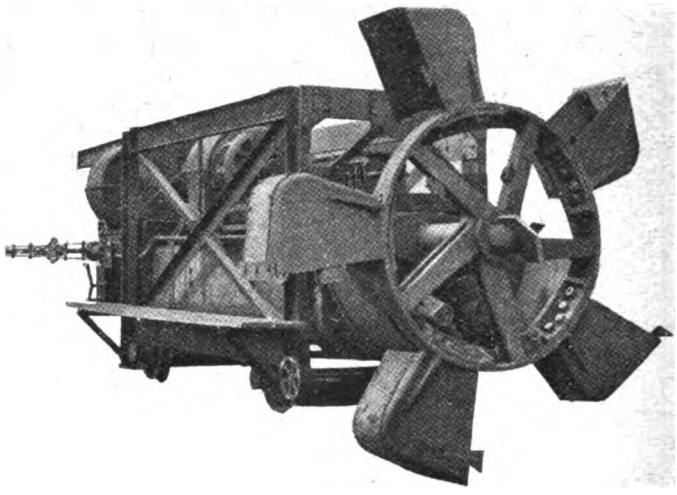

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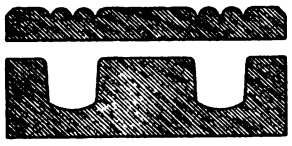

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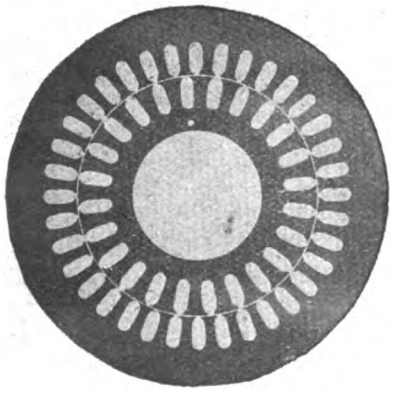

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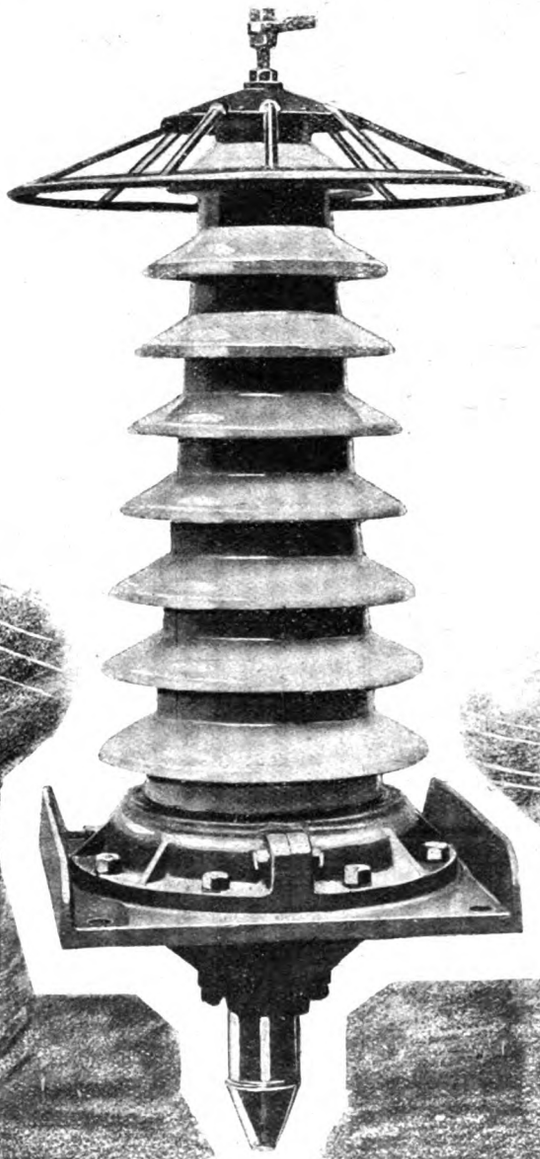

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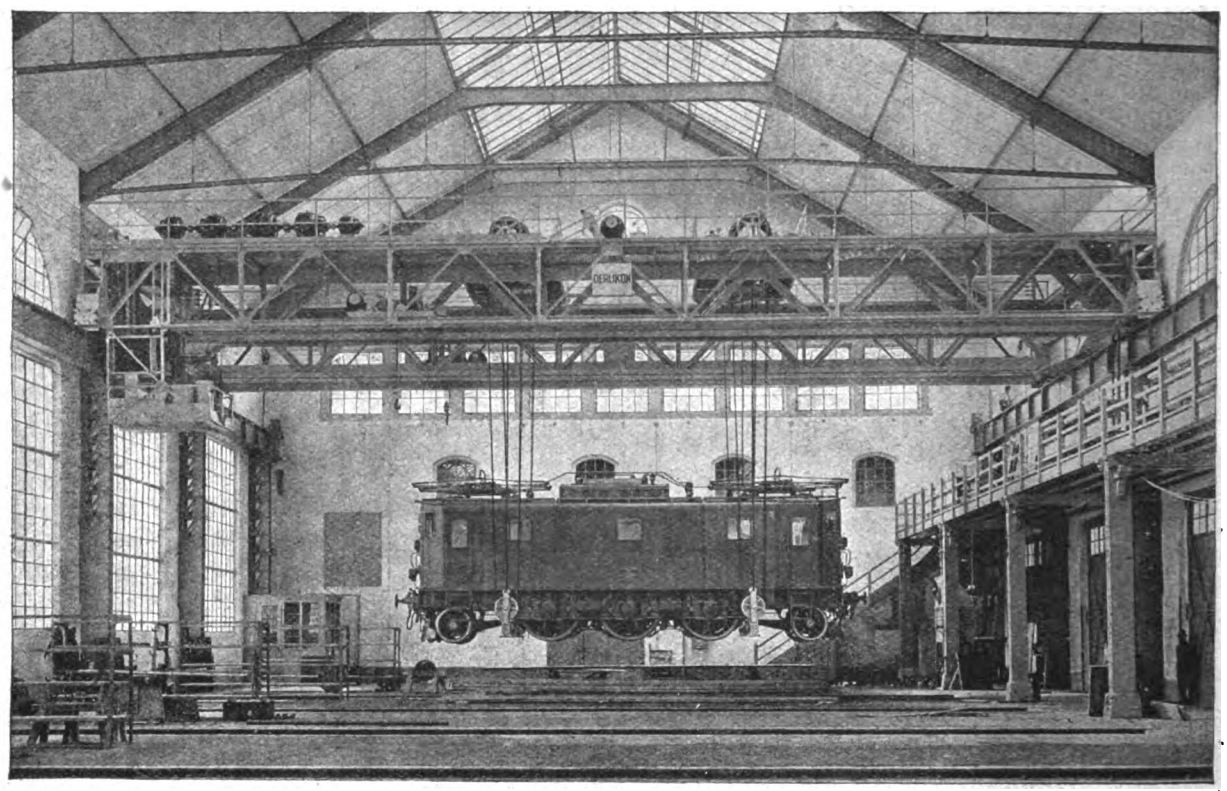

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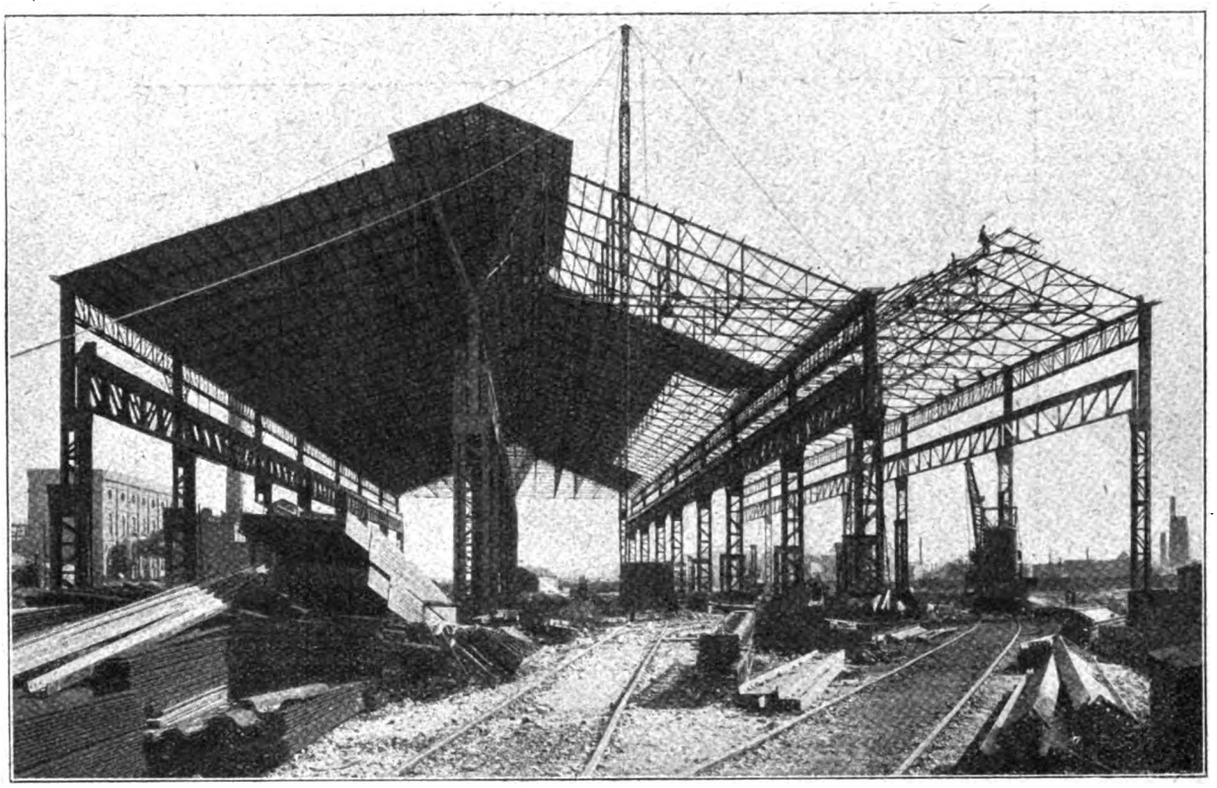

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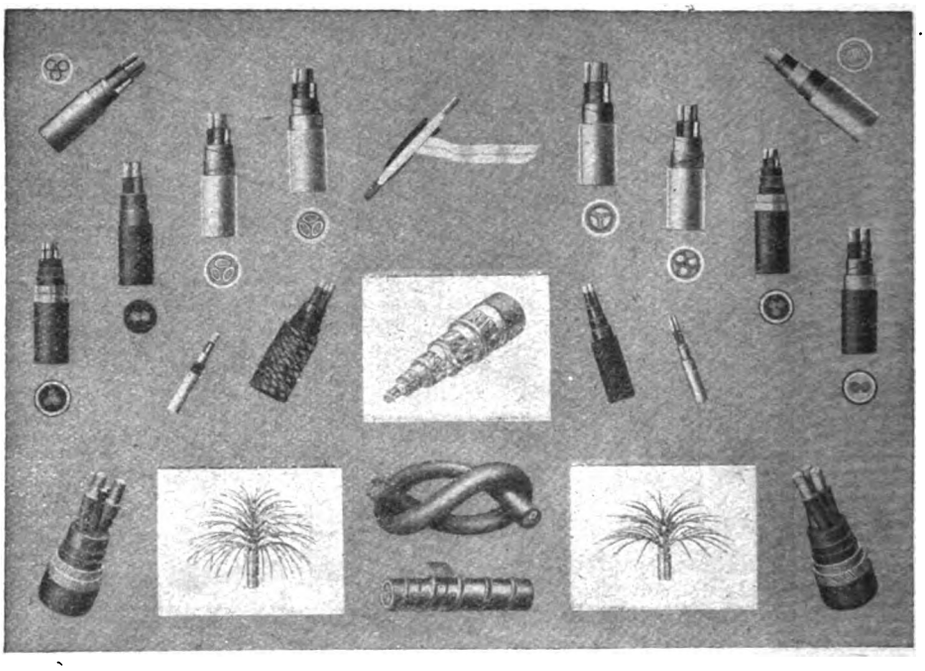

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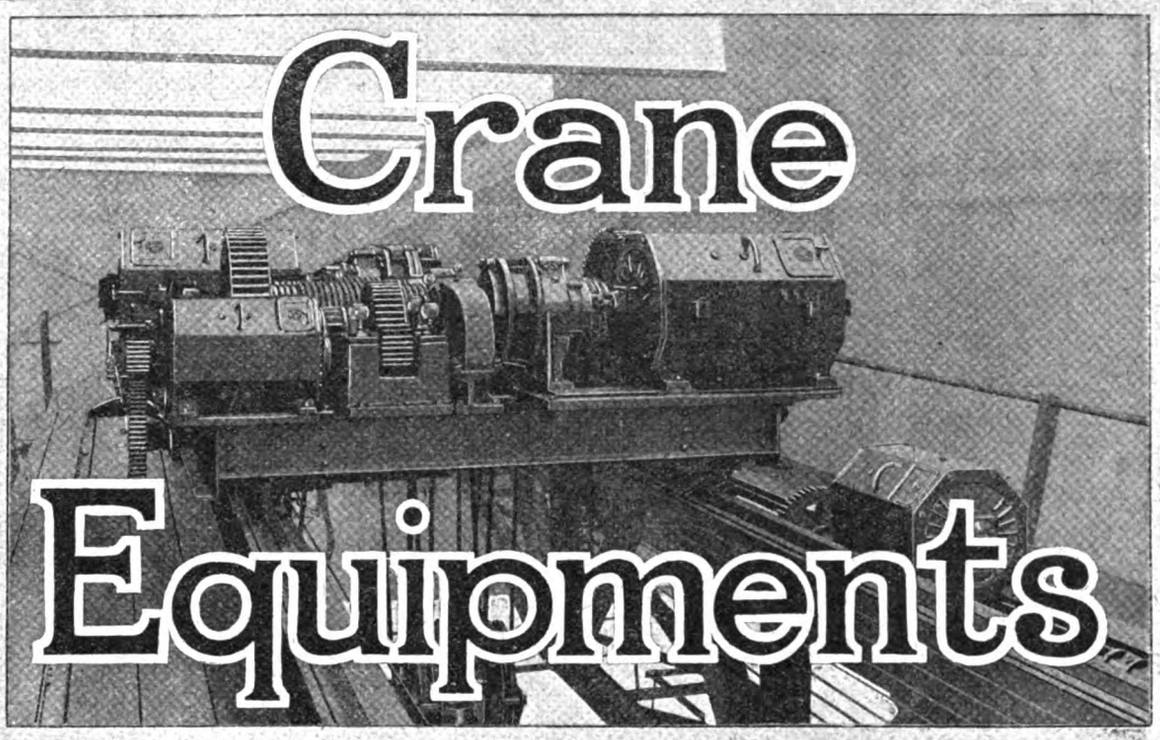

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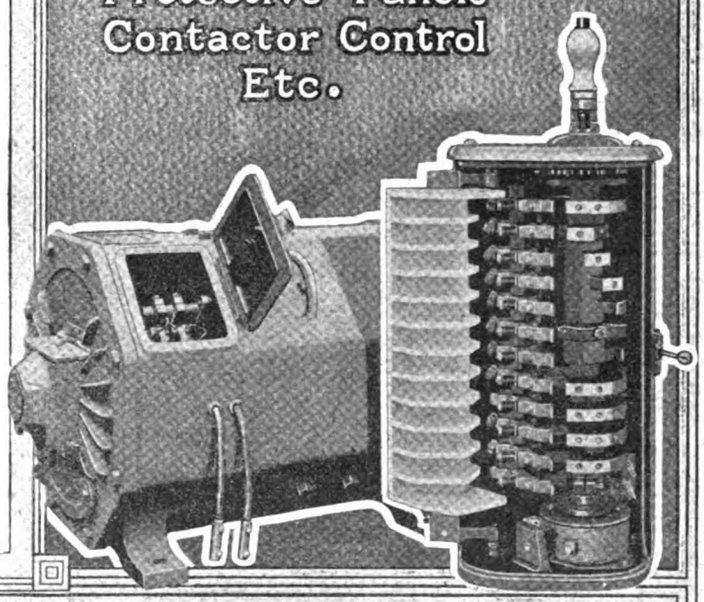

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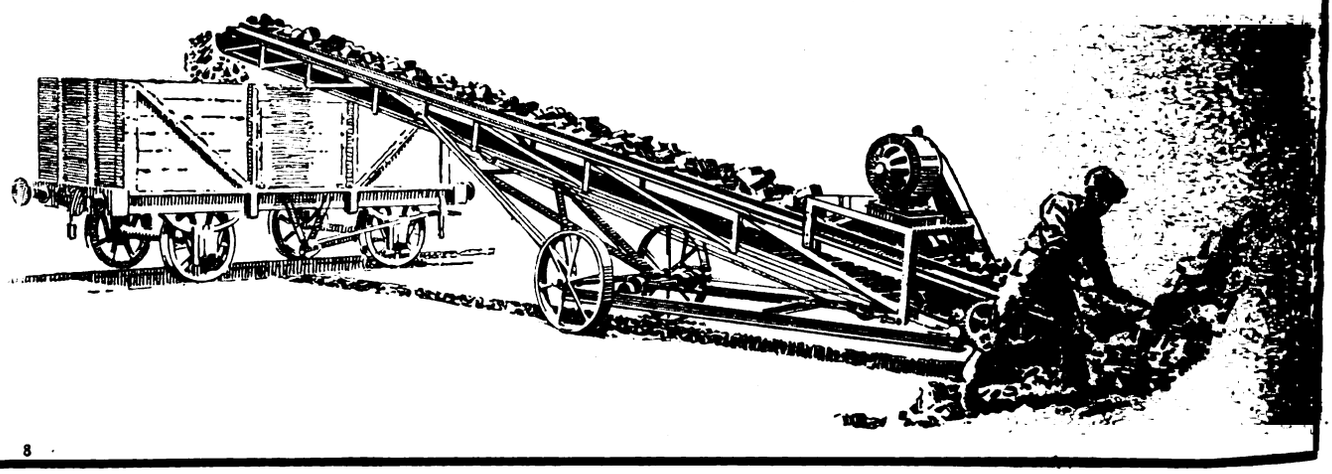

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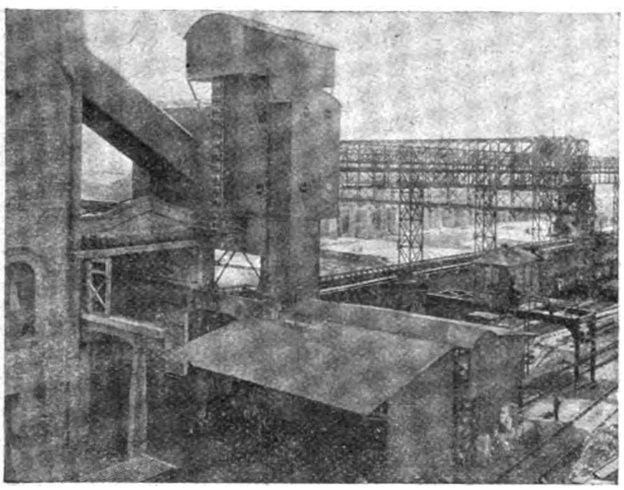

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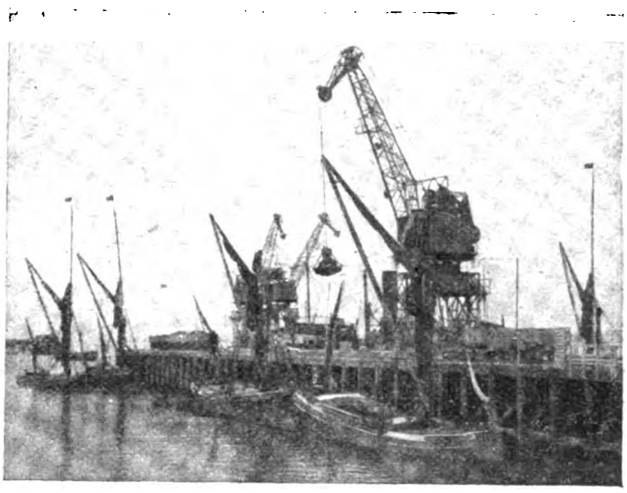

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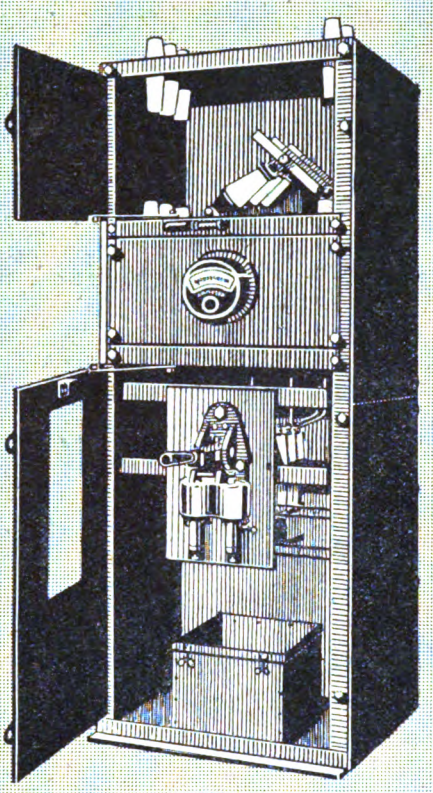

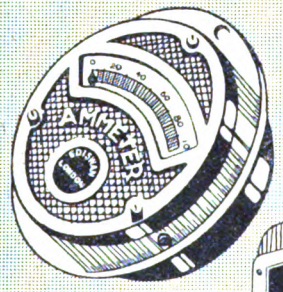

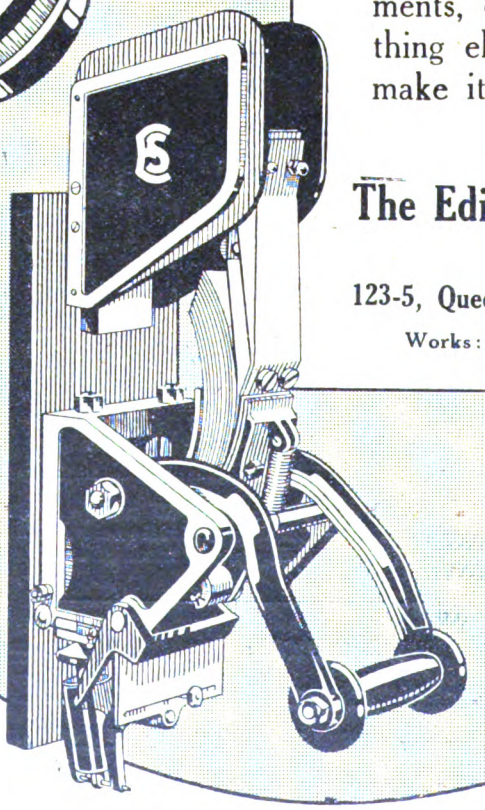

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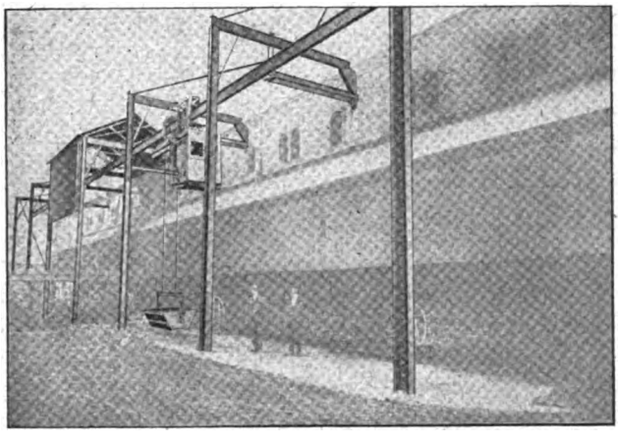

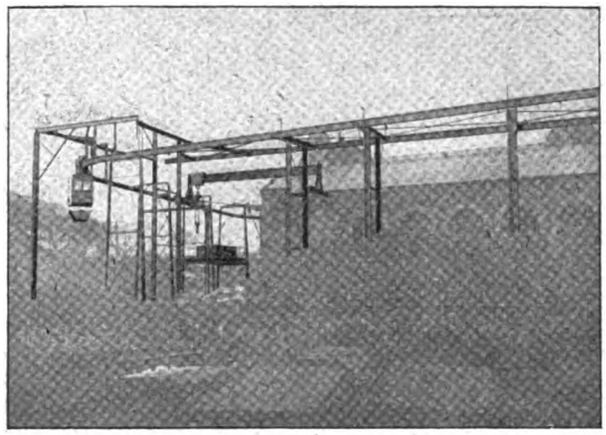

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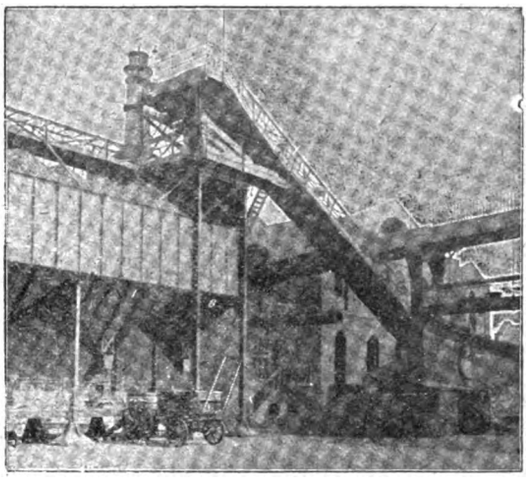

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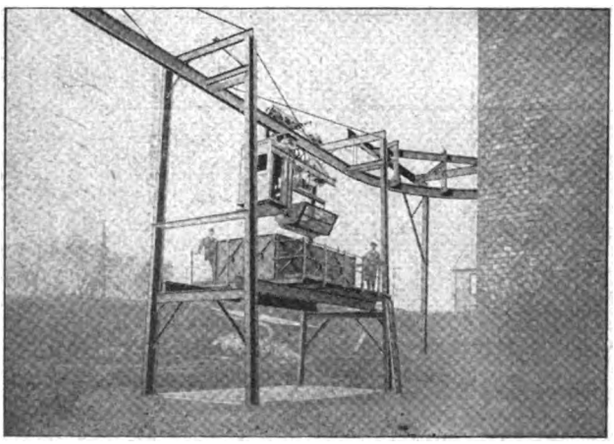

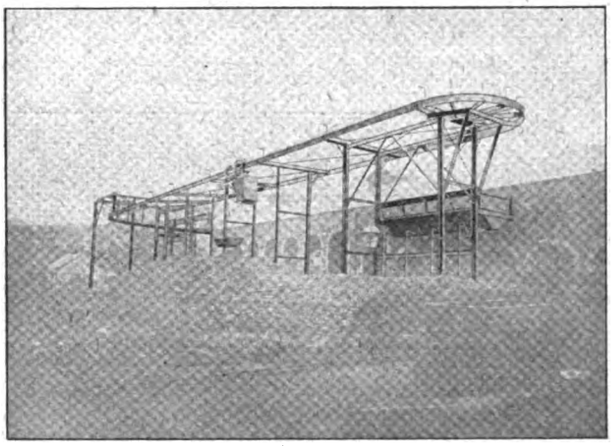

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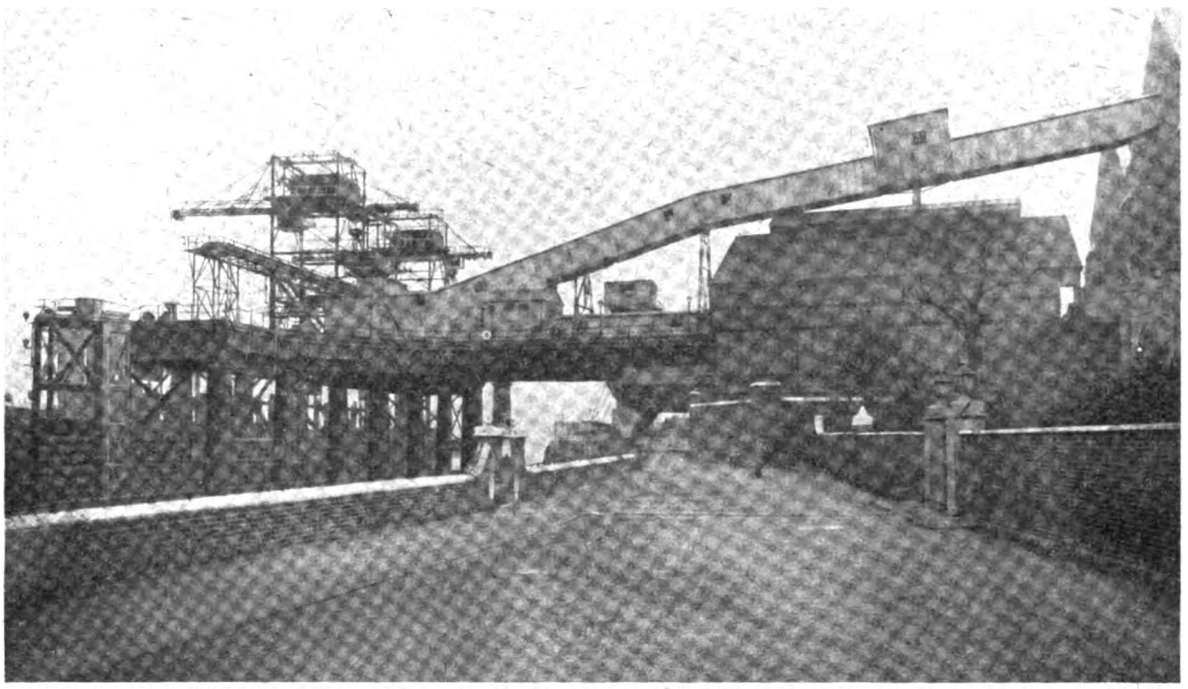

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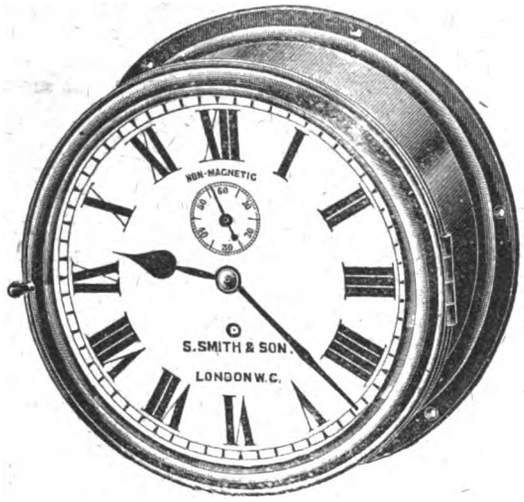

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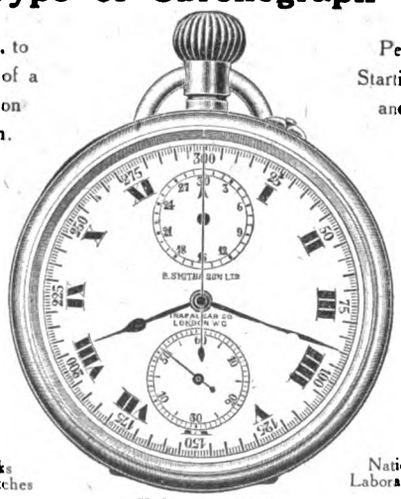

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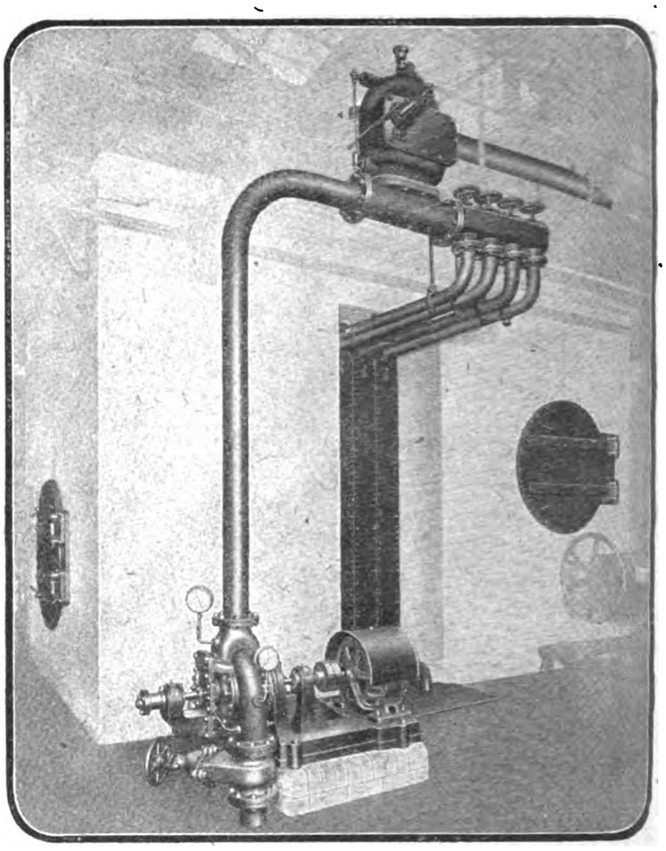

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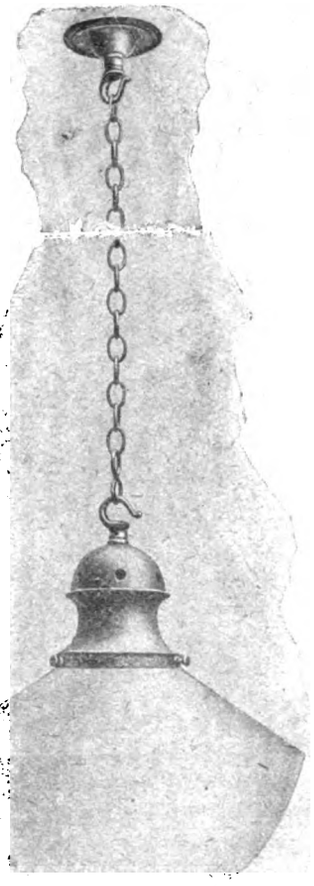

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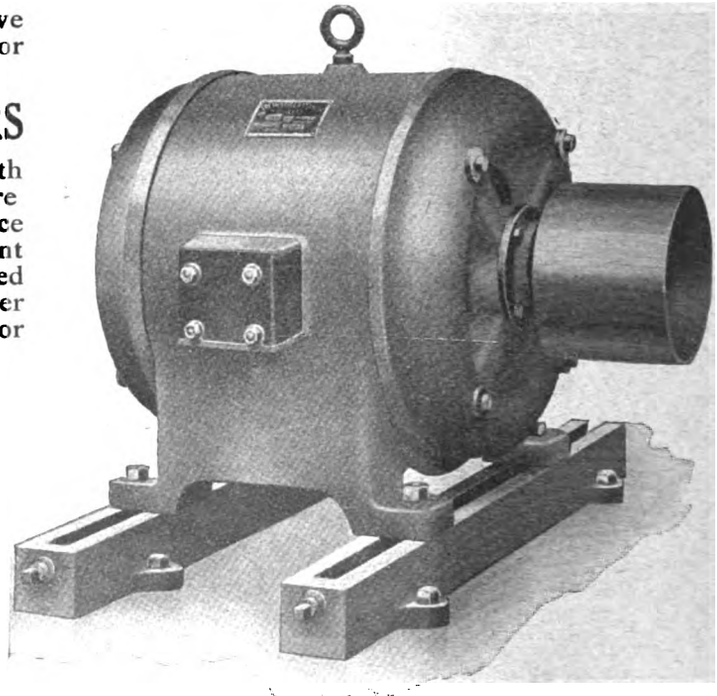

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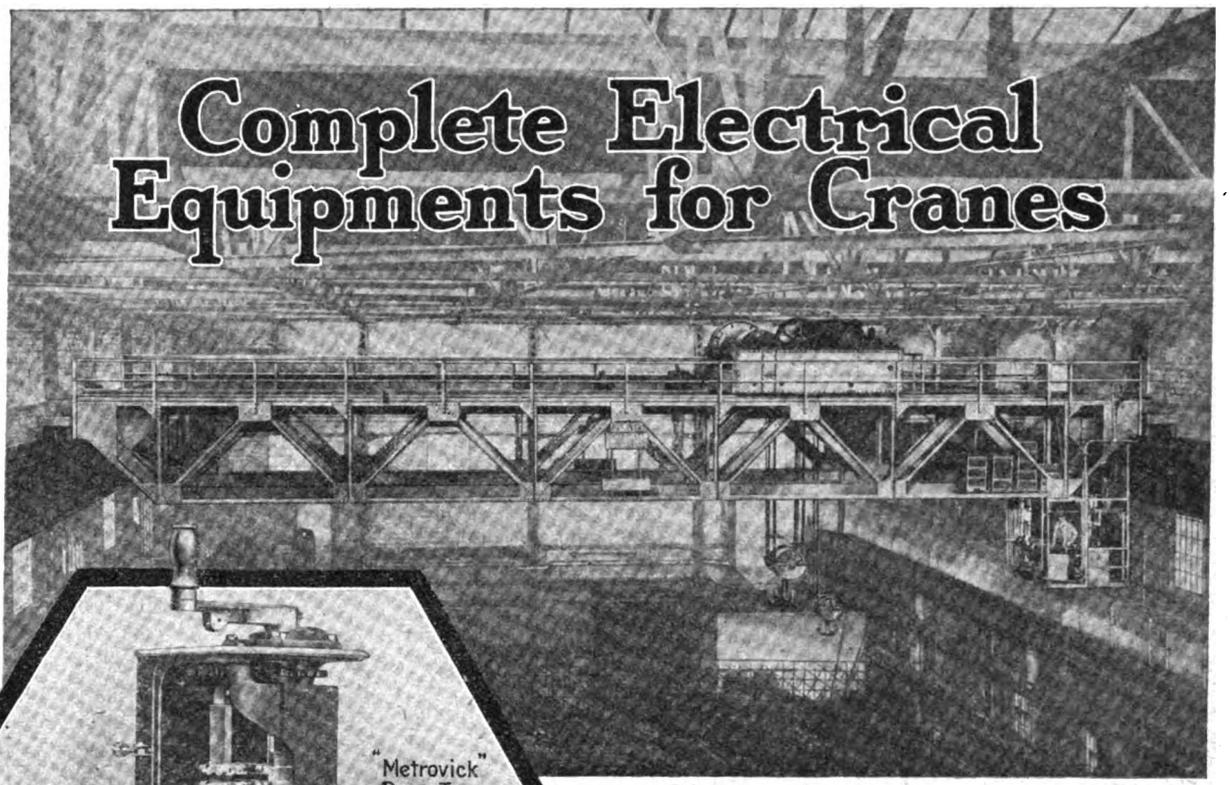

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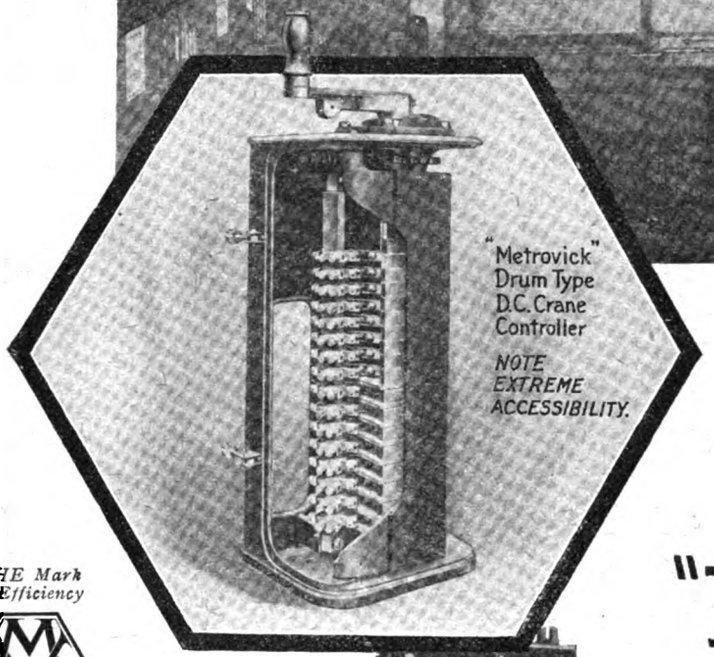

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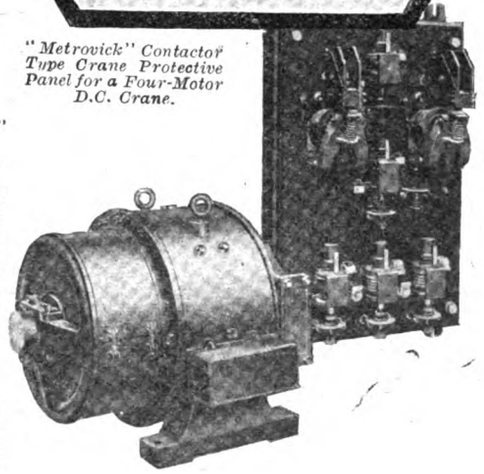

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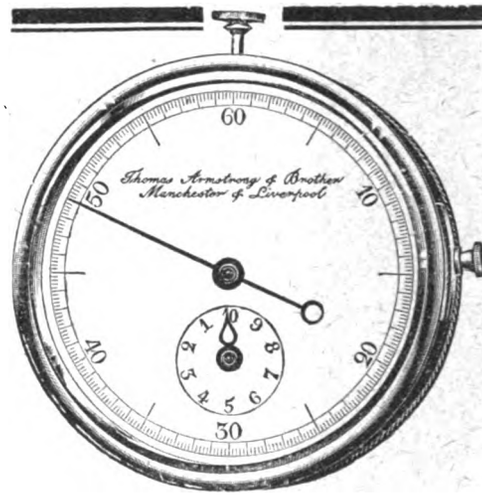

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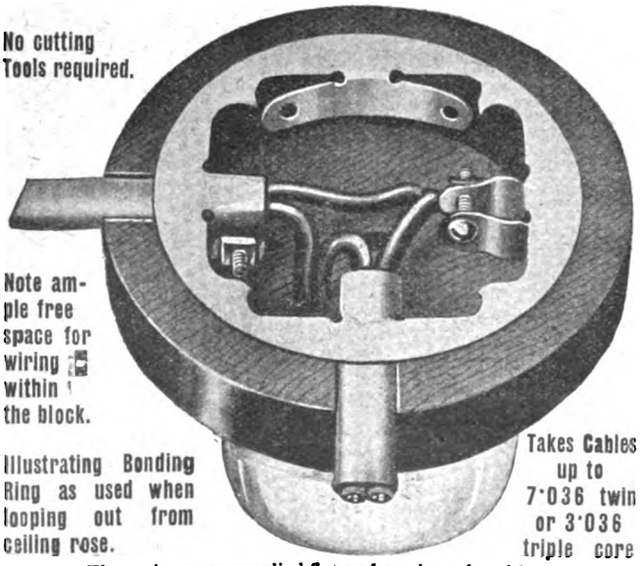

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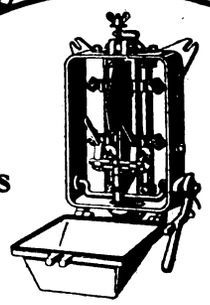

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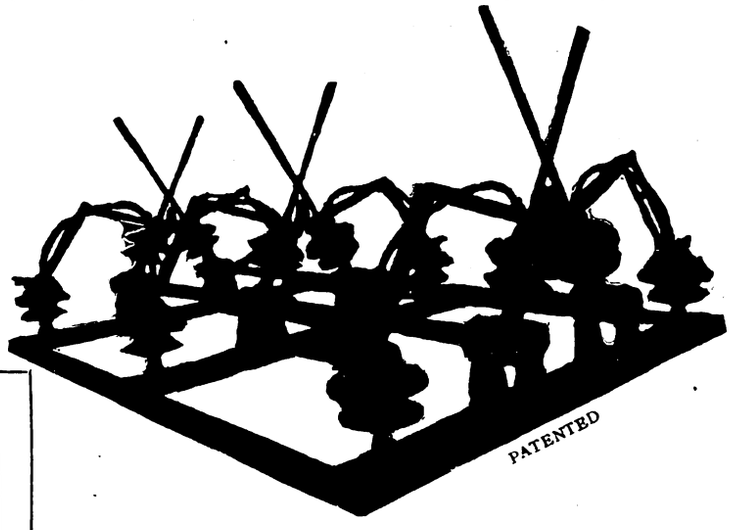

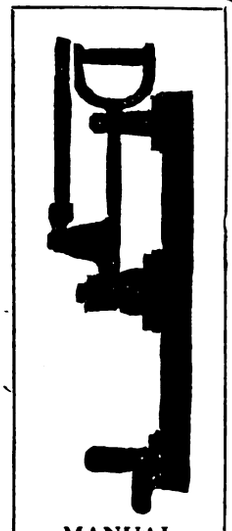

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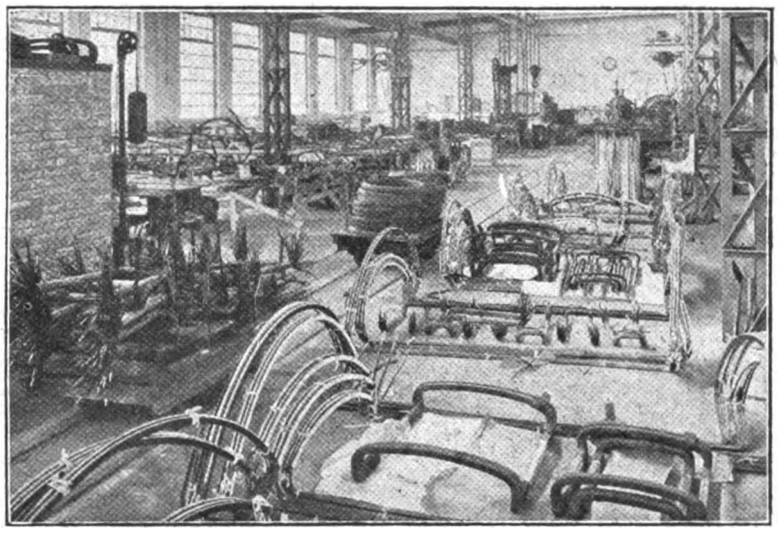

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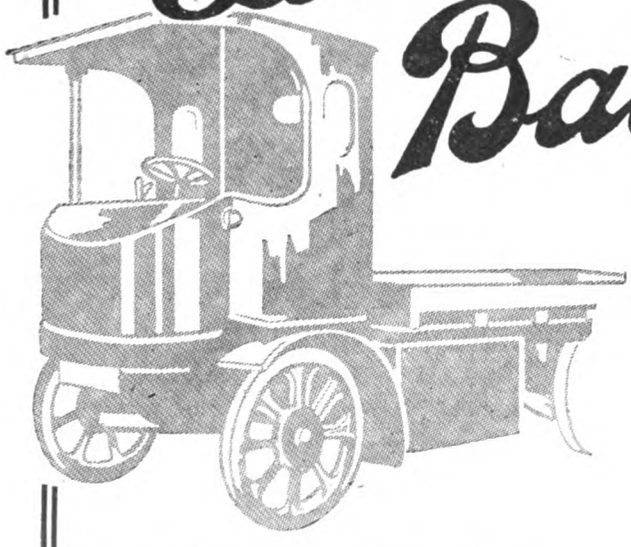

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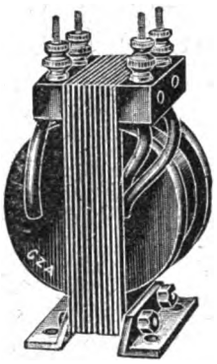

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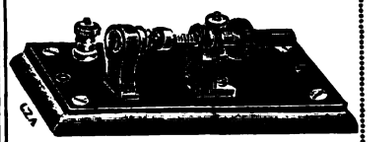

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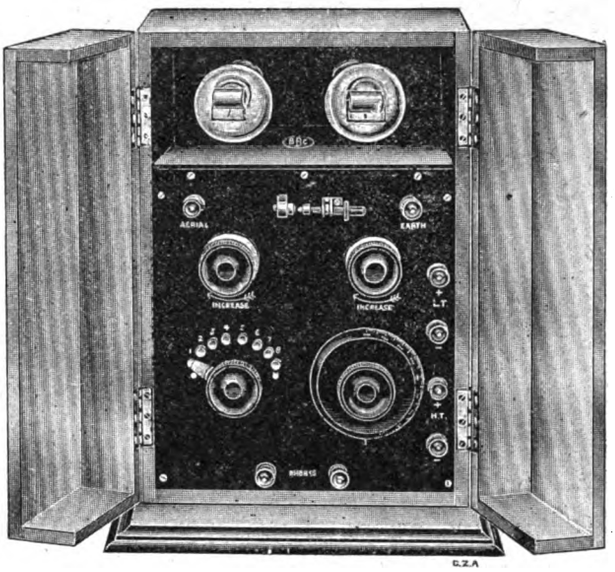

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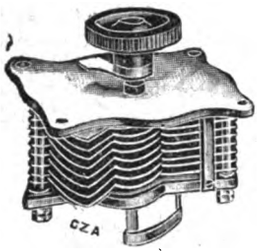

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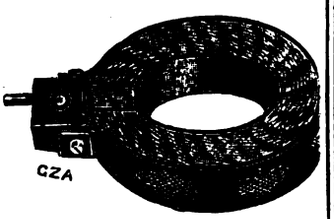

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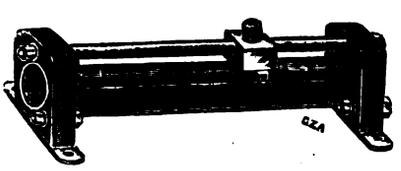

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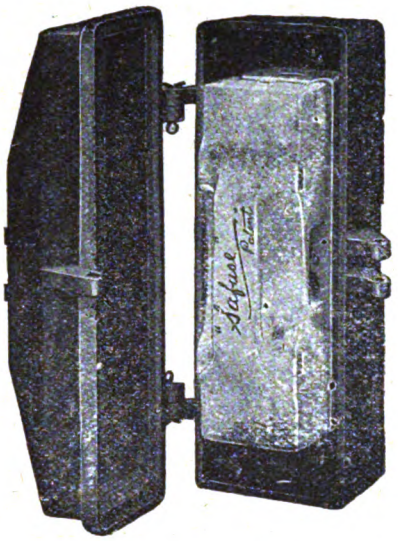

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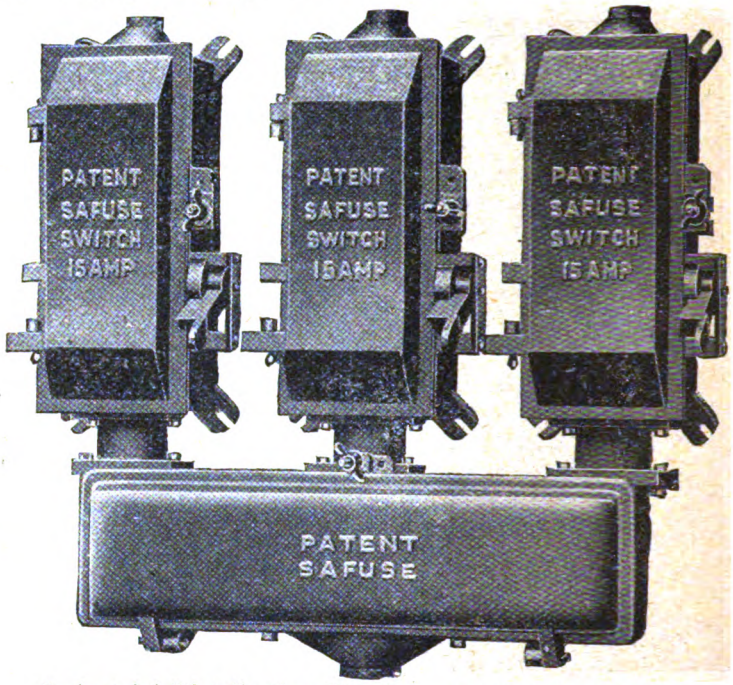

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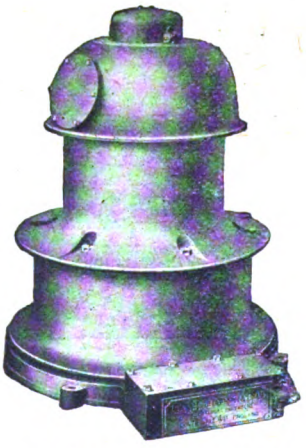

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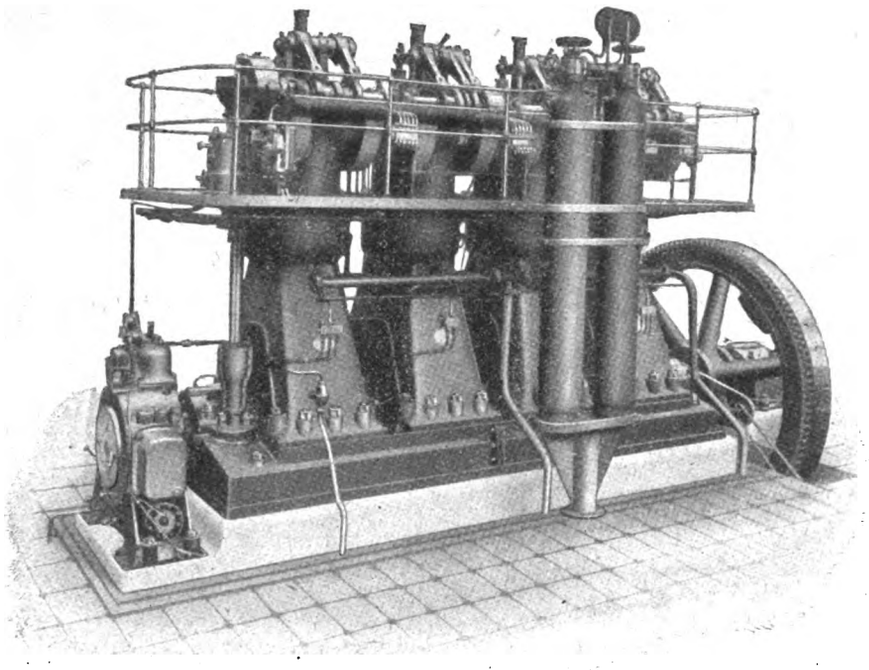

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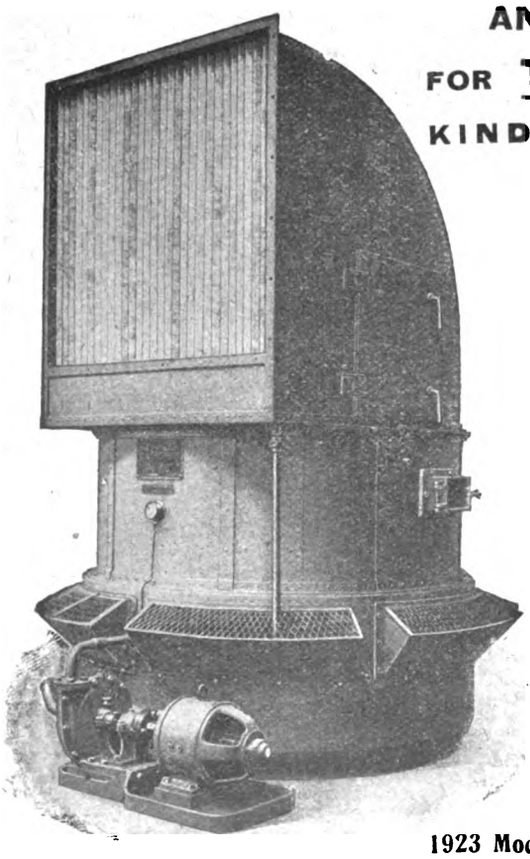

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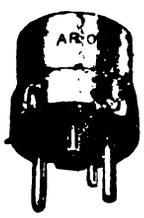

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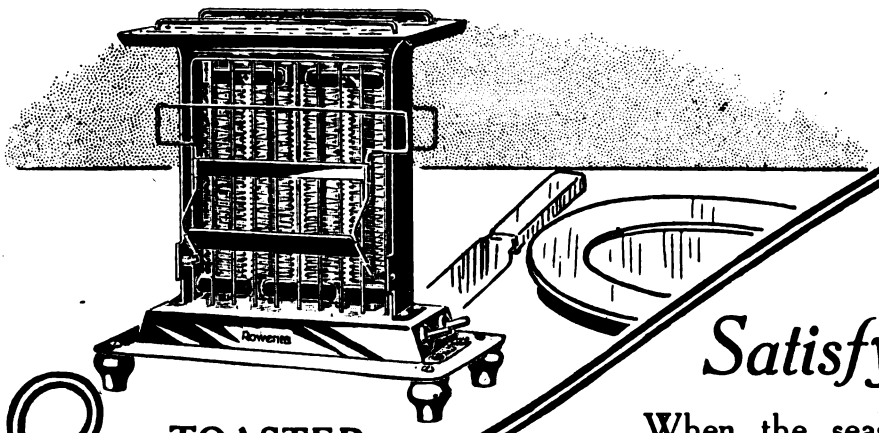

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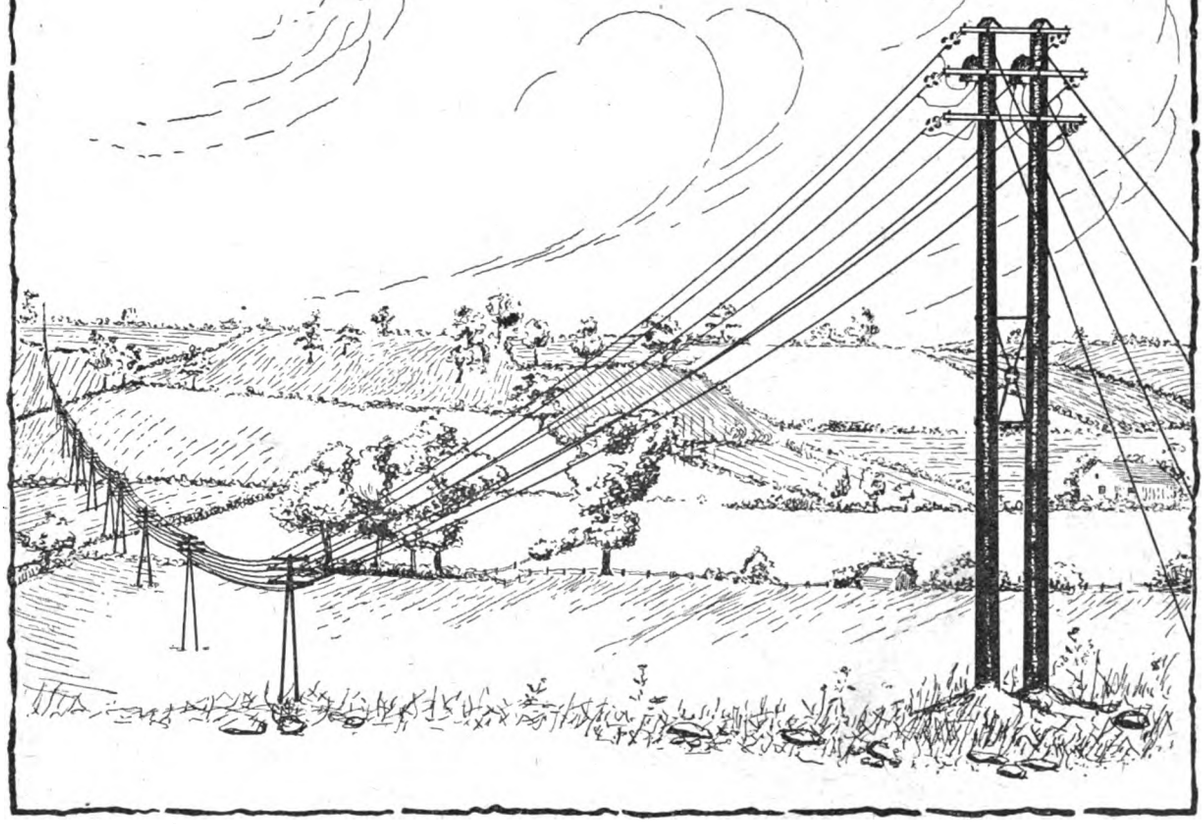

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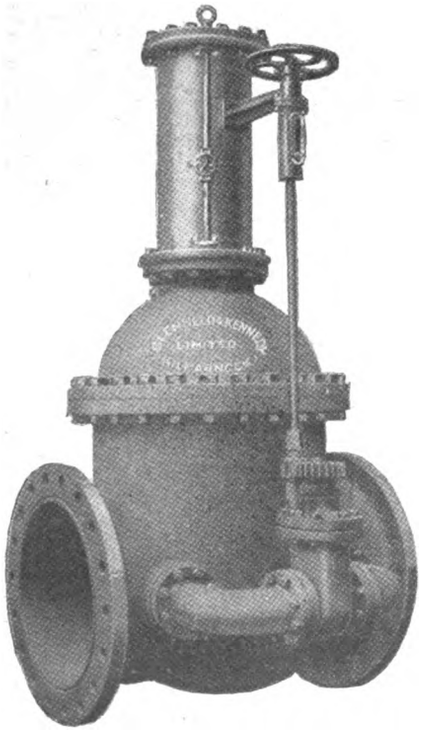

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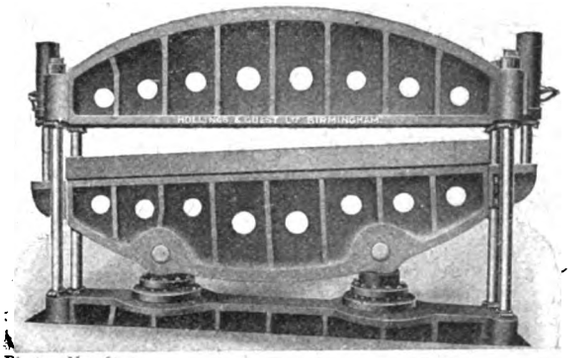

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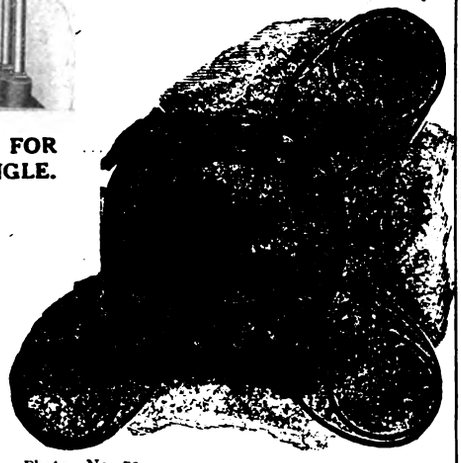

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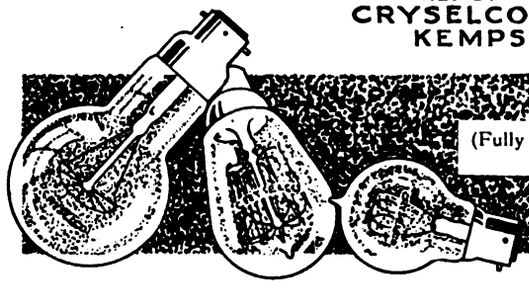

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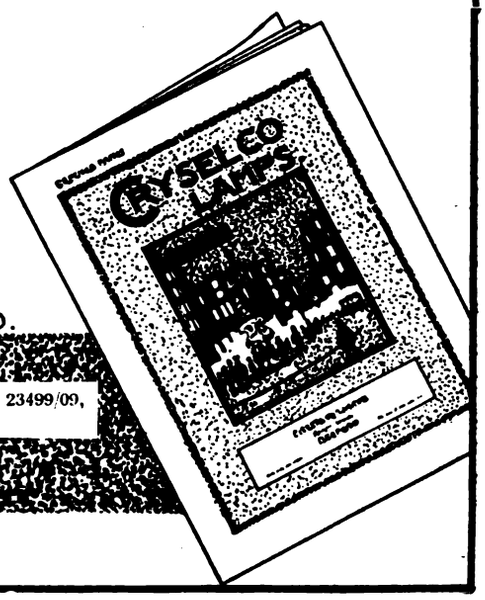

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On behalf of the Victorian Railways Commissioners,
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R. LIDDELOW,
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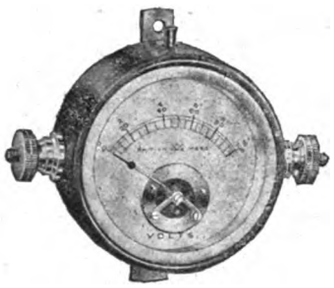

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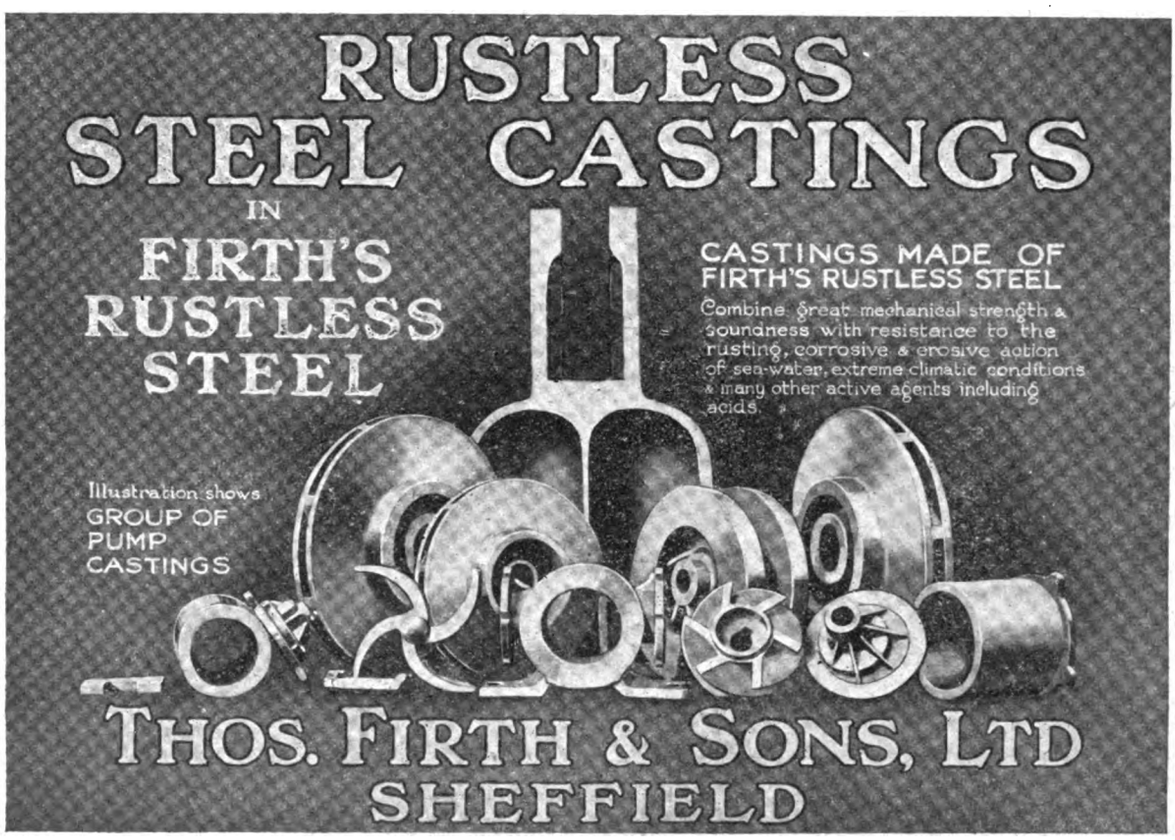

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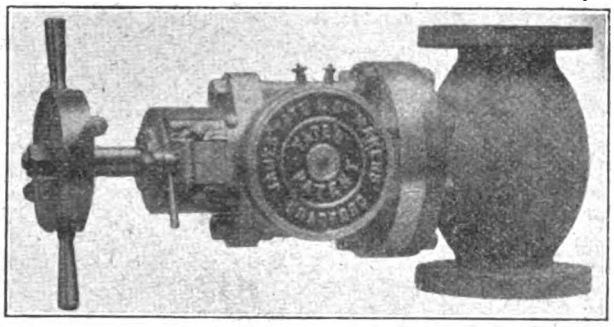

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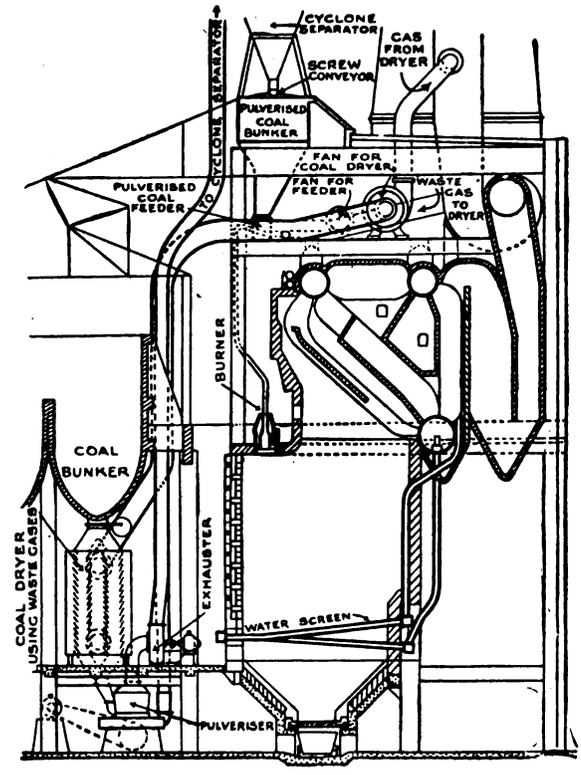

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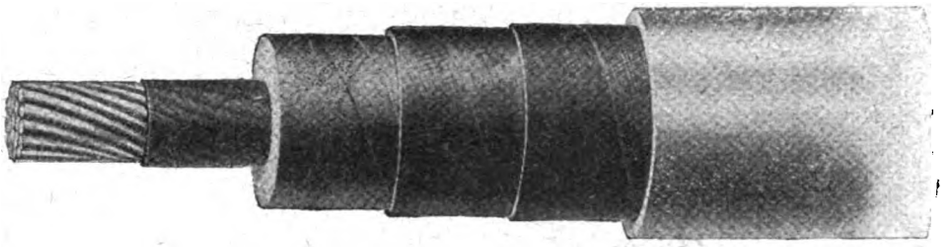

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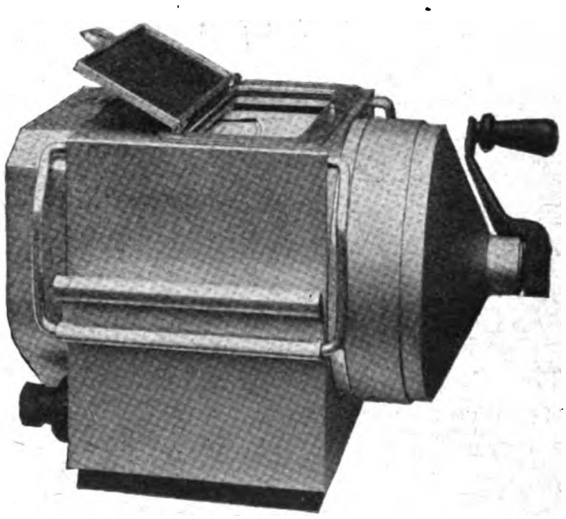

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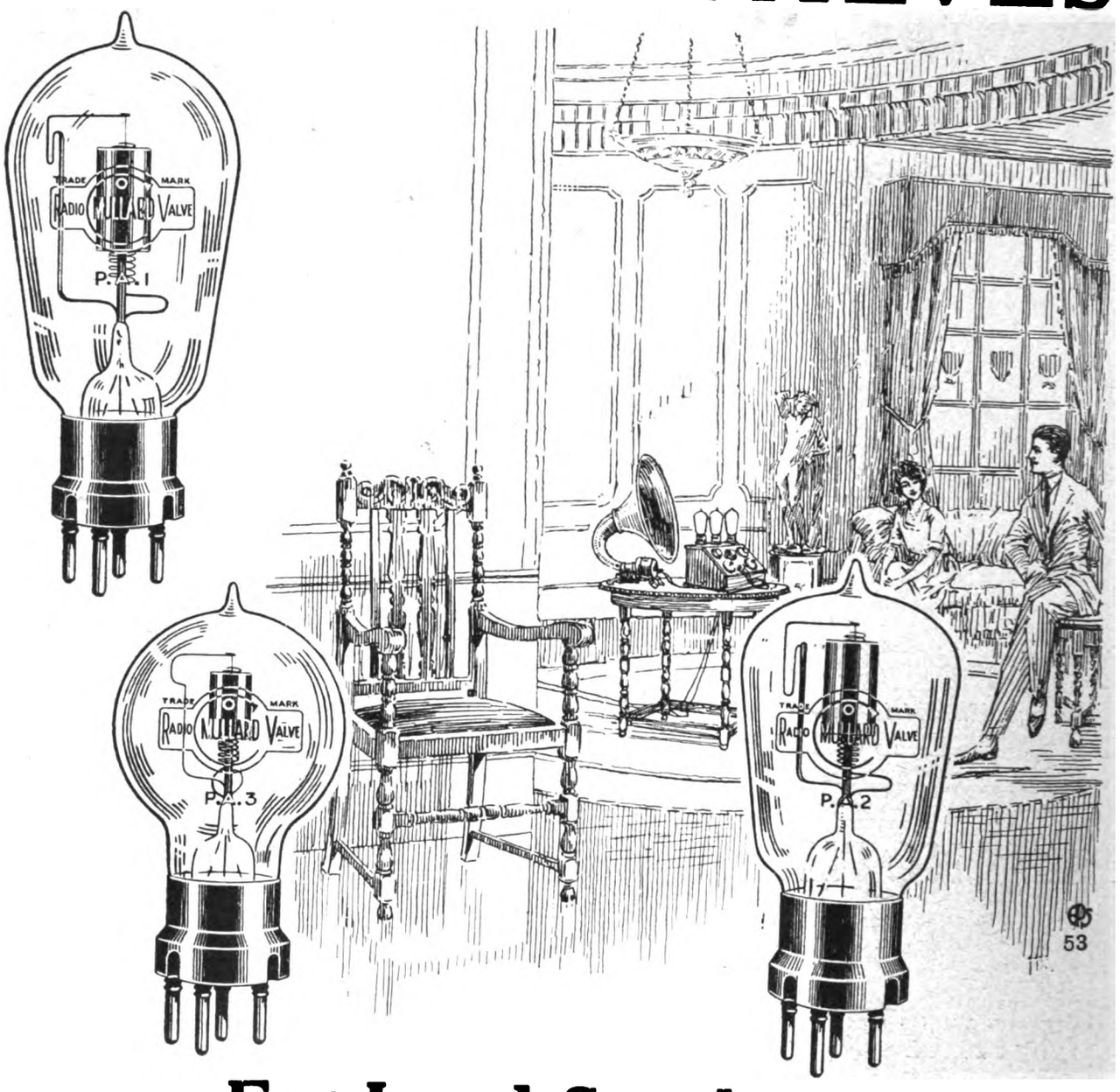

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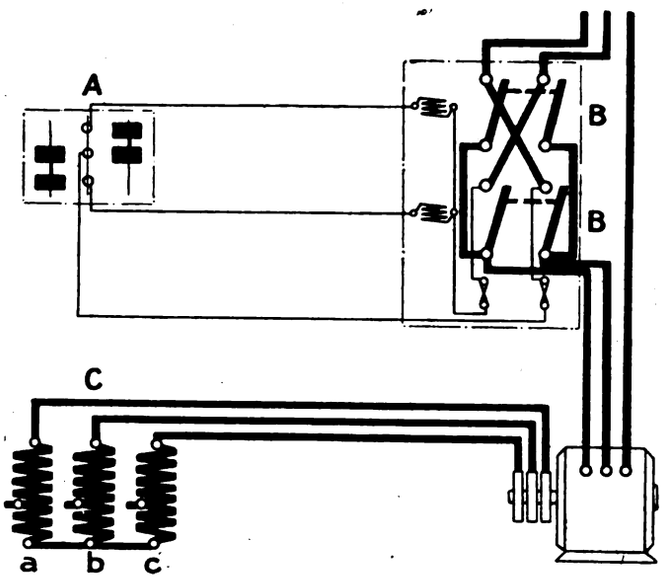

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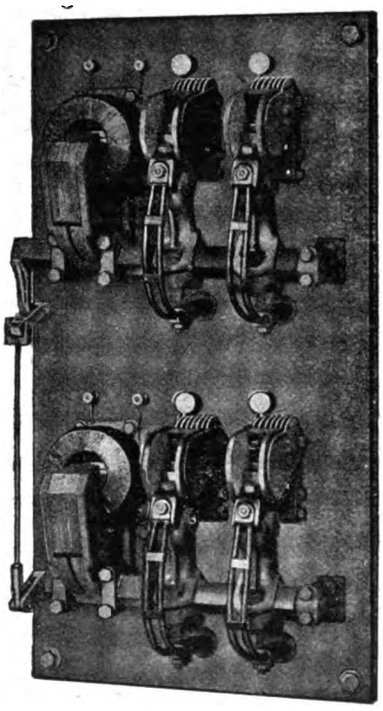

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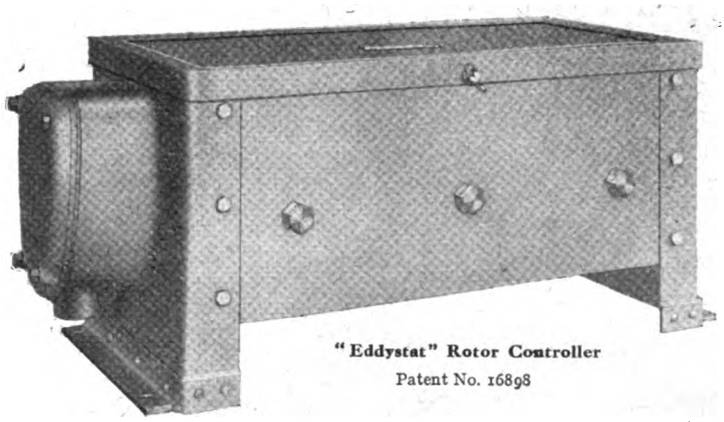

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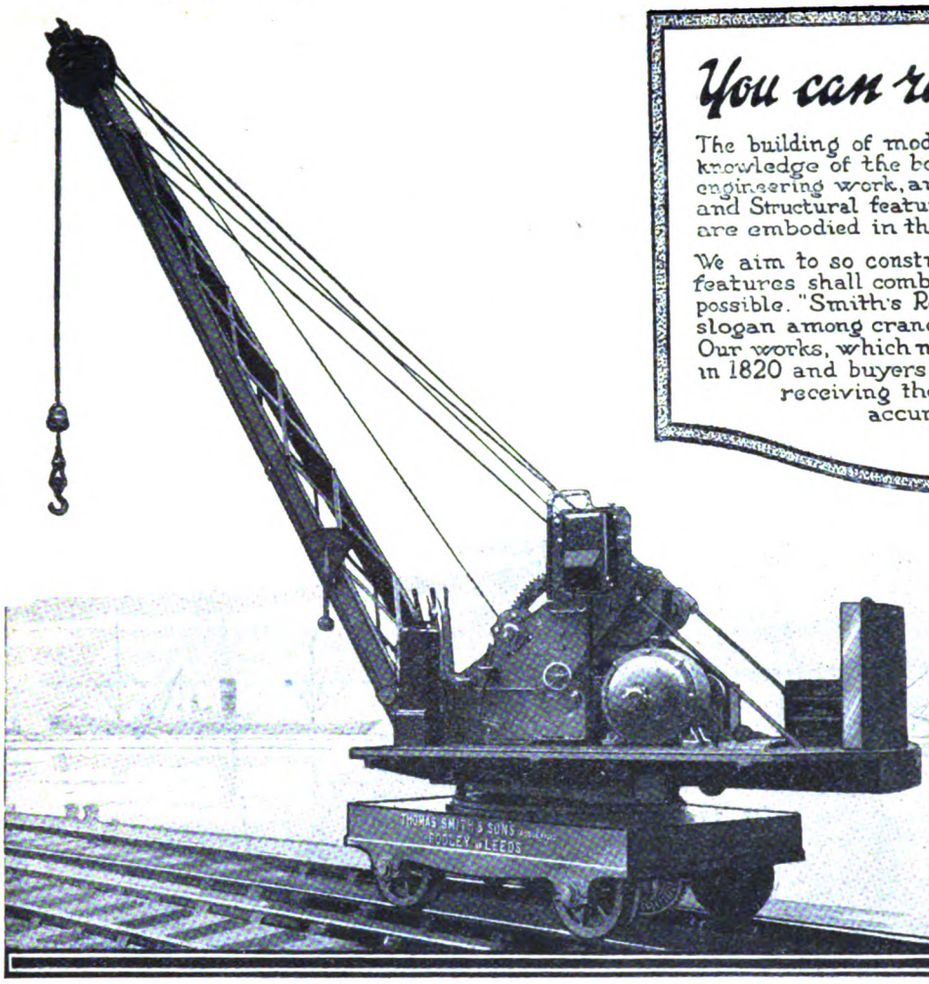

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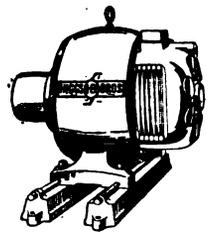

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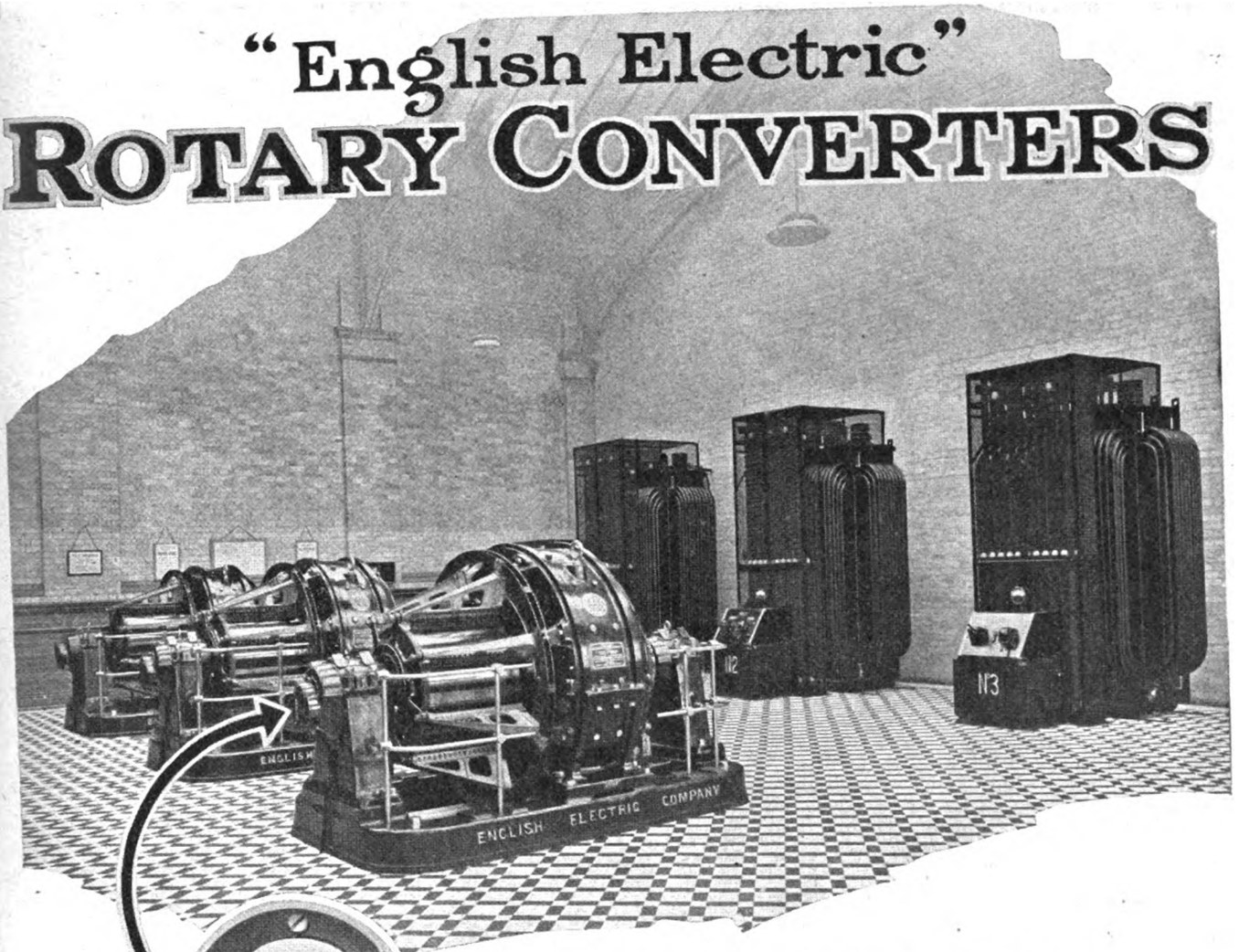

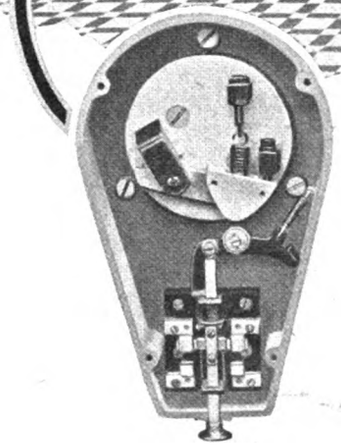

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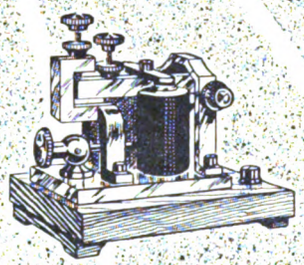

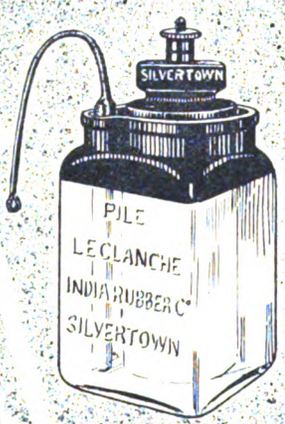

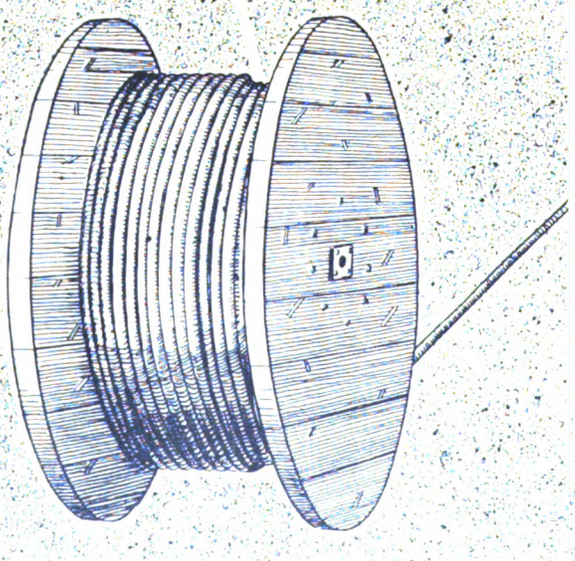

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